Four Year Bachelor of Science & BCA Examination

Scheme of Examination for Four Year Bachelor of Science (B.Sc.) & BCA Program from Academic Session 2023-24

As approved by all the Boards of Studies in the Faculty of Science & Technology in their meetings held on 20th May 2023

Placed before the Faculty of Science & Technology for consideration and approval in its meeting scheduled on 25th May 2023

Preamble:

The Academic Council of Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur has adopted the Government Resolution No. NEP-2020/प्र.क्र.09/विशी-3/शिकाना dated 20th April 2023 issued by the Government of Maharashtra in its meeting held on 21st April 2023 in view of implementation of National Education Policy, 2020. The Faculty of Science & Technology, R T M Nagpur University has approved the following 'Teaching and Examination Scheme' for 'Four Year – Bachelor of Science (B.Sc.) Honours/Research Degree with Major and Minor' in its meeting held on 25th May 2023. The scheme is also approved by the Academic Council of the University in its meeting held on 5th June 2023. This notification is issued to facilitate the HEIs (Affiliated Colleges) and students for smooth conduct of admission process for the year 2023-24. Basic details required at the time of admission are provided in this notification and a detailed Direction/Regulation containing comprehensive provisions related to all aspects shall soon be issued by the University. Further, a list of 'Co-Curricular Courses (Annexure – VI) shall also be soon issued by the University.

1. **Details of Eligibility for B.Sc. & BCA Semester I Examination**

   a. The candidate should have passed 12th Standard Examination of the Maharashtra State Board of Secondary and Higher Secondary Education/CBSE/ICSE, with English at Higher or Lower level and any Modern Indian Language at higher or lower level together with any three science subjects comprised in the Faculty of Science or an examination recognized as equivalent thereto in such subjects and with such standards of attainments as may be prescribed;

   OR

   b. 12th Standard Examination of Maharashtra State Board of Secondary and Higher Secondary and offering Education in Vocational/Bi-focal Stream with one language only with any three science subjects comprised in the faculty of Science OR any other examination recognized as equivalent thereto in such subjects and with such standards of attainments as may be prescribed by Minimum Competency Vocational Courses (MCVC).

   OR

   c. Any other Equivalent Examination of any State in (10+2) pattern with any three science subjects comprised in the Faculty of Science or an examination recognized as equivalent thereto in such subjects and with such standards of attainments as may be prescribed.

   d. For admission to the B.Sc. programs in i) Computer Science ii) Information Technology, iii) Data Science iv) Electronics and v) Bachelor in Computer Applications (BCA), the candidate should have passed the 12th Standard Examination of the Maharashtra State Board of Secondary and Higher Secondary Education with English and other Modern Indian Languages together with mathematics or an examination recognized as equivalent thereto in such subjects and with such standards of attainments as may be prescribed.

2. Duration of the Program, Student Progression Path and Provisions for Multiple Entry and Exit

Duration of the **B.Sc. & BCA** Program shall be FOUR years with the provision for multiple exits as mentioned here:

Multiple Exit:

Students will have the flexibility to enter a program in odd semesters and exit a program after the successful completion of even semester as per their future career needs:

a. A student can exit the program after successful completion of semesters I & II having earned requisite number of credits as mentioned in the scheme of examination and additional 'NSQF* Course or Internship' with 4 credits. Such a student shall be eligible for the award of 'Certificate in Science' by the University.
OR a student can continue the program in 2nd year.

b. A student can exit the program after successful completion of semesters I, II, III, & IV having earned requisite number of credits as mentioned in the scheme of examination and additional 'NSQF* Course or Internship' with 4 credits. Such a student shall be eligible for the award of 'Diploma in Science' by the University.
OR a student can continue the program in 3rd year.

c. A student can exit the program after successful completion of semesters I, II, III, IV, V & VI having earned requisite number of credits as mentioned in the scheme of examination. Such a student shall be eligible for the award of 'Three Year Bachelor of Science' degree by the University.
OR a student can continue the program in 4th year for either HONOURS or RESEARCH degree.

d. A student, on successful completion of all the 8 semesters and having earned requisite number of credits as mentioned in the scheme of examination shall be eligible for the award of either 'Bachelor of Science (Honours) Degree with Major and Minor' OR 'Bachelor of Science (Research) Degree with Major and Minor'.

Table 2: Eligibility for Award of Certificate/Diploma/Degree/Honours or Research Degree

Levels	Qualification Title	Additional Credits to be Earned	Credit Earned	Sem.	Year
4.5	UG Certificate in Science *OR* Continue with Major	4 (NSQF* Course or Internship)	44	2	1
5.0	UG Diploma in Science with Major & Minor *OR* Continue with Major	4 (NSQF* Course or Internship)	88	4	2
5.5	Three Year Bachelor Degree in Science with Major & Minor *OR* Continue with Major & Minor	Not Required	132	6	3
6.0	Bachelor Degree in Science (Honors/Research) with Major and Minor	Not Required	172	8	4

***NSQF:** National Skill Qualification Framework or the skill courses prescribed by the RTMNU.*

3. Re-entry or Lateral Entry

a. Students, opting for exit at any level, will have the option to re-enter the programme from where they had left off, in the same or in a different higher education institution within THREE years of exit and complete the degree programme within the stipulated maximum period of SEVEN years from the date of admission to first year.

b. Re-entry at various levels for lateral entrants in academic programmes shall be based on the earned and valid credits as deposited and accumulated in the Academic Bank of Credits (ABC) through Registered Higher Education Institutions (RHEI) and proficiency test records.

c. Lateral entry into the programme of study leading to the UG Diploma / Three Year UG Degree / Four Year Bachelor's Degree with Honours/Research will be based on the validation of prior learning outcomes achieved and subject to availability of seats based on intake capacity.

4. Types of Courses

A student admitted to this program is required to undergo and successfully complete the following types of courses as mentioned in the scheme of examination:

Table 1: Types of Courses and Choice for Selection

SN	Course Type	Choice for Selection
1.	Major (Core) Subject	A student is required to select her/his 'MAJOR' subject from amongst the choices provided in this scheme of examination before filling the examination form for 1st Semester. Change of major subject shall not be permitted after the examination form is submitted. Major subject comprises of Mandatory and Elective Course.
2.	Minor Subject	A student is required to select her/his 'MINOR' subject from amongst the choices provided in this scheme of examination or any other degree program offered by the university in any other faculty before filling the examination form for 3rd Semester. Change of minor subject shall not be permitted after the examination form for 3rd Semester is submitted.
3.	Open Elective Course (OE)	A student is required to select an 'OPEN ELECTIVE' from the 'Open Elective Basket' of any program offered by the university in any faculty before filling the examination form for the semester concerned. Such an 'OPEN ELECTIVE' cannot be selected from the subjects chosen by a student as 'Major' and 'Minor' subjects. A student is allowed to earn credits for 'OPEN ELECTIVE' by successfully completing online courses of equivalent credits from SWAYAM/NPTEL learning platforms or from other Higher Education Institutions affiliated to RTM Nagpur University. However, this needs to be informed by student to the college before commencement of the semester and an application for transfer of credits is required to be made by student.
4.	Vocational Skill Course (VSC)	A student is required to successfully complete the 'VOCATIONAL SKILL COURSE' as mentioned in this scheme of examination. This course must be a course corresponding to the 'MAJOR' and/or MINOR subject selected by a student. A student is allowed to earn credits for 'VOCATIONAL SKILL COURSE' by successfully completing online courses of equivalent credits from SWAYAM/NPTEL learning platforms or from other Higher Education Institutions affiliated to RTM Nagpur University provided they are approved by the competent authority of RTM Nagpur University. However, this needs to be informed by student to the college before commencement of the semester and an application for transfer of credits is required to be made by student.
5.	Skill Enhancement Course (SEC)	A student is required to select a 'SKILL ENHANCEMENT COURSE' from the basket provided by the university for this purpose. A separate notification and guidelines in this regard shall be displayed by the university on its website. A student is allowed to earn credits for 'SKILL ENHANCEMENT COURSE' by successfully completing online courses of equivalent credits from

		SWAYAM/NPTEL learning platforms or from other Higher Education Institutions affiliated to RTM Nagpur University provided they are approved by the competent authority of RTM Nagpur University or the courses from Sector Skill Council. However, this needs to be informed by student to the college before commencement of the semester and an application for transfer of credits is required to be made by student.
6.	Ability Enhancement Course (AEC)	A student is required to undergo and successfully complete the 'ABILITY ENHANCEMENT COURSE' as mentioned in this scheme of examination.
7.	Indian Knowledge System Course (IKS)	A student is required to undergo and successfully complete the 'INDIAN KNOWLEDGE SYSTEM COURSE' as mentioned in this scheme of examination.
8.	Value Education Course (VEC)	A student is required to undergo and successfully complete the 'VALUE EDUCATION COURSE' as mentioned in this scheme of examination.
9.	Co-Curricular Course (CC)	A student is required to select a 'Co-Curricular Course' as mentioned in this scheme of examination. This course must be completed at the Higher Education Institute (HEI) where the student has taken admission and transfer of credit is not permissible for this type of course.
10.	Field Project (FP) / On the Job Training (OJT) /Community Engagement Project (CEP) / Research Project (RP)	A student is required to undergo and successfully complete this course as mentioned in the scheme of examination under the guidance of supervisor/mentor assigned by the HEI. This course must be corresponding to the 'MAJOR.' This course must be completed at the HEI where the student has taken admission and transfer of credit is not permissible for this type of course.

5. Availability of 'Major' and 'Intake Capacity'

All HEIs affiliated to the University for offering B. Sc. Program in the Faculty of Science and Technology shall adhere to the following:

Table 3: List of MAJOR Subjects

Affiliated Program	**Sanctioned Intake**	**'Major' to be offered**	**Code of 'Major'**
B. Sc. (Group A)	As approved by the University	Chemistry	CH
		Environmental Science	ES
		Textile Science	TS
		Fashion Design	FD
B. Sc. (Group B)	As approved by the University	Physics	PH
		Zoology	ZO
		Biochemistry	BC
		Cosmetic Tech.	CT
B. Sc. (Group C)	As approved by the University	Mathematics	MT
		Botany	BO
		Home Science	HS
		Forensic Science	FS
		Interior Design	HD
B. Sc. (Group D)	As approved by the University	Statistics	ST
		Microbiology	MI
		Biotechnology	BT
		Geology	GE
		Electronics	EN

B. Sc. (Group E)	As approved by the University	Computer Science	CS
		Data Science	DS
		Information Technology	IT
		Bachelor of Computer Application	CA
		App. Electronics & Software Technology	ET

NOTES:

- Table 3 above has five groups accommodating all the Major programs. A student is required to select one Major program (subject) from any Basket.
- A student is required to select one Minor from any basket except the basket from which she/he has selected the Major program (subject).
- Total intake capacity for the program as approved by the university shall remain the same and be divided amongst the 'Major' subjects allowed for that program.
- The HEI may offer a particular 'Major' subject based on the availability of teachers and students.
- The HEI is not expected to force any student to opt for a particular subject where a choice is provided in the scheme of examination.
- Subject code given in the table may change, however the change if any will be notified.

6. Minor Subjects:

All HEIs affiliated to the University for offering B. Sc. Program may offer all/any of the subjects given in Table 3 (column 3) as 'MINOR' subject/s as mentioned in this scheme of examination. It is mandatory for the students to choose only one Minor subject which obviously will be other than the Major subject she/he has already chosen. Once the Minor subject is chosen, it is mandatory for a student to pursue all the courses from the basket of that Minor only.

7. All HEIs affiliated to the University offering B. Sc. Program are required to display the list of 'Major' and 'Minor' subjects offered on the Notice Board as well as on the website of HEI to make students aware about the availability of subjects. Moreover, HEIs are expected to define and display the 'Standard Operating Procedure' for their faculty members and students to facilitate the process of selecting 'Major' and 'Minor' subjects.

8. In pursuance with the National Education Policy 2020 and a Government Resolution No. NEP-2020/प्र.क्र.09/विशी-3/शिकाना dated 20th April 2023 issued by the Government of Maharashtra, the credit framework for B. Sc. Program is given in **Annexure - I.**

9. Teaching and Examination Schemes:

Teaching and Examination Schemes (of eight semesters) and Syllabus of Semester I & II for all B.Sc. subjects and BCA is appended in **Annexure - II**.

10. Credit Specifications:

a. Theory/Tutorial Courses**:** One hour/credit/week (a minimum of 15 hours of teaching per credit is required in a semester.
b. Laboratory/Performance Based Courses: A minimum of 30 hours in laboratory or Performance Based activities is required in a semester. Performance based activities include Studio activities, Workshop based activities, internship, Apprenticeship, Field based learning, community engagement learning, etc.
c. Each semester will consist of at least 15 weeks of Academic Work equivalent to 90 actual teaching days.

11. GRADE Conversion Table and Computation of SGPA & CGPA

Table 4: Grade Conversion Table (Theory)

SN	Letter Grade	Grade Point	Mark Range	Performance
1	O	9.00 - 10.00	90 - 100	Outstanding
2	A+	8.00 - < 9.00	80 - < 90	Excellent
3	A	7.00 - < 8.00	70 - < 80	Very Good
4	B+	6.00 - < 7.00	60 - < 70	Good
5	B	5.50 - < 6.00	55 - < 60	Above Average
6	C	5.00 - < 5.50	50 - < 55	Average
7	P	4.00 - < 5.00	40 - < 50	Pass
8	F	Below 4	Below 40	Fail
9	AB	0	-	Absent

Table 5: Grade Conversion Table (Practical)

SN	Letter Grade	Grade Point	Mark Range	Performance
1	O	9.00 - 10.00	90 - 100	Outstanding
2	A+	8.00 - < 9.00	80 - < 90	Excellent
3	A	7.00 - < 8.00	70 - < 80	Very Good
4	B+	6.00 - < 7.00	60 - < 70	Good
5	B	5.50 - < 6.00	55 - < 60	Above Average
6	P	5.00 - < 5.50	50 - < 55	Pass
7	F	Below 5	Below 50	Fail
8	AB	0	-	Absent

Computation of SGPA & CGPA:

The UGC recommends the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i. The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e

$$SGPA\ (Si) = \Sigma(Ci \times Gi) / \Sigma Ci$$

where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

ii. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$CGPA = \Sigma(Ci \times Si) / \Sigma Ci$$

where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

iii. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

iv. CGPA to Percentage (%) conversion formula:

$$Percentage\ (\%) = (CGPA) * 10$$

Note: Illustration for Computation of SGPA & CGPA is given on last page

12. General Guidelines:

a. Students opting Major in the subjects Computer Application, Computer Science, Information Technology and Data Science will not be eligible to take Minor Courses offered by any of these four Major subjects. For Example, a student is opting Computer Application as Major, will not be eligible to take the Minor courses from the Minor baskets of Computer Science, Information Technology and Data Science subjects.

b. A student will be eligible to the fourth year of four year with Research Degree only when she/he scores minimum 7.5 CGPA or 75% in three-year degree.

c. For non-credit courses 'Satisfactory' or 'Unsatisfactory' shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

d. The baskets of Elective & Vocational Skill Courses are related to the Major, are given at the end of scheme.

e. The baskets of Open Elective Courses, Skill Enhancement Courses, Minor Courses and Co-curricular Courses being common will be available at the end (after the scheme of all Major subjects) in the form of Annexures.

f. SEE (Semester End Examination) for Theory as well as Practical examinations as mentioned in the scheme shall be conducted by the University for all EVEN semesters and by colleges on behalf of the University for all ODD Semesters.

g. In case, a student is opting out any of the course (subject to conditions of this scheme) and bringing credits from any other institutes/online courses outside the scheme, the marks/grades obtained by student shall be certified by the Principal and be submitted to the university as CIE (Continuous Internal Examination) marks.

13. Assessment

- The final total assessment of examinees is made in terms of Continuous Internal Assessment (CIE) and Session End Examination (SEE) for each course/subject taken together.
- For each course mentioned in Annexures – II, III, IV and V, the examination shall be conducted at college level (Odd semesters examinations) and RTM Nagpur University level (Even semester examinations)
- For each course mentioned in annexure - VI, the examination shall be conducted at the college level according to the evaluation system prescribed in annexure – VI.

Table 6: CIE Assessment Plan

1a	Attendance of the student during a particular semester	05 Marks
1b	An assignment (min. two) based on curriculum to be assessed by the teacher concerned	05 Marks
1c	Subject wise class test (min. two) or activities conducted by the teacher concerned with proper rubrics.	10 Marks
	Continuous Internal Evaluation (CIE) marks/course	**20**

- In case of Courses having more than 20 marks for CIE, a scheme of evaluation is appended with the detailed syllabus of the course.
- Expected classroom activities shall consist of the following: (a) Group Discussion (b) Seminars (c) Power Point Presentations (d) Elocution (e) Debate (f) Role Play (g) Case Studies (h) Educational Games. The teacher is expected to undertake a minimum of four of the aforesaid activity.
- The CIE marks will be communicated to the University at the end of each semester, but before the semester end examinations / as instructed by the university. These marks will be considered for the declaration of the results.
- The record of internal marks, evaluation & results should be maintained for a min. period of three year by the respective institute/college for verification by the competent authority.

14. Standard of Passing

The scope of the course, percentage of passing in Theory and Project and Internal Assessment will be governed as per following rules:

(i) In order to pass the Bachelor of Science (B.Sc.) 1st, 2nd, 3rd, 4th, 5th, 6th, 7th and 8th Semester Examinations, an examinee shall obtain not less than 40 % (Grade 4) marks in each theory course/paper, taking CIE & SEE together. Whereas, for practical/performance-based examination an examinee shall obtain not less than 50 % (Grade 5) marks in each practical, taking CIE & SEE together.

(ii) An examinee who is unsuccessful at the examination shall be eligible for admission to the subsequent examinations on payment of a fee prescribed for the examination together with the conditions of the ordinance in force from time to time.

15. Abbreviations Used:

CIE: Continuous Internal Evaluation SEE: Semester End Examination

OE: Generic/Open Electives, VSEC: Vocational Skills & Skill Enhancement Courses, VSC: Vocational Skill Courses, SEC: Skill Enhancement Courses, AEC: Ability Enhancement Courses, IKS: Indian Knowledge Systems, VEC: Value Education Courses, OJT: On Job Training (Internship/Apprenticeship), FP: Field Project, CEP: Community Engagement & Service, CC: Co-curricular Courses, RM: Research Methodology, RP: Research Project

16. Provision for Transfer of Credits

The B.Sc. program offered under this direction provides enhanced academic flexibility to students in terms of selecting the courses they want to learn. A student can opt for any course from any statutory/recognized University or a MOOC from SWAYAM/NPTEL in lieu of a course mentioned in this scheme of examination as 'Open Elective', 'Vocational Skill Course' and 'Skill Enhancement Course'. The mechanism for transfer of credits earned through these courses to be adhered is mentioned here:

1. Every student is mandatorily required to create an ID on Academic Bank of Credits (ABC) and shall submits her/his ID to the college.
2. Any Course mentioned in this scheme of examination under 'Open Elective', 'Vocational Skill Course', and 'Skill Enhancement Course' may be opted by a student for taking a MOOC from SWAYAM/NPTEL learning platform.
3. A student cannot opt any other course than the courses under course category mentioned in point no. 2 mentioned above.
4. If a student is willing to opt any such course, he/she will have to mention this while submitting the examination form to the University for respective semester.
5. A certificate of completion of such an ODL/Online course shall be submitted by the student to the University through college before end term evaluation.
6. Such a certificate shall mandatorily have the number of credits, duration of the course and grades/marks obtained by the student and shall preferably have a QR code for verification.
7. The college shall submit the grades and marks obtained by the student to the University along with CIE marks for the concerned examination.
8. If a student has opted for an ODL/Online course in a particular semester and failed to submit the certificate within prescribed time, the student will be marked as 'Absent' for a particular course in that examination. Such a student will be required to fill in the examination form for the next attempt and submit the passing certificate in order to get his/her corrected result.
9. A separate guideline 'Transfer of Credits' issued by the University will be applicable to the students of B. Sc. Program from the date of its issuance.

Annexure – I: Credit Structure given by Govt. of Maharashtra as per GR dated 20/04/2023
Annexure – II: Scheme of teaching & examination of all Major programs
Annexure – III: Basket of Minor Courses of all programs
Annexure – IV: Basket of Open Electives (OE)
Annexure – V: Basket of Skill Enhancement Courses (SEC)
Annexure – VI: Basket of Co-curricular courses (CC)

NOTE: This scheme of teaching and examination for Bachelor of Science program shall be effective from the academic session 2023-24 and a comprehensive direction for other regulations in this connection shall be soon issued by the University.

Illustration for Computation of SGPA & CGPA

i) Illustration for SGPA

COURSE	CREDIT	GRADE LETTER	GRADE POINT	CREDIT POINT (Credit * Grade)
Course 1	3	A	8	3 * 8 = 24
Course 2	4	B+	7	4 * 7 = 28
Course 3	3	B	6	3 * 6 = 18
Course 4	3	O	10	3 * 10 = 30
Course 5	3	C	5	3 * 5 = 15
Course 6	4	B	6	4 * 6 = 24
	20			139

SGPA (Si) = Σ(Ci x Gi) / ΣCi

where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

Thus, SGPA = 139 / 20 = 6.95

ii) Illustration for CGPA

Semester 1	Semester 2	Semester 3	Semester 4	Semester 5	Semester 6
Credit : 20 SGPA : 6.9	Credit : 22 SGPA : 7.8	Credit : 25 SGPA : 5.6	Credit : 26 SGPA : 6.0	Credit : 26 SGPA : 6.3	Credit : 25 SGPA : 8.0

CGPA = Σ(Ci x Si) / Σ Ci

where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

$$\text{Thus, CGPA} = \frac{20 \times 6.9 + 22 \times 7.8 + 25 \times 5.6 + 26 \times 6.0 + 26 \times 6.3 + 25 \times 8.0}{144} = 6.73$$

Annexure - I

Credit distribution structure for three/ four-year Honors/Research Degree Program with Multiple Entry and Exit options (GoM GR dated 20/04/2023)

Level	Sem.	Major		Minor	OE	VSC, SEC (VSEC)	AEC, VEC, IKS	OJT, FP, CEP, CC,RP	Cum. Cr./Sem.	Degree/ Cum. Cr.
		Mandatory	Electives							
4.5	I	6	-	-	2 + 2	VSC: 2, SEC: 2	AEC: 2, VEC: 2, IKS: 2	CC: 2	22	**UG Certificate 44**
	II	6	-	-	2 + 2	VSC: 2, SEC: 2	AEC: 2, VEC:2 IKS: 2	CC: 2	22	
	Cum Cr.	12	-	-	8	4 + 4 = 8	4 + 4+ 4 = 12	4	44	
Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor										
5.0	III	6		6	2	VSC:2,	AEC:2	FP:2 CC:2	22	**UG Diploma 88**
	IV	6		6	2	SEC:2	AEC:2	CEP: 2 CC:2	22	
	Cum Cr.	24		12	12	12	16	12	88	
Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor										
5.5	V	9	4	6	-	VSC: 2	-	CEP: 1	22	**UG Degree 132**
	VI	9	4	3	-	VSC: 2	-	OJT :4	22	
	Cum Cr.	42	8	21	12	16	16	17	132	
Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor										
6.0	VII	12	4	RM:4	-	-	-	-	20	**UG Honours Degree 172**
	VIII	12	4	-	-	-	-	OJT: 4	20	
	Cum Cr.	66	16	25	12	16	16	21	172	
Four Year UG Honours Degree in Major and Minor with 160-176 credits										
6.0	VII	9	4	RM:4	-	-	-	RP: 3	20	**UG Research Degree 172**
	VIII	9	4	-	-	-	-	RP: 7	20	
	Cum Cr.	60	16	25	12	16	16	27	172	
Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits										

Annexure - II

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

Bachelor of Botany

Submitted by

Board of Studies,

Bachelor of Botany

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)

(Botany- Major)

Four Year (Eight Semester Degree Course)

Teaching and Examination Scheme

B.Sc. Sem-I (Botany - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	**Botany-1** Microorganisms-Viruses, Prokaryotes, Algae and Fungi	BBO1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	**Botany-1** Microorganisms-Viruses, Prokaryotes, Algae and Fungi	BBO1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	**Botany-2** Cryptogams-Bryophyta, Palaeobotany & Pteridophyta	BBO1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	**Botany-2** Cryptogams-Bryophyta, Palaeobotany & Pteridophyta	BBO1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Identification of Angio spermic plants	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Botany - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	**Botany-3** Spermatophyte-Gymnosperm & Angiosperm Morphology	BBO2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	**Botany-3** Spermatophyte-Gymnosperm & Angiosperm Morphology	BBO2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	**Botany-4** Cell Biology & Genetics (Mendelism)	BBO2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	**Botany-4** Cell Biology & Genetics (Mendelism)	BBO2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Horticulture	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-III (Botany - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	**Botany-5** Algae, Fungi, Lichen &Plant Pathology	BBO3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	**Botany-5** Algae, Fungi, Lichen &Plant Pathology	BBO3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	**Botany-6** Fossil Angiosperms &Angiosperm Taxonomy	BBO3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	**Botany-6** Fossil Angiosperms &Angiosperm Taxonomy	BBO3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Botany - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	**Botany-7** Genetics, Plant breeding, Biostatistics & Evolution	BBO4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	**Botany-7** Genetics, Plant breeding, Biostatistics & Evolution	BBO4P07			2	1	-	-	-	-	25	25	25
3	DSC	**Botany-8** Plant Development, Anatomy& Embryology	BBO4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	**Botany-8** Plant Development, Anatomy& Embryology	BBO4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4P06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

B.Sc. Sem-V (Botany - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min.
1	DSC	**Botany-9** Biochemistry & Plant Physiology	BBO5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	**Botany-9** Biochemistry & Plant Physiology	BBO5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	**Botany-10** Economic botany, Ethnobotany & Phytogeography.	BBO5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	**Botany-10** Economic botany, Ethnobotany & Phytogeography.	BBO5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	**Botany-11** Medicinal Plants: Cultivation and Practices	BBO5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	**Botany-11** Medicinal Plants: Cultivation and Practices	BBO5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective **1Botany 12** (Pharmacognosy and Phytochemistry / Forestry)	BBO5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective **1Botany 12** (Pharmacognosy and Phytochemistry / Forestry)	BBO5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Botany - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	**Botany-13** Ecology & Laboratory Instrumentation	BBO6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	**Botany-13** Ecology & Laboratory Instrumentation	BBO6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	**Botany-14** Biotechnology& Molecular Biology	BBO6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	**Botany-14** Biotechnology& Molecular Biology	BBO6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	**Botany-15** Seed Technology & Plant Nursery	BBO6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	**Botany-15** Seed Technology & Plant Nursery	BBO6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	**Elective-2 Botany 16** Molecular biology & Bioinformatics / LaboratoryTechniques	BBO6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	**Elective-2 Botany 16** Molecular biology & Bioinformatics / LaboratoryTechniques	BBO6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Botany - Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	**Botany-17** Microbiology, Algae and Fungi	BBO7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	**Botany-17** Microbiology, Algae and Fungi	BBO7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	**Botany-18** Bryophytes and Pteridophytes	BBO7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	**Botany-18** Bryophytes and Pteridophytes	BBO7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	**Botany-** 19 Palaeobotany and Gymnosperms	BBO7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	**Botany-** 19 Palaeobotany and Gymnosperms	BBO7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	**Botany-20** Cytology and Genetics	BBO7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	**Botany-20** Cytology and Genetics	BBO7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3 **Botany 21** (Plant Identification & Herbarium Technique / Ethnobotany)	BBO7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3 **Botany 21** (Plant Identification & Herbarium Technique / Ethnobotany)	BBO7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BBO7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BBO7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Botany - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	**Botany-23** Plant Physiology and Biochemistry.	BBO8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	**Botany-23** Plant Physiology and Biochemistry.	BBO8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	**Botany-24** Plant Development and Reproductive Biology	BBO8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	**Botany-24** Plant Development and Reproductive Biology	BBO8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	**Botany-25** Cell and Molecular Biology-I	BBO8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	**Botany-25** Cell and Molecular Biology-I	BBO8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	**Botany-26** Angiosperms-I and Ethnobotany	BBO8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	**Botany-26** Angiosperms-I and Ethnobotany	BBO8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4 **Botany-27** (Biodiversity and Environment / Plant Biochemistry)	BBO8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4 **Botany-27** (Biodiversity and Environment / Plant Biochemistry)	BBO8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Botany - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	**Botany-17** Microbiology, Algae and Fungi	BBO7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	**Botany-17** Microbiology, Algae and Fungi	BBO7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	**Botany-** 18 Palaeobotany and Gymnosperms	BBO7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	**Botany-** 18 Palaeobotany and Gymnosperms	BBO7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	**Botany-19** Cytology and Genetics	BBO7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	**Botany-19** Cytology and Genetics	BBO7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3 **Botany 20** (Plant Identification & Herbarium Technique / Ethnobotany)	BBO7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3 **Botany 20** (Plant Identification & Herbarium Technique / Ethnobotany)	BBO7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BBO7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BBO7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Botany- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	**Botany-22** Plant Physiology and Biochemistry Ethnobotany.	BBO8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	**Botany-22** Plant Physiology and Biochemistry Ethnobotany.	BBO8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	**Botany-23** Plant Development, Reproductive Biology and Angiosperms-I	BBO8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	**Botany-23** Plant Development, Reproductive Biology and Angiosperms-I	BBO8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	**Botany-24** Cell and Molecular Biology-I	BBO8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	**Botany-24** Cell and Molecular Biology-I	BBO8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4 **Botany-25** (Biodiversity and Environment / Plant Biochemistry)	BBO8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4 **Botany-25** (Biodiversity and Environment / Plant Biochemistry)	BBO8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2 +1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Botany)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Identification of Angiospermic plants	Botany	**BVS1P01**
II	**VSC**	Horticulture	Botany	**BVS2P03**
III	**VSC**	Plant pathology and Disease management	Botany	**BVS3P05**
V	**VSC**	Plant propagation and tissue culture	Botany	**BVS5P07**
VI	**VSC**			**BVS6P08**

Basket for ELECTIVE (DSE) Category Courses (Botany)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Pharmacognosy and Phytochemistry B. Forestry	BBO5T12
VI	Elective 2	A. Molecular biology & Bioinformatics B. LaboratoryTechniques	BBO6T16
VII (Honors)	Elective 3	A. Plant Identification & Herbarium Technique B. Ethnobotany	BBO7T21
VIII (Honors)	Elective 4	A. Biodiversity and Environment B. Plant Biochemistry	BBO8T27
VII (Research)	Elective 3	A. Plant Identification & Herbarium Technique B. Ethnobotany	BBO7T20R
VIII (Research)	Elective 4	A. Biodiversity and Environment B. Plant Biochemistry	BBO7T25R

Model Question Paper Format

Time:-3Hrs. Max.Marks:80

Note:-1.All questions are compulsory.
2. Each question carries equal marks.

Q. 1. Write on:-

(A) Unit-I 8Marks
(B) Unit-I 8Marks

OR

Write Short Notes on:-

(C) Unit-I 4Marks
(D) Unit-I 4Marks
(E) Unit-I 4Marks
(F) Unit-I 4Marks

Q. 2. Write on:-

(A) Unit-II 8Marks
(B) Unit-II 8Marks

OR

Write Short Notes on:-

(A) Unit-II 4Marks
(B) Unit-II 4Marks
(C) Unit-II 4Marks
(D) Unit-II 4Marks

Q. 3. Write on:-

(A) Unit-III 8Marks
(B) Unit-III 8Marks

OR

Write Short Notes on:-

(A) Unit-III 4Marks
(B) Unit-III 4Marks
(C) Unit-III 4Marks
(D) Unit-III 4Marks

Q. 4. Write on:-

(A) Unit-IV 8Marks
(B) Unit-IV 8Marks

OR

Write Short Notes on:-

(A) Unit-IV 4Marks
(B) Unit-IV 4Marks
(C) Unit-IV 4Marks
(D) Unit-IV 4Marks

Q. 5. Write in Three to Four Lines Diagrams are not necessary.

(A) Unit-I 2Marks
(B) Unit-I 2Marks
(C) Unit-II 2Marks
(D) Unit-II 2Marks
(E) Unit-III 2Marks
(F) Unit-III 2Marks
(G) Unit-IV 2Marks
(H) Unit-IV 2Marks

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

FOUR YEAR UNDERGRADUATE PROGRAMME

B.Sc. BOTANY (Honours/Research)

(Courses effective from Academic Year 2023-24)

SYLLABUS OF COURSES TO BE OFFERED

Major Courses (Discipline Specific Core), Minor Courses, Elective Courses (Discipline Specific Elective), Generic Elective (GE)/Open Elective (OE)

CHOICE BASED CREDIT SYSTEM (CBCS):

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill-based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

1. Major/Core Course: A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Major/Core course. Department/Subject Specific Core (DSC) is a single discipline course of study or specific subject course of study, which should be pursued by a student as a mandatory requirement of his /her program of study.

2. Minor Course: A course offered in a discipline/subject be treated as minor by another discipline/subject. Students are expected to gain in depth multi-/interdisciplinary understanding through theoretical and practical experiences, as well as an adequate knowledge base through the choice of minor subject and discipline. The student choosing to discipline specific core (DSC) have to choose minors from faculty/discipline unrelated to the major but something that complements the major.

3. Elective Course: A course which can be chosen from a pool of courses, and which is very specific or specialized or advanced or supportive to the discipline/subject of study or which provides an extended scope, or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course. There shall be a pool /basket of DSEs from which a student has to choose a course of study.

4. Generic Elective (GE) or Open Elective (OE) Course: An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective. Generic or open electives shall be a pool / basket of courses which is meant to provide multidisciplinary or interdisciplinary education to students.

5. Vocational Skill Course: Vocational Skill Courses enable people to work that requires technical knowledge along with artistic or practical skills. These courses do not focus on theoretical knowledge, instead, they are primarily designed to provide job centred training for very specific fields.

6. Ability Enhancement Courses (AEC): AEC courses are the courses based upon the content that leads to knowledge enhancement through various area of study. They are Language and Literature, Environmental Science and Sustainable Development courses which will be mandatory for all disciplines. Combination of courses on English, Indian language (Marathi /Hindi/ Sanskrit or other regional languages if offered in that college) and Environment studies can be taken as an example on AEC courses.

7. Professional Ethics, Value Education and Life Skills Courses (EVLSC): Value education courses are common pool of courses offered by different faculties/disciplines and are aimed at personality building embedding ethical, cultural and constitutional values promoting critical thinking and scientific temperament. Value based education is expected to accomplish the development of humanistic, ethical, constitutional and universal human values (UHV) of truth, righteous conduct, peace, love, nonviolence, scientific temper, citizenship values and life skills. Lessons in service and participation in community service programs could also be included as an integral part of the holistic education. Courses on life skills should beadded to increase the employability as well as self-esteem of the students.

8. Co-curricular Courses on Sports, Fine/Applied/Visual Arts and Cultural Activities: Students have to take some courses under co-curricular courses as a part of four-year multidisciplinary degree program.

9. Internship, apprenticeship, Field Projects and Community Engagement Projects: A student may undertake minimum of 4-6 weeks of Project Work either at University Research Centers or at any preapproved external Research Institutions/CSIR Laboratories.

The field-based learning / project should attempt to provide opportunities for students to understand the different socio-economic contexts. It should aim at giving students exposure to development related issues in rural and urban settings. This component will include participation in activities related to National Service Scheme (NSS), national Cadet Corps (NCC), adult education/literacy initiatives and mentoring school students. A minimum of 4-6weeks of summer work, either on university campus in activities related to preservation of environment/ biodiversity or community-based work in the neighbour community (through NSS unit) or field level work with a recognized NGO or regional case studies program at villages may be undertaken as a part of field projects

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

FOUR YEAR UNDERGRADUATE PROGRAMME

B.Sc. BOTANY (Honours/Research)

(Courses effective from Academic Year 2023-24)

SYLLABUS

Semester I

B. Sc. Semester-I Discipline Specific Core Course (DSC-I)- BOTANY Paper-I (BBO1T01) Microorganisms-Viruses, Prokaryotes, Algae and Fungi			
DSC-I Theory	**Hours: 2 Hours/Week**	**Marks: 80+20=100**	**Credit: 2**
Unit-I			
1. Introduction to microorganisms. 2. Classification of microorganisms (Outline) –Carl Woese's- Domain system (1990). 3. Brief account of Bacteria- Archaebacteria, Mycoplasma, Actinomycetes 4. **Viruses-** General account, structure& multiplication of –T4 Phage (Lytic, Lysogenic) 5. **Bacteria**: General characteristics, cell structure and economic importance. 6. **Cyanobacteria** : *Nostoc* (Morphology, Reproduction and importance in Agriculture)			7 Hrs
Unit-II			
1. General characteristics and Economic importance's of Algae. 2. **Classification of algae**: Lee (2008) up to phylum with examples 3. **Morphology and reproduction of the following**: *Oedogonium, Chara* and *Ectocarpus,*			8 Hrs
Unit-III			
1. **Fungi** General characteristics and Economic importance. 2. **Classification outline:** Alexopolous and Mims, 1996 3. **Life cycle** of *Albugo*, *Rhizopus* and *Agaricus*. 4. **Mycorrhiza:** ectomycorrhiza and endomycorrhiza.			7 Hrs
Unit-IV			
1. **Lichens:** General account, Types of lichens, Internal Structure, Reproduction and Economic importance. 2. **Plant Pathology:** Casual organism, Symptoms, transmission and control measures of Plant diseases- Citrus canker, Red Rot of Sugar cane, Little leaf of Brinjal and Leaf Curl of Papaya.			8 Hrs

DSC-I Practical	Hours: 2 Hours/Week	Marks: 25+25=50	Credit: 1

1. Study of Viruses from models / photographs (TMV and T4 Bacteriophage).
2. Study of gram staining of the given Bacterial culture.
3. Study of ultrastructure of Bacteriophage from TEM photographs.
4. Study of vegetative and reproductive structure of Cyanobacteria: *Nostoc*, *temporary* preparations and from permanent slides.
5. Study of vegetative and reproductive structure of Algae: *Chara, Ectocarpus, and Oedogonium,* temporary preparations and from permanent slides.
6. Study of Fungal genera: *Albugo, Rhizopus, and Agaricus*.
7. Study of Lichen: Thallus structure, Types of lichens.
8. **Plant Pathology** Study of diseases caused by the following: Citrus canker, Red Rot of Sugar cane, Little leaf of Brinjal and Leaf Curl of Papaya.
9. **Mycorrhiza:** ectomycorrhiza and endomycorrhiza (Photographs).
10. Instruments of Micro biology laboratory.

Suggested activity:

Seminar, Quiz, debate, Assignments, collection of diseased plant parts –studying symptoms and identification of pathogen, collection and study of Algae available in local area, Field work, Study Projects, Models etc. are Part of Curriculum for all units in all papers

B.Sc - SEMESTER –I BOTANY PRACTICAL

PAPER –I

Microorganisms-Viruses, Prokaryotes, Algae and Fungi

Time: 3hrs. **Max. Marks: 25**

1. Perform Gram staining of the given Bacterial culture **/** Identify giving reasons the given C**yanobacteria (A)**. **5 Marks**
2. Identify giving reasons the given **Algae (B)** **5 Marks**
3. Identify giving reasons the given Fungi **(C)** **5 Marks**
4. **Spotting:** **5 Marks**
   D. One of the instruments of Micro biology laboratory.
   E. Whole specimen or a permanent slide of Algae.
   F. Whole specimen or a permanent slide of Fungi.
   G. Whole specimen or a permanent slide of Plant disease studied.
   H. Whole specimen or a permanent slide of Lichens, Mycorrhiza.
5. Record and excursion report(submission is compulsory) **5 Marks**

Suggested readings

1. Barsanti, L. and Gualtieri, P. (2014). Algae: Anatomy, Biochemistry and Biotechnology, 2 nd Edition. CRC/ Taylor & Francis,
2. NY. Lee, R.E. (2018). Phycology, Fifth Edition. Cambridge University Press, Cambridge.
3. Marjorie, Kelly and Cowan, Heidi Smith. (2017). Microbiology: A Systems Approach. McGraw Hill New York, 5th edition.
4. Pandey, S.N and Trivedi, P.S. (2015). A text book of Botany Vol.I Vikas publishing House Pvt/ Ltd, New Delhi
5. Mehrotra, R.S. and K.R. Aneja. (1999). An Introduction to Mycology. New Age International Publisher.
6. Pelczar M.J., Chan E.C.S and Kreig N.R. (1997). Microbiology. Tata MacGraw Hill.
7. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGrawHill, Delhi, India.
8. Robert Edward Lee. (2018). Phycology. Cambridge University Press, U.K. 5th edition.
9. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.
10. Sharma, O. P. (2011). Algae. Tata McGraw Hill Education Private Limited, U.K. 1st edition.
11. Tortora, G.J., Funke, B.R., Case, C.L. (2011). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 13th edition

12. Aneja, K.R. (1993): Experimental in Microbiology, Plant Pathology & Tissue Culture, Wiswa Prakashan, New Delhi.
13. Bold H. C. and M. J. Wynne (1978): Introduction of Algae: Structure and Reproduction (Prentice Hall of India Pvt. Ltd.)
14. Sharma, P. D. [1991]: The Fungi (Rastogi & Co. Meerut)
15. Sharma, P.D. [1993] Microbiology and plant pathology (Rastogi & Co)
16. Smith, GM. [1971] Cryptogamic Botany, Vol 1 Algae and Fungi(TMI)
17. Smith, K. M. [1992]: Plant Viruses 6th Ed (university Book Stall New Delhi)
18. Sunder Rajan, S. (2001): Tools and Techniques of Microbiology, Anmol Publ New Delhi
19. Vasistha, B. R. (1990): Algae (S. Chand & Co. New Delhi)
20. Vasistha, B. R. (1990): Fungi (S. Chand & Co. New Delhi)
21. Woese CR, Fox GE (November 1977). "Phylogenetic structure of the prokaryotic domain: the primary kingdoms". Proceedings of the National Academy of Sciences of the United States of America. 74 (11): 5088 0. Bibcode:1977PNAS...74.5088W. doi:10.1073/pnas.74.11.5088. PMC 432104. PMID 270744
22. Agrios, G.N. (1980) Plant Pathology, academic Press, INC, New York.
23. Ainsworth, G.C. and A.S.Sussman (eds). The Fungi, An advance Treatise Vol.I, II, III & IV Academic Press, New York.
24. Alexopoulos C.J., Mims C.W. and Blackwell M. 2002. Introductory Mycology (4thed.). John Wiley and Sons (Asia), Singapore.
25. Alexopoulos, C.J., Mims and Black well (1996) 4th ed. John Wiley and Sons, Inc. Wiley, New York
26. Gangulee H.C. and Kar A.K. 2011. College Botany (Vol. II).New Central Book Agency. Calcutta.
27. Gupta, V.K. and M.K.Behl (1994) Indian Plant Viruses and Mycoplasma Kalyani Publishers, 1/1, Rejinder Nagar, Ludhiana.
28. Rangaswamy, G. and A.Mahadevan (1999) Diseases of Crop Plant in India, Prentice Hall
29. Bergey's Manual of Systematic Bacteriology, 2nd ed., vol. 1-3, Springer Verlag, New York, NY.
30. Pandey, B.P. (2014). Modern Practical Botany Vol. I. S. Chand and Company Ltd. Ramnagar, New Delhi.
31. Purohit, S.D., Kundra, G. K. and Singhvi, A. (2013). Practical Botany (part I). Apex Publishing House Durga Nursery Road Udaipur, Rajasthan.
32. Sambamurty, A.V.S.S. (2006). A text book of Algae. I.K International Publishing House,Pvt. Ltd.
33. Dube, R.C. and D.K. Maheshwari (2000) Practical Microbiology -S.Chand & Co. Ltd.

B. Sc. Semester-I

Discipline Specific Core Course (DSC-II)- BOTANY Paper-II (BBO1T02)

Paleobotany, Bryophyta and Pteridophyta

DSC-II Theory	Hours: 2 Hours/Week	Marks: 80+20=100	Credit: 2

Unit-I	
1. Palaeobotany: Concept and Importance. Geological Time Scale. 2. Contributions of Birbal Sahni 3. Types of fossils: Impression, Compression, Petrifaction, Cast, Mold and Amber. 4. Fossil plants: *Glossopteris* (Leaf, Scutum).	7 Hrs
Unit-II	
1. Bryophytes – Bryophytes as amphibians of kingdom Plantae, General characteristics of Hepaticopsida, Anthocerotopsida and Bryopsida, alternation of generation and classification (Proskauer 1957) of Bryophytes. 2. Distribution, morphology, anatomy, reproductive structures and life-cycles of *Riccia* and *Funaria* 3. Economic Importance of Bryophytes.	8 Hrs
Unit-III	
1.Pteridophytes- General characteristics of Psilopsida, Lycopsida, Sphenopsida and Pteropsida 2.Classification (Smith 1955) and Economic importance 3.Alternation of generation in Pteridophytes (Homosporic and Heterosporic) 4.Stelar system in Pteridophytes	7 Hrs
Unit-IV	
1. Fossil Pteridophyte : Rhynia 2. Morphology, anatomy, reproductive structures and life-cycle in Selaginella, and Pteris 3. Heterospory and Seed habit.	8 Hrs
Note- 1. Developmental details not to be included. 2. Short Excursion tour/visit is expected to study Bryophytes and Pteridophytes or fossils in natural habitat.	

DSC-II Practical	Hours: Hours/Week	Marks: 25+25=50	Credit: 1

1. Study of Fossil types
2. Study of fossil plants- Rhynia, Glsossopteris.
3. Study of morphology, classification, reproductive structures and life-cycle of Riccia and Funaria
4. Study of morphology, classification, anatomy, reproductive structures and lifecycle of Selaginella, and Pteris

B.Sc - SEMESTER –I BOTANY PRACTICAL

PAPER –II

Palaeobotany, Bryophytes and Pteridophytes

Time: 3hrs. **Max. Marks: 25**

Q. 1) Identify & give characters of the given Bryophytic material [A] and make a temporary Mount 05

Q. 2) Identify & give characters of the given Pteridophytic material [B]and make temporary Mount. 05

Q. 3) Describe the given fossil Type [C] 05

Q. 4) Spotting: 05

D- Bryophyte

E- Pteridophyte (Morphology)

F- Pteridophyte (Reproductive)

G- *Glossopteris*

H- Types of Stele

Q. 5) Practical Record & Excursion Report 05

Suggested reading

1. Agashe SN 1995. Paleobotany- Plants of the past, their evolution, paleoenvironment and Allied plants. Hutchinson & Co., Ltd., London.
2. Prasad KN 1999. An Introduction to Paleobotany. APH Publication.
3. Siddiqui KA 2002. Elements of Paleobotany. Kitab Mahal Allahabad.
4. Parihar NS 1995. Essential of Paleobotany. Central Book, Allahabad.
5. Gangulee HC, Kar AK and Santra SC 2018. College Botany Vol II. New central Book Agency Ltd London.
6. Singh V, Pande PC and Jain DK 2007. Diversity of Microbes and Cryptograms. Rastogi Publication.
7. Hait G, Bhattacharya K and Ghosh AK 2017. A Textbook of Botany Vol I. New central Book Agency Ltd London.
8. Bhattacharya K, Hait G, and Ghosh AK 2015. A Textbook of Botany Vol II. New central Book Agency Ltd London.
9. Rashid A 2016. An Introduction to Archegoniate Plants. Vikas Publishing House.
10. Thakur AK and Bassi SK 2007. Diversity of Microbes and Cryptograms. S. Chand Publication, New Delhi.
11. Rashid A 2018. An Introduction to Bryophyta. Vikas Publishing House.
12. Satish Kumar 2015. Diversity of Algae, Lichen and Bryophytes. Pragati Publication.
13. Sharma OP 2017. Bryophyta. Tata McGraw Hill Publishing Co. New Delhi.
14. Vashishtha BR 2016. Bryophyta. S. Chand Publication, New Delhi.

15. Parihar NS 1997. The biology and Morphology of Bryophytes. Central Book Depot, allahabad.
16. Smith GM 1971. Cryptogamic Botany. Vol. II. Bryophytes & Pteridophytes. Tata McGraw Hill Publishing, New Delhi.
17. Vanderpoorten A and Goffinet B 2009. Introduction to Bryophytes, Cambridge Unversity Press, Cambridge.
18. Sharma OP 1990. Text Book of Pteridophyta. McMillan India Ltd. New Delhi.
19. Sharma OP 2012. Pteridophyta. Tata McGraw Hill Publishing Co. New Delhi.
20. Sporne KR 1970. The Morphology of Pteridophytes. Hutchinson University Library London.
21. Dhaka TS and Lalit Singh 2017. Elementary Pteridophyta. Pragati Prakashan.
22. Rashid A 2018. An Introduction to Pteridophyta. Vikas Publication House Pvt. Ltd.
23. Parihar NS 1970. An Introduction to Embryophyta. Vol. I. Bryophyta. Central Book, Allahabad.
24. Parihar NS 1976. An Introduction to Pteridophytes, Central Book Depot, Allahabad.
25. Vashishtha BR 1992. Pteridophyta. S. Chand and Co. New Delhi.
26. Sundara Rajan 2000. Practical Manual of Pteridophyta. Anmol Publication Pvt. Ltd. New Delhi.
27. Santra SC 2015. Practical Botany Vol I NCBA London.

B. Sc. Semester-I

VSC Botany (BVS1P01)

Identification of Higher plants

VSC Practical	Hours: 4 Hours/Week	Marks: 50+50=100	Credit: 2

Unit-I	
1. Study of Morphological features of vegetative parts of plant. a) Morphology of different types of Roots and its Modifications with examples. b) Morphology of Stem and its Modifications with examples. c) Morphology of Leaf and its Modifications with locally available plants. d) Study of phyllotaxy and venation pattern and epidermal features of different leaves with locally available suitable examples.	15 Hrs
Unit-II	
2. Study of Morphological features of reproductive parts of plant. a) Study of Inflorescence- i) Cymose, 2) Racemose, 3) Special types b) Structure of typical flower and its variations.	15 Hrs
Unit-III	
3. Study of Morphological features of reproductive parts of plant. a) Study of family specific characteristics features of plants, b) Study of accessory whorls of flower-Calyx and Corolla with Modifications c) Study of essential whorls of flower – Androecium and Gynoecium with modifications. d) Study of fruits- Simple, aggregate and composite with suitable examples.	15 Hrs
Unit-IV	
4. Taxonomic description of various locally available different taxa representing various members of dicot and monocot groups (minimum 7 from Dicot and 3 from monocot) and preparation of Key (for any two families by using available Flora) 5. Identification of plant by – a) Flora (10 Plants). b) By using different online applications (Minimum two apps) c) Visit to different taxonomic digital data base.	15 Hrs

B.Sc - SEMESTER –I BOTANY PRACTICAL

VSC Botany (BVS1P01)

Identification of Higher plants

Time: 5 Hrs **Total Marks: 50**

Q1. Describe the given plant material in technical language and identify the family.	10
Q2. Describe the morphology of different leaf	10
Q3. Prepare a family key of given plants	10
Q4. Identify the given plant species using Flora	05
Q5. Spotting 1. (Vegetative Morphology - 3) 2. (Types of Inflorescence - 2)	05
Q6. Viva-voce & Practical Record	10

Suggested Reading

1. Flora of British India By T. Cooke
2. Flora of Nagpur District By Dr. N. R. Ugemuge.
3. Practical Botany Vol. II, Bendre & Kumar
4. Flora of Maharashtra State By- Sharma, Karthikeyan, Singh.
5. Various other flora available from different websites.

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto- cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr **P.U. Meshram, Allied Publishers, New Delhi.**
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, Motilal Banarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books.

Semester II

B. Sc. Semester-II Discipline Specific Core Course (DSC-3)- BOTANY Paper-3 (BBO2T03) Spermatophyte: Gymnosperms and Angiosperm Morphology			
DSC-III Theory	**Hours: 2 Hours/Week**	**Marks: 80+20=100**	**Credit: 2**
Unit-I			
Gymosperms: 1. **Gymnosperms:** General characteristics, Classification (Stewart, 1982) and Economic Importance 2. **Fossil Gymnosperms:** *Cycadeoidea* (Morphology and Reproductive structure) 3. **Life cycle of:** *Cycas* (Morphology, Anatomy and Reproductive structures)			7 Hrs
Unit-II			
Vegetative Morphology: 1. **Root:** Tap root and adventitious root, modification of root for storage and respiration. 2. **Stem:** Branching (Monopodial and Sympodial), Modification of stem (Runner, Suckers Rhizome, Tuber, Bulb) 3. **Leaf:** Typical leaf, Types (Simple and Compound), Types of phyllotaxy, Venation, Modification of leaf (Tendril, Phyllode)			8 Hrs
Unit-III			
Reproductive Morphology: 1. **Inflorescence:** Definition, Racemose, Cymose and Special types. 2. **Flower:** Structure of Typical flower, insertion of floral whorls, Variation in thalamus (Androphore, Gynophore and Gynandrophore) 3. **Calyx and Corolla:** Cohesion, Forms of corolla and Aestivation. 4. **Androecium:** Parts, Cohesion, Adhesion and Fixation.			7 Hrs
Unit-IV			
Carpel and Fruit: 1. **Gynoecium:** Parts, Cohesion, Adhesion and Placentation. 2. **Fruit:** Definition, Pericarp, Types of fruits: Simple (Dehiscent, Schizocarpic, Dry Indehiscent, Fleshy Indehiscent); Aggregate (Etaerio) fruits, Composite Fruits			8 Hrs

(Sorosis and Syconus).	

DSC-III Practical	Hours: 2Hours/Week	Marks: 25+25=50	Credit: 1

1. Study of Gymnosperms*:* Fossil gymnosperm *Cycadeoidea and Cycas*
2. Study of different root modifications
3. Study of nature of branching and modification of stem
4. Study of leaf: Types (Simple & Compound), Phyllotaxy, Venation and Modifications.
5. Inflorescence: Types mentioned in theory.
6. Flower: Parts, calyx, corolla, androecium, gynoecium, Insertion of Floral whorls, variation in thalamus.
7. Fruits: Study of different types of fruits

B.Sc - SEMESTER –II BOTANY PRACTICAL

PAPER –III

Spermatophyte: Gymnosperms and Angiosperm Morphology

TIME: FIVE HOURS **MAX. MARKS: 25**

Q. 1: Identify the given **Gymnospermic** material **(A)**. Prepare temporary mount and write identifying characters. 05 M

Q. 2: Describe the given **leaf** material**(B)**. 05 M

Q. 3: Describe the given **flower(C)** 05 M

Q. 4: **Spotting**: 05 M

(D) Gymnosperm **(E)**Fossil gymnosperm **(F)**Modified root/Stem

(G) Inflorescence **(H)** Fruit

Q. 5: Practical Record and Excursion report. 05 M

Suggested Readings:

1. Bhatnagar, S. P. and Moitra A. (1996): Gymnosperms. New Age International Limited, New Delhi.
2. Bierhorst, D. W. [1971]: Morphology of Vascular Plants. Macmillon& Co. N. R.
3. Chamberlain, C. J. (1986) Gymnosperms-Structure and Evolution .CBS Publishers & Distributors.
4. Cronquist A. (1961) Introductory Botany . Harper and Brothers , Publishers, New York.
5. Datta A. C. [1971] A Class-book of Botany, Oxford University Press .
6. Galbraith D (1989) Understanding Biology.John Wiley & Sons Inc.
7. Gangulee H. C. and Kar A. K (1970) College Botany Vol. I & II, New Central Book Agency, Calcutta
8. Moore, R, Clark W. D, Vodopich D. S. (1998) Botany. Second Edition . WCB/McGraw-Hill,
9. Sambamurty A.V.S.S. (2013) A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. I K International Publishing House Pvt. Ltd .
10. Saxena A. K. and Sarabhai R. P. (1962) A Textbook of Botany Vol. II.RatanPrakashanMandir, Agra.
11. Sharma, O. P. (2004). Gymnosperms.McMillan India Ltd.
12. Singh M. P, Sharma A K (2002) Textbook of Botany. Anmol Publications Pvt. Ltd.
13. Sporne, K. R. (1965): The Morphology of Gymnosperms. Hutchinson University Library Press,London.
14. Vashishtha, B. R. [1992]: Gymnosperm. S. Chand & Co. New Delhi.
15. Vashistha, P.C (1978) Botany for Degree Students- Gymnosperms Vol. V. S. Chand and Co. New Delhi.
16. Vashistha, P.C, Sinha A. K. and Kumar A (1976) Botany for Degree Students- Gymnosperms S. Chand Publishing.
17. Verma, V. (2010) Botany. Ane Books Pvt. Ltd.

B. Sc. Semester-II

Discipline Specific Core Course (DSC-4)- BOTANY Paper4 (BBO2T04) Cell Biology and Genetics			
DSC-III Theory	**Hours: 2 Hours/Week**	**Marks: 80+20=100**	**Credit: 2**
Unit-I			
1. Definition of cell, brief account of Schleiden and **Schwann** Cell theory. 2. Comparison of prokaryotic and eukaryotic cell 3. Ultra-structure of typical plant cell 4. Ultra-Structure and functions of: a. Cell wall b. Cell membrane (Fluid Mosaic model) c. Endoplasmic reticulum			7 Hrs
Unit-II			
Ultra- Structure and functions of: Continued d. Golgi complex e. Ribosomes f. Mitochondria g. Chloroplast h. Lysosome i. Vacuole j. Peroxisomes and Glyoxysomes			8 Hrs
Unit-III			
Ultra-Structure and functions of: Continued k. Nucleus 5. Morphology of typical eukaryotic chromosome 6. Karyotype and idiogram 7. Molecular organization of chromosome- **Nucleosome model** 8. Sex chromosomes in ***Melandrium album*** (XY-type)			7 Hrs
Unit-IV			
9. Cell cycle 10. Mitosis in plants 11. Meiosis in plants 12. Significance of Mitosis and Meiosis 13. Mendelism: Monohybrid and dihybrid cross, Laws of inheritance – Law of segregation and Law of independent assortment			8 Hrs

DSC-IV Practical	Hours: 2Hours/Week	Marks: 25+25=50	Credit: 1
1. To study the cell organelles with the help of photographs and slides. 2. To study the mitosis with suitable plant materials. 3. To study the meiosis with suitable plant materials. 4. To work out the Numerical problems based on monohybrid and dihybrid ratio. 5. To prove Mendel's law of segregation by applying Chi-square test with the help of coloured beads. 6. To prove Mendel's law of independent assortment by applying Chi-square test with the help of coloured beads. 7. To study the morphology of eukaryotic Chromosome. 8. To demonstrate monohybrid cross by using Pea plant.			
Note: **Botanical excursion and visits is compulsory**			

B.Sc - SEMESTER –II BOTANY PRACTICAL

PAPER –IV

Cell Biology and Genetics

TIME: FIVE HOURS **MAX. MARKS: 25**

Q. 1: To prepare semi permanent smear/squash of the given plant material (A), identify stage/ Stages of Cell division. 05 M

Q. 2: to prove Mendels law of inheritance by using colour beads (B) and apply chi square test 06 M

Q. 3: To work out numerical problem based on monohybrid/ dihybrid ratio. 04 M

Q. 4: **Spotting**: 05 M

(D)Cell organelle **(E)** Cell organelle

(F) Mitosis/ Meiosis

(G) Types of cell **(H)** Chromosome morphology

Q. 5: Practical Record and Excursion report. 05 M

Suggested reading:

1. The Science of Genetics, William Hexter; Henry t. Yost Jr, Printice-Hall of India Pvt. Ltd, New-Delhi; 1977.
2. Genetics 2nd Ed., Strickberger M.W.; Mac Millan Publising Co. Inc., New York, 1976.
3. Cell and Molecular Biology, E. De. Robertis and E.M. De. Robertis; 7th Ed. Saunders College/Holt Rinehart and Winston, Philadelphia, 1980.
4. Fundamental of Genetics, 6th Ed. B.D. Singh; MedTech Science Press, Scientific International Pvt. Ltd., New Delhi, 2023.
5. Cytology and Genetics, V.R. Dnyansagar; Tata Mc Graw Hill, 1986.
6. Genetics, C. Sarin; Tata Mc Graw Hill, 1985.
7. Principles of Genetics, Gardner E.J.; Simmons M.S. and D. Peter Snustad, Wiley India Pvt. Ltd., New Delhi, 2006.
8. Cell Biology, Gerald Karp; 7th Ed., Wiley India Pvt. Ltd., New Delhi, 2013.
9. Introduction to Cytogenetics, Ganesh Prasad, Kalyani Publishers, New-Delhi, 1998.
10. Cell Biology, C.B. Powar, Himalaya Publishing House, Mumbai, 2010.

B. Sc. Semester-II VSC Botany (BVS2P03) Horticulture			
VSEC Practical	**Hours: 4 Hours/Week**	**Marks: 50+50=100**	**Credit: 2**
Unit-I			
1. Visit to a garden/orchard/vegetable farm. 2. Identification of major fruit crops of our country. 3. Identification of major vegetable crops of our country. 4. Identification of major flower crops of our country.			15 Hrs.
Unit-II			
1. Identification of ornamental plants for avenues and lawn- grasses, hedges, edges plants of our country 2. Identification of indoor and outdoor foliage ornamentals, cacti-succulents and bulbous plants. • Understanding interior environments. • Plants for different light conditions. • Deciding the location of the indoor plant, managing colour, Using mirrors, Plants in baskets, Miniature gardens 3. Dealing with indoor plants- Potting Media, Container selection, managing plant nutrition, pruning indoor plants, Factors for growing indoor plants			15 Hrs.
Unit-III			
1. Propagation of horticultural crops through seeds 2. Propagation through asexual methods-cuttings, layering, runners, suckers, grafting, and budding. 3. Preparation of pot for planting, cleaning, media preparation and filling.			15 Hrs.
Unit-IV			
1. Identification of different fertilizers-NPK 2. Identification of organic manures-FYM, vermicompost, cakes, bone meal. 3. Preparation of model of a low-cost storage structure for horticultural produce			15 Hrs.

B.Sc. Semester-II BOTANY

PRACTICALEXAMINATION

VSEC-3 Botany (BVS2P03)

Subject: Horticulture

Time: 5 hrs. **Max. Marks: 50**

Q.1. Identify Given five Fruit material and state its importance.	05
Q.2. Identify Given five Vegetable materials and state its importance.	05
Q.3. Identify given four flowers crops of our country.	10
Q.4. Describe various Potting Media, Container selection for indoor plants,	05
Q.5. Prepare a pot for planting by cleaning, media preparation and filling.	05
Q.6. Spotting:	10
Identify given 05 fertilizer samples and comment on it.	
Q.7. Viva-voce	05
Q.8. Practical Record and field visit report.	05

Suggested Reading

1. Fundamentals of Horticulture Dr. G. S. K. Swamy, Dr. J. Auxcilia
2. Principles of Horticulture Fifth edition C.R. Adams, K.M. Bamford and M.P. Early Butterworth-Heinemann is an imprint of Elsevier
3. Fundamentals of Horticulture A Laboratory Manual Dr. Divya Slathia, Dr. Amit Saurabh, Dr. Yogendra Singh & Dr. Shalini Singh Dr. Khem Singh Gill, Akal College of agriculture, Eternal University, Baru Sahib, Sirmour 173101, Himachal Pradesh, India.
4. Fundamentals of Horticulture (Practical Manual) S.K. Pandey, C.S. Pandey Department of Horticulture College of Agriculture Jawaharlal Nehru Krishi Vishwa Vidyalaya Jabalpur 482004 (MP)
5. Practical manual of Basic Agriculture CBSE First Edition

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

Bachelor of Science (Biochemistry)

Submitted by

Board of Studies,

Bachelor of Science (Biochemistry)

FYUGP-Scheme I-VIII Semester
Bachelor of Science (Honors/Research)
(Biochemistry - Major)
Four Year (Eight Semester Degree Course)
Teaching and Examination Scheme

B.Sc. Sem-I (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Biomolecules & Nutritional Biochemistry	BBC1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Biomolecules & Nutritional Biochemistry	BBC1P01	-		2	1	-	-	-	-	25	25	25
3	DSC	Microbial Biochemistry	BBC1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Microbial Biochemistry	BBC1P02	-		2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Refer VSC Basket	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Human Physiology & Clinical Biochemistry	BBC2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Human Physiology & Clinical Biochemistry	BBC2P03			2	1	-	-	-	-	25	25	25
3	DSC	Techniques in Biochemistry	BBC2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Techniques in Biochemistry	BBC2P04			2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Microbial Culture Media	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-III (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Agriculture Biochemistry	BBC3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Agriculture Biochemistry	BBC3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Enzymes and Enzyme Technology	BBC3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Enzymes and Enzyme Technology	BBC3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Food Processing Techniques	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Molecular Biology-Prokaryotes	BBC4T07	2	-	-	2	3	80	20	40	-	--	
2	DSC	Molecular Biology-Prokaryotes	BBC4P07	-	-	2	1					25	25	25
3	DSC	Metabolism	BBC4T08	2	-	-	2	3	80	20	40	-	--	
4	DSC	Metabolism	BBC4P08	-	-	2	1					-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	--	
6	Minor	Minor 3 (Refer Minor Basket)		-	-	2	1					25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	--	
8	Minor	Minor 4 (Refer Minor Basket)		-	-	2	1					-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Molecular Biology-Eukaryotes	BBC5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Molecular Biology-Eukaryotes	BBC5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Advanced Biophysical Techniques	BBC5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Advanced Biophysical Techniques	BBC5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Cell Communication and Signalling	BBC5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Cell Communication and Signalling	BBC5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Molecular Genetics or Forensic Biochemistry	BBC5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Molecular Genetics or Forensic Biochemistry	BBC5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Genetic Engineering	BBC6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Genetic Engineering	BBC6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Biochemistry of Diseases	BBC6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Biochemistry of Diseases	BBC6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Immunology	BBC6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Immunology	BBC6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Immunodiagnostics or Molecular sequencing Techniques	BBC6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Immunodiagnostics or Molecular sequencing Techniques	BBC6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Bioinformatics	BBC7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Bioinformatics	BBC7P17			2	1	-	-	-	-	25	25	25
3	DSC	Protein Biochemistry	BBC7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Protein Biochemistry	BBC7P18			2	1	-	-	-	-	-	50	25
5	DSC	Applied Biochemistry	BBC7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Applied Biochemistry	BBC7P19			2	1	-	-	-	-	25	25	25
7	DSC	Neurobiochemistry	BBC7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Neurobiochemistry	BBC7P20			2	1	-	-	-	-	-	50	25
9	DSE	Scientific communications and Data representations OR Obesity &Endocrine Disorders	BBC7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Scientific communications and Data representations OR Obesity &Endocrine Disorders	BBC7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BBC7T22	2	-	-	2	3	80	20	40			
12	RM	Research Methodology	BBC7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Toxicology and clinical research	BBC8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Toxicology and clinical research	BBC8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Protein Engineering and Drug delivery	BBC8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Protein Engineering and Drug delivery	BBC8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Environmental Biochemistry	BBC8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Environmental Biochemistry	BBC8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Secondary Metabolites and Its Applications	BBC8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Secondary Metabolites and Its Applications	BBC8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Reproductive Biochemistry OR Cancer Biology	BBC8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Reproductive Biochemistry OR Cancer Biology	BBC8P27	-	-	2	1					25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Bioinformatics & Protein Biochemistry	BBC7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Bioinformatics & Protein Biochemistry	BBC7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Neurobiochemistry	BBC7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Neurobiochemistry	BBC7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Applied Biochemistry	BBC7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Applied Biochemistry	BBC7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Scientific communications and Data representations OR Model Systems for Research	BBC7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Scientific communications and Data representations OR Model Systems for Research	BBC7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BBC7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BBC7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Toxicology, &Clinical Research and + Environmental Biochemistry	BBC8T22 R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Toxicology, &Clinical Research and + Environmental Biochemistry	BBC8P22 R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Protein Engineering and Drug delivery	BBC8T23 R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Protein Engineering and Drug delivery	BBC8P23 R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Secondary Metabolites and Its Applications	BBC8T24 R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Secondary Metabolites and Its Applications	BBC8P24 R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Reproductive Biochemistry OR Cancer Biology	BBC8T25 R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Reproductive Biochemistry OR Cancer Biology	BBC8P25 R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2+1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits: 1. Three Year UG Degree Program: 132

2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Biochemistry)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Microbial Culture media	Biochemistry	**BVS1P01**
II	**VSC**	Food Processing Techniques	Biochemistry	**BVS2P03**
III	**VSC**	Protein Purification	Biochemistry	**BVS3P05**
V	**VSC**	Methods of DNA Analysis	Biochemistry	**BVS5P07**
VI	**VSC**	Data Retrieval & Analysis	Biochemistry	**BVS6P08**

Basket for ELECTIVE (DSE) Category Courses (Biochemistry)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Molecular Genetics B. Forensic Biochemistry	BBC5T12
VI	Elective 2	A. Immunodiagnostics B. Molecular sequencing Techniques	BBC6T16
VII (Honors)	Elective 3	A. Scientific communications and Data representations B. Obesity & Endocrine Disorders	BBC7T21
VIII (Honors)	Elective 4	A. Reproductive Biochemistry B. Cancer Biology	BBC8T27
VII (Research)	Elective 3	A. Scientific communications and Data representations B. Model Systems for Research	BBC7T20R
VIII (Research)	Elective 4	A. Reproductive Biochemistry B. Cancer Biology	BBC7T25R

B. Sc. Part I
SEMESTER: I, PAPER: I

(Biomolecules and Nutritional Biochemistry)

UNIT-I

Carbohydrates: Classification and Biological Functions of monosaccharides(glucose, fructose, Manose, galactose), disaccharides, oligosaccharides, polysaccharides : starch, cellulose, chitin, food sources, digestion and storage in body. Nutritional aspects of carbohydrates, types of dietary carbohydrates, role of non starch carbohydrates.

Lipids: Nomenclature, classification, saturated and unsaturated lipids, Triglycerides, Conjugated lipids, Saponification value, Iodine Number, Acid value and RM number, Nutritional aspects of lipids, dietary types of lipids, essential lipids, classification, food sources, function of fats.

UNIT-II

Amino acids, classification, peptide bond, polypeptides. Proteins, functions, structure: primary Secondary, Tertiary, quaternary, Forces stabilizing protein structure, denaturation.

Nutritional aspects of proteins, Proteins - composition, sources, essential & non-essential amino acids, quality of proteins, digestibility coefficient, net protein utilization, biological value, amino acid score, Protein deficiency. Protein Energy malnutrition

Nucleic acids: Bases, Nucleoside, Nucleotide, DNA, Watson-Crick Model, A,B and Z forms of DNA, RNA, types and functions of RNA

UNIT-III

Vitamins (water & fat soluble) - definition, classification & functions. Minerals - macro & micronutrients. - functions, sources. Bioavailability, and deficiency of Calcium, Iron, Iodine, Sodium & Potassium (in very brief).

Modern methods of improvement or nutritional quality of food, food fortification, enrichment and nutrient supplementations

UNIT-IV

Direct and indirect calorimetry, energy value of foods, Basal Metabolic Rate, Measurement of BMR, Factors affecting BMR, energy requirements of human being Malnutrition- meaning. factors contributing to malnutrition, over nutrition.

Effect of cooking & heat processing on the nutritive value of foods. Role of fibers in human nutrition, Water - as a nutrient, function, sources, requirement, water balance & effect of deficiency.

B. Sc. Part I
SEMESTER: I, PAPER: II
(MICROBIAL BIOCHEMISTRY)

UNIT I

A) **History of Microbiology**: Contribution of Louis Pasteur, Robert Koch and Edward Jenner

B) **Microscopy:** Principle, Ray diagram and Applications of Compound Microscope, Phase contrast.

C) **Structure of Bacteria**: i) General morphology of bacteria, shapes & sizes ii) Biomolecular composition of Slime layer & capsule iii) Cell wall structure and composition of Gm + ve & Gm -ve cells iv) General account of Flagella, Pili & Fimbriae v) Endospore: Detailed study of endospore structure & its formation.

UNIT II

A) **Bacterial Nutrition**: i) Basic nutritional requirements (nutrients as water, carbon, nitrogen, sulfur and vitamins etc.). ii) natural and synthetic media, nutritional classification of bacteria. Selective and Differential media.
B) **Bacterial Growth:** Growth rate and generation time, growth curve ii) Physical conditions required for growth: Temperature (classification of microorganisms on the basis of temperature requirements), Ph etc.
C) **Isolation and Maintenance of Bacteria:** Pure cultures and cultural characteristics. I)Maintenance of pure culture. ii) Measurement of growth: - Total cell count and viable cell count method. ii)Biochemical characterization of bacteria

Unit III

A) **Terminologies:** Terminology Sterilization, disisinfectant, Antiseptic, Antimetabolite, Antibiotics, Microbiostatic, Microbicidal, Pasteurization and Sanitization.
B) **Biochemical basis of microbial control**: Factors influencing antimicrobial activity. Mechanism of cell injury
C) **Microbial control Methods**: Physical control methods and Chemical control methods.

Unit IV

A) Staining: Principle and technique of simple & differential staining, Gram staining, Endospore staining, Capsule staining, Negative staining.

B) **Introductory Medical Parasitology:** i) Classes of Pathogens (Bacteria, fungi, Protozoans, Helminths etc.), ii) Methods for diagnosis for parasitic infections iii) Pathogen induced disease: Malaria –(pathogen, lifecycle and stages of infection), Widal test

C) **Viruses:** General characteristics of viruses. Virus Structure. General characteristics of RNA and DNA Viruses. Bacteriophages, Lytic cycle & Lysogeny.

B. Sc. Part I Semester I PRACTICALS

[A] Biomolecules & Nutritional Biochemistry

1) Qualitative analysis of Carbohydrates.
2) Qualitative analysis of Proteins and Lipids.
3) Determination Saponification value of fats.
4) Determination of Acid value of fats.
5) Titrimetric estimation of calcium in food sample
6) Estimation of Vitamin C by DCPIP method.
7) Calculation Body Mass Index (BMI)
8) Determination of food adulterants.

[B] Microbial Biochemistry

1) Demonstration compound microscope, uses, & care of microbiological equipments.
2) Preparation of culture media: Nutrient agar slants and nutrient broth.
3) Sterilization of media and glassware by autoclaving.
4) Sterilization of heat labile compounds by filter sterilization.
5) Isolation of pure culture by streak plate and pour plate method.
6) Isolation of Bacteria on nutrient agar plate from water, air, skin, teeth samples etc.
7) Simple staining of Bacteria.
8) Differential staining: Gram staining and Endospore staining
9) Anaerobic culture of bacteria
10) Isolation of bacteriophage from sewage / other sources.

Note: - Mandatory to perform atleast 3 practical from each section

LIST OF BOOKS B.Sc. Semester I

1) Biochemistry – U. Satyanarayana, 6th Edition
2) Food Science, Chemistry and Experimental Foods: Dr.M.Swaminathan, The Bangalore Printing and Publishing Co. Ltd.
3) Fundamentals of Foods, Nutrition and Diet Therapy :S.R Mudambi and M.V. Rajgopal. New Age International Ltd
4) Harper's Biochemistry – Murray, Granner, Mayes, and Rodwell – Prentice Hall International Inc.
5) Biochemistry – Lehninger – CBS Publishers.
6) Biochemistry – Stryer – W. H. Freeman & Co. – New York.
7) Text Book of Biochemistry – West, Todd, Mason, Bruggen – Amerind Publishing Co. Pvt., Ltd.
8) General Microbiology, Vol. I & II – Powar, Daginawala – Himalaya Publishing House.
9) General Microbiology – Stanier, Adelberg, Ingraham – The Macmillan Press – London.
10) Fundamental Principals of Bacteriology – Salle – TMH Pub. Co. Ltd. – New Delhi.
11) Microbiology – Davis, Dulbacco, Eisen, Ginsberg – Harper International Edition.
12) Microbiology – Pelczar, Chan, Kreig –McGraw Hill Int. Edition.
13) Microbiology-An Introduction – Tortora, Funke, Case, Benjamin – Cummings Publ. Co.
14) Fundamental Virology (1995) – B. N. Fields, D. M. Knipe, P. M. Howley, R. M. Chanock, J. L. Meenick, T. P. Monath, Strans, Lippin Cott Raven.

VSC Basket Biochemistry (2 credit, 4 hour Practical) Semester 1

MICROBIAL CULTURE MEDIA (BVS1P01)

Course Objective: This course is designed to offer enhanced practical skills to students. After completion of this course student will have understand, learn and perform skills needed in a microbial laboratory/pathology laboratory.

1. Basic instrumentations in microbial culture.
2. Preparation and use of nutrient broth for microbial cultivation.
3. Preparation and use of nutrient agar for microbial cultivation.
4. Preparation of enriched media and cultivation of micro-organisms from water and soil.
5. Preparation and uses of alkaline peptone water enrichment media for cultivation of *Vibrio cholerae*.
6. Preparation and uses of Selenite F broth enrichment media for isolation of Salmonella from feces, urine, water, foods and other materials.
7. Preparation and use of differential media (Mac Conkey agar, Blood agar etc.) in microbial culture.
8. Preparation and use of transport media.
9. Preparation and use of storage media for microbial culture (Egg saline medium, chalk cooked meat broth etc.).
10. Isolation of salt sensitive E Coli using LB lennox broth.
11. Cultivation of aerobic and facultative anaerobic bacteria using Mueller Hinton Broth.

References:

1. American Society for Microbiology Commi. Manual of Methods for Pure Culture Study. 2nd edition. Sagwan Press publication.
2. Stuart Isaacs and Prof David Jennings. **Microbial Culture (Introduction to Biotechniques). Taylor and Francis.**

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto- cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr

P.U. Meshram, Allied Publishers, New Delhi.

8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

B. Sc. Part I
SEMESTER: II, PAPER: I
(Human Physiology & Clinical Biochemistry)

UNIT I

A) Acid base balance concepts: i). Concepts of Acid Base reaction and hydrogen ion concentration. pH meter & pH buffer. Ii)Disorders: Acidosis, Alkalosis

B) Blood: Composition, Hemoglobin, plasma proteins, Mechanism of blood coagulation, Anemia (Sickle cell anemia)

C) Muscles and Neurons: Structure of striated muscle fiber. Sliding mechanism of muscle contraction, Structure of Neuron, conduction of impulse, Neuromuscular Junction

UNIT-II

A) Cardiac Profile: Blood pressure (BP), BP disorders: Hypotension and Hypertension, Angina, Myocardial Infarction, Pattern of Cardiac Enzymes in heart diseases.

B) Kidney: Structure of Nephron, Urine formation, GFR, analysis of urine, Renal Function Tests,

C) Liver Function Tests, Jaundice, Importance of alkaline phosphatase, SGOT,SGPT and bilirubin

UNIT-III

A) Endocrine glands & their hormones, Classification of hormones. Role of Hypothalamus & Pituitary in hormone secretion

B) Function of hormones: Thyroxine, parathormone, adrenaline, noradrenaline, cortisol, Basic mechanism of action of Peptide and Steroid hormones.

UNIT-IV

A) Examination of body fluids:Semen analysis, CSF (Cerebrospinal Fluid) and Stool Examination.

B) Diabetic Profile 1. Regulation of Blood Glucose, 2. Glucose tolerance test, 3. Glycosylated Hemoglobin, 4. Microalbuminuria etc. Role of insulin, glucagon in diabetes

B. Sc. Part I

SEMESTER: II, PAPER: II

(Techniques in Biochemistry)

UNIT – I:

Spectrophotometry:-Concepts of electromagnetic radiation, Spectrum, Absorption of electromagnetic radiation, Concept of chromophores.
Beer's law – derivation & deviations, Extinction coefficient.
Instrumentation & applications of UV & Visible spectrophotometry.

UNIT-II

Chromatography:-Partition principle, partition coefficient, Paper Chromatography and thin layer chromatography,
Gel filtration: - Concept of distribution coefficient, Types of gels & glass beads, Applications Ion-Exchange chromatography: - Principle, Types of resins, Choice of buffers, Applications. Affinity chromatography: - Principle, Selection of ligand, Applications.

UNIT – III:

Electrophoresis: Migration of ions in electric field, Factors affecting electrophoretic mobility.
Paper electrophoresis: - Electrophoretic run, Detection techniques, Cellulose acetate electrophoresis
Gel electrophoresis: - Types of gels, Solubilizers, Procedure, Column & slab gels, Detection, Recovery & Estimation of macromolecules, Applications.

UNIT-IV:

Radioactive & stable isotopes: Pattern and rate of radioactive decay. Units of radioactivity. Isotopes commonly used in biochemical studies – 32P, 35S, 14C, 3H. Applications of isotopes in RIA, PET Scan etc.)

Centrifugation: Basic principles, RCF, Sedimentation coefficient, Svedberg constant, Types of centrifuge:- Desk top, High speed & Ultracentrifuges. Preparative centrifugation: - Differential & density gradient centrifugation, Isolation of cell components. Analytical centrifugation: - sedimentation velocity & sedimentation equilibrium methods.

B. Sc. Part I Semester II PRACTICALS

[A] Human Physiology & Clinical Biochemistry

1) Calculation of Normality, Molarity and preparation of Phosphate buffer.
2) Determination creatinine in urine by Jeff's method.
3) Determination serum bilirubin by Malloy and Evllyn method.
4) Estimation of blood urea by Nesslerization method.
5) Estimation of SGOT and SGPT activity.
6) Routine urine analysis.
7) Determination of alkaline phosphatase activity.
8)Determination of clotting time of blood by capillary tube method.
9) Estimation of glucose by Benedict quantitative method.
10)Measurement of blood pressure and blood group determination.

[B] Techniques in Biochemistry

1) Determination of absorption maxima of hemoglobin.
2) The validity of Beer's law for colorimetric estimation of creatinine.
3) Estimation of DNA by diphenylamine reaction.
4) Subcellular fractionation by centrifugation
5) Separation of amino acids by TLC.
6) Separation of amino acids by descending\ascending paper chromatography..
7) Determination of isoelectric pH of casein.
8) Estimation of proteins by Folin-Lowry's method.
9) Demonstration of Salting-Out of proteins by ammonium sulphate precipitation.
10) Agarose Gel electrophoresis of DNA

Note: - Mandatory to perform atleast 3 practical from each section

LIST OF BOOKS FOR SEMESTER II

1) Human Physiology, Vol. I & II, - C. C. Chatterjee – Medical Allied Agency – Calcutta.
2) Concise Medical Physiology – Choudhary – New Central Book Agency – Calcutta.
3) TextBook of Medical Physiology – Guyton – Prism Books Pvt. Ltd. – Bangalore.
4) Harper's Biochemistry – Murray, Granner, Mayes, and Rodwell – Prentice Hall International Inc.
5) Biochemistry – Lehninger – CBS Publishers.
6) Biochemistry – Stryer – W. H. Freeman & Co. – New York.
7) Text Book of Biochemistry – West, Todd, Mason, Bruggen – Amerind Publishing Co. Pvt., Ltd.
8) Biophysical Chemistry, Principles & Techniques – Upadhyay, Upadhyay & Nath – Himalaya Publ. House.
9) 2) A Biologists Guide to Principle & Techniques of Practical Biochemistry – Williams & Wilson – Edward Ernold Publ. 11
10) The Tools of Biochemistry – T. G. Cooper.
11) Principles & Techniques of Practical Biochemistry – Wilson, Walker- Cambridge Univ. Press.
12) Physical Biochemistry – H. B. Bull – John Wiley & Sons.
13) Enzyme Kinetics – Irwin H. Segal – Wiley Intersci. Publ.
14) Biologist's Physical Chemistry – T. G. Morris.
15) Chromatography – G. Abbott.
16) Methods in Experimental Biology – R. Ralph.
17) Physical biochemistry – vanHolde – Prentice Hall Inc.

VSC Basket Biochemistry (2 credit, 4-hour Practical) Semester 2

FOOD PROCESSING TECHNIQUES (BVS2P03)

Course Objectives: After completion of this course, the student should be able to:

- Understand methods of processing and analysis of important parameters related to food science.
- Perform proximate analysis to know components of food,
- Demonstrate various principle applied to food processing.
- Understand the importance of processing techniques.

SYLLABUS

1. Introduction to food laboratory practices,
2. Proximate analysis (protein, carbohydrate, fat) of food
3. Estimate the moisture content of food.
4. Determination of ash content in food.
5. Determination of fiber content.
6. Precipitation of casein protein from milk with vinegar and to test the effectiveness of casein as a bonding agent to make casein glue.
7. To demonstrate how changes in air pressure can affect food products and the principle behind applying a vacuum in meat processing.
8. Jelly preparation and effect of sugar content on the quality of Jelly.
9. Effect of Temperature on Taste
10. Estimation of microbial load in food materials by aerobic plate count
11. Estimation of protein by lowry's method
12. To study the osmotic dehydration of foods
13. Determination of rehydration ratio of dehydrated food
14. To detect the adulterants, present in the food.
15. Food preservation Techniques.

REFERENCES

1.Food – The Chemistry of Its Components by T P Coultate, Royal Society of Chemistry, 2016 6^{TH} , edition ,

2.Food Processing and Preservation by B. Sivasanker, Prentic Hall of India, 2014

3.Food Microbiology by W C Frazier and D C Westhoff, McGraw-Hill Book Company

4. Modern Food Microbiology by J M Jay, Springer US, Language:English, Author:James M. Jay, Martin J. Loessner, David A. Golden2005,

5.Food Processing: Principles and Applications by J Scott Smith and Y H Hui

6.Principles of Food Processing by Sathya Prakash Sinha

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus
Bachelor of Science (Biotechnology)

Submitted by

Board of Studies,
Bachelor of Science (Biotechnology)

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)

(Biotechnology - Major)

Four Year (Eight Semester Degree Course)

Teaching and Examination Scheme

B.Sc. Sem-I (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Introductory Microbial Biotechnology	BBT1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Introductory Microbial Biotechnology	BBT1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Cellular Macromolecules	BBT1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Cellular Macromolecules	BBT1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Basic Transformation Techniqus	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Techniques in Biotechnology	BBT2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Techniques in Biotechnology	BBT2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Enzyme Technology	BBT2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Enzyme Technology	BBT2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Dairy Technology	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-III (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Molecular Biology –I	BBT3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Molecular Biology –I	BBT3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Molecular Biology -II	BBT3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Molecular Biology -II	BBT3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Fundamentals of Genetic Engineering	BBT4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Fundamentals of Genetic Engineering	BBT4907	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Microbial Genetics	BBT4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Microbial Genetics	BBT4P08	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Immunology	BBT5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Immunology	BBT5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Medical Biotechnology	BBT5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Medical Biotechnology	BBT5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Techniques for gene editing	BBT5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Techniques for gene editing	BBT5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BBT5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BBT5P12	-	-	2	3	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Industrial Biotechnology	BBT6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Industrial Biotechnology	BBT6P13			2	1	-	-	-	-	25	25	25
3	DSC	Environmental Biotechnology	BBT6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Environmental Biotechnology	BBT6P14			2	1	-	-	-	-	-	50	25
5	DSC	Gene Transformation Techniques	BBT6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Gene Transformation Techniques	BBT6P15			2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BBT6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BBT6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Genomics	BBT7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Genomics	BBT7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Proteomics	BBT7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Proteomics	BBT7P18	-	-	2	1	-	-	-	-	-	50	25
3	DSC	Bioinformatics-I	BBT7T19	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Bioinformatics-I	BBT7P19	-		2	1	-	-	-	-	25	25	25
5	DSC	Bioinformatics-II	BBT7T20	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Bioinformatics-II	BBT7P20	-		2	1	-	-	-	-	-	50	25
7	DSE	Elective 3	BBT7T21	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BBT7P21	-		2	1	-	-	-	-	25	25	25
9	RM	Research Methodology	BBT7T22	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BBT7P22	-		4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Molecular Diagnostics	BBT8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Molecular Diagnostics	BBT8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Agricultural Biotechnology	BBT8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Agricultural Biotechnology	BBT8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Systems Biology-I	BBT8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Systems Biology-I	BBT8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Systems Biology-II	BBT8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Systems Biology-II	BBT8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BBT8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BBT8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Genomics	BBT7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Genomics	BBT7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Proteomics	BBT7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Proteomics	BBT7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Bioinformatics	BBT7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Bioinformatics	BBT7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BBT7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BBT7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BBT7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BBT7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Molecular Diagnostics	BBT8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Molecular Diagnostics	BBT8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Agricultural Biotechnology	BBT8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Agricultural Biotechnology	BBT8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Systems Biology	BBT8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Systems Biology	BBT8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BBT8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BBT8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2+1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Biotechnology)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Basic Transformation Techniques	Biotechnology	**BVS1P01**
II	**VSC**	Dairy Technology	Biotechnology	**BVS2P03**
III	**VSC**	Polymerase Chain Reaction (PCR) in Diagnostics	Biotechnology	**BVS3P05**
V	**VSC**	Next Generation Sequencing	Biotechnology	**BVS5P07**
VI	**VSC**	Tools for Scientific Communication	Biotechnology	**BVS6P08**

Basket for <u>ELECTIVE</u> (DSE) Category Courses (Biotechnology)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	**A.** Vaccinology **B.** Gene Therapy	BBT5T12
VI	Elective 2	**A.** Fermentation Technology **B**. Food Biotechnology	BBT6T16
VII (Honors)	Elective 3	**A.** Drug Discovery and Development **B.** Transcriptomics	BBT7T21
VIII (Honors)	Elective 4	**A.** Ethics in Biotechnology **B.** Nanobiotechnology	BBT8T27
VII (Research)	Elective 3	**A.** Drug Discovery and Development **B**. Transcriptomics	BBT7T20R
VIII (Research)	Elective 4	**A**. Ethics in Biotechnology **B**. Nanobiotechnology	BBT7T25R

'R' in the subject code indicates 'Research'.

BSc Biotechnology (Hons./Res)

Semester 1

Course Pre-requisite(s): *Basic Training in Chemical and Biological Concepts at the level of Higher Secondary.*

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Describe at conceptual level the microbial cell suitability for execution of biotechnological principles.

2. Diagrammatically demonstrate structure of various categories of microorganisms routinely utilized for biotechnological purposes.

3. Conceptualize handling of microbes for biotechnology applications.

4. Establish correlation of macromolecular organization and function at cellular level.

5. *Design basic strategy for associating changes in DNA with cellular functioning*.

6. Establish enzymatic correlation for execution of DNA manipulations

7. Select technical methods for analysis of manipulated Biomolecules

BSc Biotechnology (Basic / Hons.)

Semester 1

Title of the Courses:

Course 1 BBT1T01 : DSC-1 Introductory Microbial Biotechnology

Course 2 BBT1T02 : DSC-2 Macromolecular Foundations of Biotechnology

Course 3 BBT1P01: DSC-1P, Practical

Content of Course 1 (Course Code: BBT1T01)Theory DSC Introductory Microbial Biotechnology	30 Hrs

Unit – 1: Microorganisms: Concept and Importance	7 Hrs
Relevance of Microbiology in the field of Biotechnology; Landmark discoveries (Anton van Leuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Edward Jenner, Alexander Fleming); Distinguishing features of prokaryotic and eukaryotic microorganisms General morphology of bacteria: Size, shapes and arrangement; Bacterial Cell Structure: Slime layer and capsule, Flagella and Fimbriae, Endospore: Endospore structure & its formation, Basis of resistance; Ribosomes, Cell inclusions (Gas vesicles, carboxysomes, magnetosomes, PHB granules, Glycogen bodies, metachromatic granules)	
Unit -2 : Bacterial Cultivation and Growth	7 hrs
Basic nutritional (Macro and micronutrients) and environmental (temperature, oxygen and pH) requirements of Bacteria; Types of culture medium: Liquid, semi-solid and solid media; Selective media, Enrichment media, Enriched media, differential media. Nutritional classification of bacteria (phototrophs, chemotrophs, autotrophs, heterotrophs, prototrophs, auxotrophs). Concept of Pure culture, maintenance of pure cultures. Replica plating for isolation of mutants, screening of mutants/recombinants (Lederberg experiment) Details of growth curve & its various phases. Concept of culturable and non-culturable bacteria (VBNC).	
Unit – 3: Technical foundations of Microbiology	8 hrs
Importance of Sterilization; Physical methods of control: Moist Heat (Boiling, Pasteurization, Fractional sterilization, Autoclave), Dry Heat (Incineration, Hot air Oven), Filtration (Diatomaceous filters, membrane filters, HEPA), Radiation (Ionizing radiation-gamma radiations, non-ionizing radiations-UV radiations); Chemical methods of control: Alcohols, phenol, halogens, heavy metal salts, quaternary ammonium compounds, Gaseous sterilization agents Compound Microscopy: Parts of Compound microscope, Numerical aperture & its importance, Resolving power, Importance of Oil immersion objective, Ray diagram of compound light microscope. Importance of electron microscopy. Staining: Nature of stains, Types of stains, Principle of simple & differential staining	
Unit – 4: Microbial Diversity & Viruses	8 hrs

Algae & Fungi: Characteristics & applications in Biotechnology; Archaebacteria: Characteristics, classification and applications in Biotechnology; Viruses: General characteristics, different shapes and symmetries with one example of each type, classification of viruses on the basis of nucleic acids, Brief idea of lytic cycle and lysogeny. Commercially important microbial products [curd formation, penicillin, alcohol (wine), vaccine, vinegar/ Spirulina.]	

Content of Course 2 : DSC-2 (Course Code: BBT1T02), Macromolecular Foundations of Biotechnology	**30 Hrs**
Unit – 1: Structural foundations of macromolecules-1	8 hrs
Carbohydrates: Definition, classification, monosaccharide structure and properties. Simple sugars as carbon sources Amino acids and proteins: Definition, structure, classification and properties of amino acids, classification of proteins on the basis of structure (Globular and Fibrous proteins).	
Unit – 2: Structural foundations of macromolecules-2	8 hrs
Lipids and Fats: Definition, classification, structure, properties and importance of lipids. Nucleic Acids: Definition, classification, structure of nucleotides, properties and importance of sequence of nucleic acids (DNA and RNA).	
Unit – 3: Macromolecular organization in Bacterial cell	7 Hrs
Carbohydrate, protein and lipid foundations of bacterial cell wall, comparison of Gram positive and negative cell walls. Macromolecular basis of differential staining techniques (Gram staining, Acid Fast, Endospore and Capsule staining). Phospholipid bilayer as bacterial cell membrane. Proteins as structural and functional cellular units (Cytoskeleton and Transport proteins (porins) and enzymes).	

Unit -4 : Nucleic acids-blueprint of life	7 hrs
Identifying deoxyribonucleic acid (DNA) as the "transforming principle" (Avery, MacLeod and McCarty's Experiment). Beadle and Tatum experiments on Neurospora connecting gene (DNA) to Protein function. DNA protein complexes as Nuclear Materials – Bacterial chromosomes structure (its differences with the Eukaryotic chromosome); Extra Chromosomal materials (plasmid and episomes).	

Practical:

Practical 1 (BBT1P01)

1. Microbiological laboratory standards and safety protocols.
2. Standard aseptic conditions of Microbiological laboratory.
3. Operation and working principles of Light/ Compound microscope.
4. Working principles and operations of basic equipments of microbiological laboratory (Autoclave, Oven, Incubator, pH meter, Spectrophotometer, Colorimeter, vortex, magnetic stirrer etc).
5. Applications of basic microbiological tools (Pipettes, Micropipette, Bunsen burner, Inoculation loop, Spreader).
6. Qualitative test for carbohydrates: Molisch Test, Benedict's test, Barfoed test, Osazone test
7. Qualitative test for proteins and amino acids: Biuret Test, Ninhydrin Test, Lead Acetate test, Xanthoproteic test
8. Qualitative test for lipids: Solubility test, Saponification test, Acrolein test, Hubl's iodine test, Bromine water test

Practical 2 (BBT1P02)

1. Demonstration and observations of microorganisms from natural sources under light microscope (Algae, Yeast and Protozoa).
2. Demonstration of bacterial motility by hanging drop method.
3. Simple staining.
4. Differential staining - Gram staining.
5. Acid fast staining.
6. Structural staining - Flagella and Capsule.
7. Bacterial endospore staining.
8. Staining of reserved food materials.
9. Staining of fungi by Lactophenol cotton blue.
10. Negative staining.
11. Isolation of coliphage from sewage water

Text Books / References

1. Prescott, Harley, Klein's Microbiology, J.M. Willey, L.M. Sherwood, C.J.

Woolverton, 7th International, edition 2008, McGraw Hill.
2. Foundations in Microbiology, K. P. Talaro, 7th International edition 2009, McGraw Hill.
3. Basic Microbiology, Avinash Upadhyay, Kakoli Upadhyay & Sunita Bundale 1st edition, 2019, Himalaya Publishing House.
4. Brock Biology of Microorganisms, M.T.Madigan, J.M.Martinko, P. V. Dunlap, D. P. Clark- 12th edition, Pearson International edition 2009, Pearson Benjamin Cummings.
5. Microbiology – An Introduction, G. J.Tortora, B. R.Funke, C. L. Case, 10th ed. 2008,Pearson Education.
6. General Microbiology, Stanier, Ingraham et al, 4th and 5th edition 1987, Macmillan education limited.
7. Microbiology- Concepts and Applications, Pelczar Jr,Chan, Krieg, International ed, McGraw Hill.
8. Alexopoulos, C.J., Mims, C.W., and Blackwell, M. 2002. Introductory Mycology. John Wiley and Sons (Asia) Pvt. Ltd. Singapore. 869 pp.
9. Atlas, R.M. 1984. Basic and practical microbiology. Mac Millan Publishers, USA. 987pp.
10. Black, J.G. 2008. Microbiology principles and explorations. 7edn. John Wiley and Sons Inc., New Jersey 846 pp.
11. Pommerville, J.C. Alcamo's Fundamentals of Microbiology. Jones and Bartlett Pub..Sudburry, 835 pp.
12. Schlegel, H.G. 1995.General Microbiology. Cambridge University Press, Cambridge, 655 pp.
13. Toratora, G.J., Funke, B.R. and Case, C.L. 2007. Microbiology 9^{th} ed. Pearson Education Pte. Ltd., San Francisco. 958pp.
14. Harper's Biochemistry – Murray, Granner, Mayes, and Rodwell – Prentice Hall International Inc.
15. Biochemistry – Lehninger – CBS Publishers.
16. Biochemistry – Stryer – W. H. Freeman & Co. – New York.
17. Text Book of Biochemistry – West, Todd, Mason, Bruggen – Amerind Publishing Co. Pvt., Ltd.

Vocational Skill Courses

SEMESTER – I

BASIC TRANSFORMATION TECHNIQUES

Course Code: BVS1P01 **Total Contact Hours:60**

Course Outcomes:

After successful completion of this Course, students will be able to:

CO 1. Get an insight about the principles of bacterial/yeast cell transformation techniques.

CO2. Learn handling and development of genetically engineered organisms in the laboratory.

CO 3. Design strategies to screen genetically modified organisms.

CO 4. Work around the working principles behind various screening strategies

PRACTICALS

1. Bacterial Media preparation and Sterilisation principles for planning a transformation experiment- Eg. LB media preparation and Sterilisation
2. Handling bacterial pure cultures and subculturing- *E. coli* Dh5alpha
3. Pour plate versus Spread plate techniques for obtaining isolated bacterial colonies
4. Plasmid DNA isolation
5. Homogeneity analysis of isolated plasmid DNA by Agarose gel electrophoresis
6. Preparation of competent bacterial cells- $CaCl_2$ Method
7. Cryopreservation of competent cells
8. Transformation of competent bacterial cells with Plasmid DNA containing an antibiotic selection marker- Heat Shock Method
9. Selection of transformed cells using Pour plate/spread plate method
10. Comparison of any two transformation methods of the following to grade transformation efficiency of the methods: Heat Shock, PEG, Microwave, Electroporation, and Ultrasound method.
11. Blue-white screening of bacterial transformants
12. Culture of yeast cells in YPD medium
13. Preparation of competent yeast cells- Lithium Acetate method
14. Yeast transformation using either of the listed gene selection markers- His3, Leu2, Trp1 and Ura3 as selectable marker
15. Positive selection method for screening of yeast transformants-Auxotrophs
16. Negative selection method for screening of yeast transformants- Ura3

References:

1. Sambrook, Joseph, Edward F. Fritsch, and Tom Maniatis. *Molecular cloning: a laboratory manual*. No. Ed. 2. Cold spring harbor laboratory press, 1989.

2. Scarlett, Garry, ed. *DNA Manipulation and Analysis*. Vol. 2633. Springer Nature, 2023.

3. Chang, Donald, ed. *Guide to electroporation and electrofusion*. Academic Press, 1991.

4. Gietz, R. Daniel, and Robin A. Woods. "Yeast transformation by the LiAc/SS Carrier DNA/PEG method." *Yeast Protocol* (2006): 107-120.

5. Das, Surajit, and Hirak Ranjan Dash. *Microbial biotechnology-A laboratory manual for bacterial systems*. Springer, 2014.

6. Gingold, Elliot B. "Bacterial transformation." *Nucleic Acids* (1984): 237-240.

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.

B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.

C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.

B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.

C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr

P.U. Meshram, Allied Publishers, New Delhi.

8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

BSc Biotechnology (Basic / Hons.)

Semester 2

Title of the Courses:

Course 3 BBT2T03 : DSC-3 Technical Foundations of Biotechnology

Course 4 BBT2T04 : DSC-4 Enzyme Technology

Course 5: Practical DSC-3P, BBT2P02,

Content of Course 3: DSC-3T, (Course Code: BBT2T03), Technical Foundations of Biotechnology	**30 Hrs**
Unit – 1: Microbiological techniques	7 Hrs
Pure culture methods: Serial dilution and plating methods (pour, spread, streak); Enumeration methods: turbidity, cell counting, colony counting, maintenance and preservation of pure cultures; cultivation of anaerobic bacteria Bacterial identification techniques (Brief concept of Biochemical/ Automated/ Molecular identification methods). Importance of AMR, Mechanism of antimicrobial resistance, Concept of Quorum sensing and AMR screening methods (Antibiotic sensitivity assay method) Concept of MIC, MBC (Broth dilution method and microplate assay)	
Unit – 4: Spectroscopy	8 hrs
Concepts of electromagnetic radiation, Spectrum, Absorption of electromagnetic radiations, Orbital theory, Concept of orbitals & their involvement in absorption of electromagnetic radiations, Concept of chromophores, Beer's law – derivation & deviations, Extinction coefficient. Instrumentation & applications of UV & Visible spectrophotometry	
Unit – 3: Chromatography and Centrifugation	7 hrs
Partition principle, partition coefficient, Nature of partition forces, Paper, Thin layer & Column chromatography (Column efficiency and concept of plates) Gel filtration, Ion-Exchange and Affinity chromatography: Principle and Applications. Brief idea of HPLC and its applications. Centrifugation: Basic principles, Mathematics & theory (RCF, Sedimentation coefficient, Svedberg constant) Types of centrifuge : Desk top, High speed & Ultracentrifuges.	
Unit -4: Electrophoresis	8 hrs

Migration of ions in electric field, Factors affecting electrophoretic mobility. Gel electrophoresis: - Types of gels, Solubilizers, Procedure, Column & slab gels, Detection, Recovery & Estimation of macromolecules, Applications. SDS-PAGE and Agarose Gel Electrophoresis with Applications	

Content of Course 4: DSC-4T (Course Code: BBT2T04), Enzyme Technology	**30 Hrs**
Unit – 1: Proteins as Enzymes	8 Hrs
Protein structure in detail- Structural Organisation of proteins (Primary, Secondary, Tertiary and quaternary structure) Examples of secondary structure of proteins: - The alpha helix, beta pleated sheet structures. Tertiary structure of proteins: Forces that stabilize the structure, Concept of domains, Quaternary structure of proteins: Subunit interaction. Relevance of protein structural dynamics in enzyme activity.	
Unit -2 :	7 hrs
Terminology: Active site, allosteric site, Holoenzyme, apoenzyme, coenzyme, substrate, inhibitor, activator, modulator etc. Classification and nomenclature. Substrate Specificity (bond specificity, group specificity, absolute specificity, stereo-specificity, proof-reading mechanism), lock and key and induced fit models. Concept of allosteric enzymes	
Unit – 3: Introduction to Enzymes in Biotechnology	8 hrs
Restriction enzymes and their classification, exonucleases and endonucleases, ligases, polymerases, DNA modification enzymes (methylases, demethylases, phosphatases) and topoisomerases.	
Unit – 4: Modified Enzymes in Biotechnology	7 hrs

Concept of Immobilized enzymes, advantages and applications, methods of immobilization (Adsorption, covalent coupling, cross-linking, Entrapment/encapsulation) Concept of enzyme engineering- Imparting desired abilities to enzymes, Naturally occurring enzymes with novel properties eg. Taq Polymerase, its special properties, domain structure, mutants and applications	

Practical

Practical 1: (Course Code: BBT2P01) Analytical methods

1. Preparation of Solutions: Normal and Molar solutions
2. Calibration of pH meter and determination of pH of natural samples
3. Preparation of Buffer Solutions
4. Separation of amino acids using paper chromatography
5. Colorimetric estimation of Reducing Sugar by DNS method
6. Colorimetric estimation of Proteins by Biuret and
7. Colorimetric estimation of Proteins by Lowry's method

Practical 2: (Course Code: BBT2P02) Microbiological methods

1. Bacterial DNA isolation
2. Agarose gel electrophoresis of DNA
3. DNA digestion using Restriction enzymes
4. Determination of bacterial growth by spectrophotometric method & calculation of generation time
5. Isolation of bacteria from air, water, soil
6. Isolation of Pure Culture (Streak Plate, Pour Plate methods)
7. Antibiotic Sensitivity assay

Text Books / References

1. Basic Microbiology, Avinash Upadhyay, Kakoli Upadhyay & Sunita Bundale 1st edition, 2019, Himalaya Publishing House.
2. Brock Biology of Microorganisms, M.T.Madigan, J.M.Martinko, P. V. Dunlap, D. P. Clark- 12th edition, Pearson International edition 2009, Pearson Benjamin Cummings.
3. Microbiology – An Introduction, G. J.Tortora, B. R.Funke, C. L. Case, 10th ed. 2008,Pearson Education.
4. The nature of enzymology – Foster – Croom Helm, London.
5. Fundamentals of enzymology – Price & Stevens – Oxford Science Publ.
6. Principals of enzymology for food science – J. R. Whitkar – M. Dekker Publs.
7. Enzymes – Dixon & Webb – Academic press.
8. Biophysical Chemistry, Principles & Techniques – Upadhyay, Upadhyay & Nath – Himalaya Publ. House.

9. A Biologists Guide to Principle & Techniques of Practical Biochemistry – Williams & Wilson – Edward Ernold Publ.
10. The Tools of Biochemistry – T. G. Cooper.
11. Principles & Techniques of Practical Biochemistry – Wilson, Walker- Cambridge Univ. Press.
12. Physical Biochemistry – H. B. Bull – John Wiley & Sons.
13. Principles of Biochemistry – White, Handler, Smith – McGrew Hill Publ.
14. Biologist's Physical Chemistry – T. G. Morris.
15. Enzyme Technology – Chaplin, Buche – Cambridge Univ. Press.
16. Chromatography – G. Abbott.
17. Methods in Experimental Biology – R. Ralph.
18. Physical biochemistry – vanHolde – Prentice Hall Inc.
19. Physical Biochemistry – D. Friefelder – W. H. Freeman & Co.

Vocational Skill Courses

SEMESTER – II

DAIRY TECHNOLOGY

Course Code: BVS2P03 **Total Contact Hours:60**

Course Outcomes:

CO 1. This course will help students learn various methods of isolation, detection and identification of spoilage microorganisms in milk.
CO 2. Understand the application of principle of effect of temperature on spoilage of milk products.
CO 3. Develop technician level human resource for dairy industry.
CO 4. Develop young entrepreneurs for self-employment through dairy technology and associated activities.
CO 5. Impart knowledge and technical proficiency in processing of milk, testing and quality control of milk and milk products

PRACTICALS

1. Sampling of milk for physical and chemical examination
2. Determination of Titratable Acidity of Milk
3. Fat test by Gerber's method
4. Tests for Sanitation of Dairy Equipments (Rinse Solution and Swab Contact Methods)
5. Enumeration of total aerobic viable count in raw and pasteurized milk by serial dilution method
6. MBRT of milk samples
7. Resazurin Test
8. Determination of Efficiency of Pasteurization
9. Production of curd by using standard lactic culture and determining acidity.
10. Preparation of Shrikhand/Cheese
11. Preparation of Probiotic food (yoghurt)
12. Isolation of food borne bacteria and fungi from milk products.
13. Molecular identification of food borne bacteria from milk products
14. Effect of temperature on the spoilage of milk products.
15. Detection of Adulterants in milk
16. Detection of preservatives in milk

References:

- Food Microbiology by Frazier 5th ed
- Modern Food Microbiology by James Jay 6th ed
- Applied Dairy Microbiology by Martha & Steele
- Dairy India Year Book. 2007 & 2017. P.R. Gupta Publ., New Delhi.
- Jagadish Prasad, 2002. Principles and practices of Dairy Farm Management, 3rd Ed. Kalyani Publishers, Ludhiana.

- Walstra, P. Wouters, J.T.M. and Geurts, T.J. 2006. Dairy Science and Technology. CRC Press, New York.
- Robinson (1986), Modern Dairy Technology, Vol.I, Advances in Milk Processing, Chapman and Hall India, Madras.
- Fernandes, R.2009 , Microbiology Hand book: Dairy Products. Royal Society of Chemistry, Revised ed., London
- Foster E.M (1957) Dairy Microbiology, Prentice Hall Inc, USA.
- Mani. A., A.M. Selvaraj, L.M. Narayanan, N.Arumugam, Microbiology (General and Applied), Saras Publication, A.R.P. Camp road, Periavilai, Kottar (PO), Nagercoil, Kanyakumari, Dist – 629 002.
- Pelczar.Reid and Chan, 1977 - Microbiology, Tata McGraw-Hill Publishing company Ltd., New Delhi.

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

Bachelor of Science (Chemistry)

Submitted by

Board of Studies,

Bachelor of Science (Chemistry)

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)

(Chemistry - Major)

Four Year (Eight Semester Degree Course)

Teaching and Examination Scheme

B.Sc. Sem-I (Chemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Inorganic Chemistry-1 (Atomic structure, bonding and main group elements)	BCH1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Inorganic Chemistry-1 (Atomic structure, bonding and main group elements)	BCH1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Organic Chemistry-1 (Fundamentals, stereochemistry and hydrocarbons)	BCH1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Organic Chemistry-1 (Fundamentals, stereochemistry and hydrocarbons)	BCH1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Soap, detergent and disinfectant Technology	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Chemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Organic Chemistry-2 (Functional group chemistry)	BCH2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Organic Chemistry-2 (Functional group chemistry)	BCH2P03			2	1	-	-	-	-	25	25	25
3	DSC	Physical Chemistry-1 (Thermodynamics, gaseous and liquid states)	BCH2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Physical Chemistry-1 (Thermodynamics, gaseous and liquid states)	BCH2P04			2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Drug synthesis and analysis	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-III (Chemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Physical Chemistry-2 (Surface chemistry, phase equilibria, electrochemistry and kinetics)	BCH3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Physical Chemistry-2 (Surface chemistry, phase equilibria, electrochemistry and kinetics)	BCH3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Inorganic Chemistry-2 (Bonding, transition elements and solutions)	BCH3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Inorganic Chemistry-2 (Bonding, transition elements and solutions)	BCH3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Chemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Inorganic Chemistry-3 (Coordination chemistry, Redox reactions and Inorganic Polymers)	BCH4T07	2	-	-	2	3	80	20	40			
2	DSC	Inorganic Chemistry-3 (Coordination chemistry, Redox reactions and Inorganic Polymers)	BCH4P07	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Organic Chemistry-3 (Nitrogen compounds, Heterocyclics and organometallics)	BCH4T08	2	-	-	2	3	80	20	40			
4	DSC	Organic Chemistry-3 (Nitrogen compounds, Heterocyclics and organometallics)	BCH4P08	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40			
6	Minor	Minor 3 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-	-	2	3	80	20	40			
8	Minor	Minor 4 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Chemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Organic Chemistry-4 (NMR, Enolates and Natural products)	BCH5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Organic Chemistry-4 (NMR, Enolates and Natural products)	BCH5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Physical Chemistry-3 (Solid state, Surface Chemistry, Spectroscopy and Quantum mechanics)	BCH5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Physical Chemistry-3 (Solid state, Surface Chemistry, Spectroscopy and Quantum mechanics)	BCH5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Inorganic Chemistry-4 (Complexes and Organometallics)	BCH5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Inorganic Chemistry-4 (Complexes and Organometallics)	BCH5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BCH5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BCH5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Chemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Physical Chemistry-4 (Electrochemistry, Quantum Chemistry and Characterization)	BCH6T13	2	-	-	2	3	80	20	40	-	-	-
	DSC	Physical Chemistry-4 (Electrochemistry, Quantum Chemistry and Characterization)	BCH6P13	-	-	2	1	-	-	-	-	25	25	25
2	DSC	Inorganic Chemistry-5 (Bioinorganic Chemistry)	BCH6T14	2	-	-	2	3	80	20	40	-	-	-
	DSC	Inorganic Chemistry-5 (Bioinorganic Chemistry)	BCH6P14	-	-	2	1	-	-	-	-	-	50	25
3	DSC	Organic Chemistry-5 (Molecules of life)	BCH6T15	2	-	-	2	3	80	20	40	-	-	-
	DSC	Organic Chemistry-5 (Molecules of life)	BCH6P15	-	-	2	1	-	-	-	-	25	25	25
4	DSE	Elective 2	BCH6T16	3	-	-	3	3	120	30	60	-	-	-
	DSE	Elective 2	BCH6P16	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
6	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
7	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Chemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Advanced Inorganic Chemistry-1	BCH7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advanced Inorganic Chemistry-1	BCH7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Advanced Organic Chemistry-1	BCH7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Advanced Organic Chemistry-1	BCH7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Advanced Physical Chemistry-1	BCH7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Advanced Physical Chemistry-1	BCH7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Advanced Analytical Chemistry-1	BCH7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Advanced Analytical Chemistry-1	BCH7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3	BCH7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BCH7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BCH7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BCH7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Chemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Advanced Inorganic Chemistry-2	BCH8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advanced Inorganic Chemistry-2	BCH8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Advanced Organic Chemistry-2	BCH8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Advanced Organic Chemistry-2	BCH8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Advanced Physical Chemistry-2	BCH8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Advanced Physical Chemistry-2	BCH8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Advanced Analytical Chemistry-2	BCH8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Advanced Analytical Chemistry-2	BCH8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BCH8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BCH8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Chemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Advanced Inorganic Chemistry-1	BCH7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advanced Inorganic Chemistry-1	BCH7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Advanced Organic Chemistry-1	BCH7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Advanced Organic Chemistry-1	BCH7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Advanced Physical Chemistry-1	BCH7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Advanced Physical Chemistry-1	BCH7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BCH7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BCH7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BCH7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BCH7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Chemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Advanced Inorganic Chemistry-2	BCH8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advanced Inorganic Chemistry-2	BCH8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Advanced Organic Chemistry-2	BCH8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Advanced Organic Chemistry-2	BCH8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Advanced Physical Chemistry-2	BCH8T24R	2	-		2	3	80	20	40	-	-	-
6	DSC	Advanced Physical Chemistry-2	BCH8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BCH8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BCH8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2+1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

R' in the subject code indicates 'Research'

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Chemistry)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Soap, detergent and disinfectant Technology	Chemistry	**BVS1P01**
II	**VSC**	Drug synthesis and analysis	Chemistry	**BVS2P03**
III	**VSC**	Soil sampling and analysis	Chemistry	**BVS3P05**
V	**VSC**	Vocational IT skills	Chemistry	**BVS5P07**
VI	**VSC**	Oil and Fats technology	Chemistry	**BVS6P08**

Basket for <u>ELECTIVE</u> (DSE) Category Courses (Chemistry)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Basic Analytical Chemistry	BCH5T12
		B. Industrial Chemistry	
VI	Elective 2	A. Instrumental Methods of Analysis	BCH6T16
		B. Chemistry of dyes and drugs	
VII (Honors)	Elective 3	A. Environmental Chemistry	BCH7T21
		B. Chemistry of natural products	
VIII (Honors)	Elective 4	A. Polymer Chemistry	BCH8T27
		B. Organometallic and bioinorganic Chemistry	
VII (Research)	Elective 3	A. Environmental Chemistry	BCH7T20R
		B. Natural product chemistry	
VIII (Research)	Elective 4	A. Polymer Chemistry	BCH7T25R
		B. Organometallic and bioinorganic Chemistry	

B.Sc. Chemistry (Honours/ Research)

A four-year eight semester degree program

1. Introduction to B.Sc. (Honours/ Research) Chemistry

The Choice Based Credit System (CBCS) provides an opportunity to a student to choose courses from the syllabus comprising Core, Elective, Generic and Skill-based vocational courses. It offers a flexibility of programme structure while ensuring that the student gets a strong foundation in the subject and gains in-depth knowledge. The learning outcome based curriculum framework (LOCF) will provide students with a clear purpose to focus their learning efforts and enable them to make a well judged choice regarding the course they wish to study. This will suit the present day needs of students in terms of securing their paths towards higher studies or employment.

Programme Duration and Design: The B.Sc. (Hons/Res) Chemistry course is a eight semester course spread over four academic years. The teaching – learning process involves theory and practical classes and will be student-centred. Apart from the conventional chalk and talk method, power point presentations, audio–video tools, class discussions, simulations and virtual labs (wherever possible) will be used. Students will be encouraged to carry out short term projects and participate in industrial and institutional visits, seminars and workshops. Assessment will be based on continuous internal evaluation (CIE) and semester end examination (SEE). Each theory paper will be of 100 marks out of which 20% marks are for internal assessment while a practical paper will be of 50 marks comprising 50% internal assessment.

2. Learning Outcome-based Curriculum Framework in BSc (Hons/ Res) Chemistry

The Learning Outcomes-based Curriculum Framework (LOCF) for the B.Sc. (Hons/ Res) degree in Chemistry provides a broad structural framework that can accommodate the current curricular needs as well as gives sufficient flexibility to include changes in content that assume importance as the frontiers of science grow. The inherent flexibility in framework allows design of course basket in tune with individual preferences. The basic uniformity in core course design ensures smooth movement across universities in the country.

Nature and Extent: The B.Sc. (Hons/Res) Chemistry programme covers a wide range of basic and applied courses as well as courses of interdisciplinary nature.

Aims of the Programme: The core courses offered in the programme aim to build a strong conceptual chemical knowledge base in the student, the contents of electives and skill enhancement courses help them explore their fitness and suitability to pursue studies in these areas.

3. Programme Specific Outcomes (PSOs) in B.Sc. (Hons/Res) Chemistry

The B.Sc.(Hons/Res) programme in Chemistry is designed to develop in students in depth knowledge of the core concepts and principles that are central to the understanding of this core science discipline. Undergraduates pursuing this programme of study go through laboratory work that specifically develops their quantitative and qualitative skills, provides opportunities for critical thinking and team work, and exposes them to techniques useful for applied areas of scientific study.

1. ***Knowledge: Width and depth*****:** Students acquire theoretical knowledge and understanding of the fundamental concepts, principles and processes in main branches of chemistry, namely, organic chemistry, inorganic chemistry, physical chemistry, analytical chemistry and biochemistry. In depth understanding is the outcome of transactional effectiveness and treatment of specialized course contents. Width results from the choice of electives that students are offered.

2. ***Laboratory Skills: Quantitative, analytical and instrument based*:** A much valued learning outcome of this programme is the laboratory skills that students develop during the course. Quantitative techniques gained through hands on methods opens choice of joining the industrial laboratory work force early on. The programme also provides ample training in handling basic chemical laboratory instruments and their use in analytical and biochemical determinations. Undergraduates on completion of this programme can cross branches to join analytical, pharmaceutical, material testing and biochemical labs besides standard chemical laboratories.
3. ***Communication*:** Communication is a highly desirable attribute to possess. Opportunities to enhance students' ability to write methodical, logical and precise reports are inherent to the structure of the programme. Techniques that effectively communicate scientific chemical content to large audiences are acquired through oral and poster presentations and regular laboratory report writing.
4. ***Capacity Enhancement*:** Modern day scientific environment requires students to possess ability to think independently as well as be able to work productively in groups. This requires some degree of balancing. The chemistry honours programme course is designed to take care of this important aspect of student development through effective teaching learning process.
5. ***Portable Skills*:** Besides communication skills, the programme develops a range of portable or transferable skills in students that they can carry with them to their new work environment after completion of chemistry honours programme. These are problem solving, numeracy and mathematical skills- error analysis, units and conversions, information retrieval skills, IT skills and organizational skills. These are valued across work environments.

4. Structure of the Programme in B.Sc. (Hons/Res) Chemistry

The programme includes Core Courses and Elective Courses. The Discipline Specific Core (DSC) Courses are all compulsory courses. There are three types of Elective Courses – Discipline Specific Elective (DSE), Generic Elective (GE), Vocational/ Skill Enhancement Courses (VS). In addition there are Ability Enhancement Courses (AEC). Field based projects and research projects add to the skill component.

CORE PAPERS/ MINOR PAPERS
B.Sc. Semester – I
BCH1T01
Inorganic Chemistry-1 (Atomic structure, bonding and main group elements)
Theory 2 credits + Practical 1 credit

Course Outcomes

By the end of the course, the students will be able to:

1. *Solve the conceptual questions using the knowledge gained by studying the quantum mechanical model of the atom, quantum numbers, electronic configuration, radial and angular distribution curves, shapes of s, p, and d orbitals, and periodicity in atomic properties.*
2. *Draw the plausible structures and geometries of molecules using VSEPR theory.*
3. *Explain geometries and properties of molecules based on VBT.*
4. *Understand the concept of lattice energy using Born-Haber Cycle.*
5. *Rationalize the metallic properties based on various theories.*
6. *Elaborate structures and properties of common compounds formed by main group elements.*
7. *Identify acidic and basic radicals in simple inorganic salts.*

Unit-I: 7.5 h

(A) Atomic structure: Bohr model**,** Idea of de-Broglie matter Waves, Heisenberg's uncertainty principle. Schrodinger wave equation, significance of ψ and ψ^2, Quantum numbers, Concept of atomic orbital, Radial and angular wave functions and probability distribution curves for *1s, 2s, 2p, 3s, 3p* and *3d* orbitals, shapes of *s, p* and *d* orbitals, Aufbau principle, Bohr-Bury rule, Pauli's exclusion principle and Hund's rule of maximum multiplicity. Principle of extra stability. Electronic Configuration of elements and ions.

(B) Periodic Properties: Atomic and ionic radii, ionization energy, electron affinity and electronegativity-Definition, trends in periodic table. Factors affecting ionization potential. Pauling's, Mulliken's and Allred-Rochow scale of electronegativity. Effective nuclear charge and Slater's rule with some numericals.

Unit-II: 7.5 h

(A) Covalent Bond: Valency Bond Theory, Formation of Hydrogen molecule with potential energy diagram with all improvements, Limitations of VBT, Bond energy, bond length, Bond order, Bond angle. Various types of hybridization and shape of inorganic molecules [BeF_2, BCl_3, CH_4, NH_3, H_2O, PCl_5, SF_6 and IF_7].

VSEPR Theory: Rules/postulates and their applications to various common molecules and ions (NH_3, ClF_3, H_2O, SF_4, H_3O^+, NH_4^+, ICl_2^- etc)

(B) Ionic solids: Close packing in ionic solids [Square, Hexagonal, Cubic, BCC and FCC], Radius ratio rule and its limitations, Ionic structures with respect to NaCl and CsCl, Lattice energy and Born- Haber cycle. Solvation energy and solubility of ionic solids, polarizing power and polarizability of ions, Fajan's rules.

Unit -III: 7.5 h

(A) s- block elements: Electronic configuration, atomic and ionic radii, Ionisation potential, Reducing properties and Metallic Properties. Diagonal Relationships (Li-Mg).

Metallic Bond – Free electron, Valence Bond and Band theory of metallic bond. Properties of conductors, insulators and semiconductors based on Band theory.

Hydrogen bonding - Classification and effect of Hydrogen bonding on viscosity, solubility, melting point and boiling point.

(B) p-block elements: Introduction to p-block elements, comparative study of groups 15, 16 and 17 with respect to atomic and ionic radii, ionisation potential, electron affinity, electronegativity, redox properties, oxidation state. Diagonal relationship (B-Si).

Unit- IV:7.5 h

Hydrides: Comparative study with respect to structure of NH_3, PH_3, AsH_3 and SbH_3. Structure and bonding of diborane, structure of borazine.

Allotropes of Carbon [Graphite, Diamond and Fullerene], **Carbides:** Classification and uses, **Silicates:** classification, **Nitrides of sulphur:** Structure of S_4N_4, **Fluorocarbon** and its uses.

Oxides of Phosphorus: Structure and bonding in P_2O_3 and P_2O_5.

Oxyacids of Phosphorous: Structures of H_3PO_2, H_3PO_3, H_3PO_4, $H_4P_2O_6$ and $H_4P_2O_7$

Peroxyacids of Sulphur: Preparation and structure of Caro's and Marshall's acids.

Interhalogens and Polyhalides: Preparation, properties and structure of Interhalogen compounds. Polyhalides- Classification, Structure of I_3^-, I_5^-, ICl_4^-.

Inorganic Chemistry Practical (1 credit)

A) Introduction to Chemistry Laboratory:

1. Safety rules in laboratory
2. Introduction to nomenclature of glassware and instruments
3. Demonstration of handling pipette, burette, volumetric flask and other common glassware.
4. Pipettable and non-pipettable liquids (aqueous, organic, volatile, viscous, carcinogenic etc)
5. Common mistakes in chemistry laboratory

B) Semimicro Qualitative Analysis: Qualitative analysis of inorganic salt mixture containing two acidic radicals of different group and two basic radicals of same groups.

Note: At least eight mixtures should be analyzed.

Reference books

1. Lee, J.D. (2010),Concise Inorganic Chemistry, Wiley India.
2. Huheey, J.E.; Keiter, E.A.; Keiter; R. L.; Medhi, O.K. (2009), Inorganic Chemistry- Principles of Structure and Reactivity, Pearson Education.
3. Douglas, B.E.; McDaniel, D.H.; Alexander, J.J.(1994),Concepts and Models of Inorganic Chemistry, John Wiley & Sons.
4. Atkins, P.W.; Overton, T.L.; Rourke, J.P.; Weller, M.T.; Armstrong, F.A. (2010),Shriver and Atkins Inorganic Chemistry, 5th Edition, Oxford University Press.
5. Wulfsberg, G (2002),Inorganic Chemistry, Viva Books Private Limited.
6. Miessler, G.L.; Fischer P.J.; Tarr, D. A. (2014),Inorganic Chemistry, 5th Edition, Pearson.
7. Jeffery, G.H.; Bassett, J.; Mendham, J.; Denney, R.C. (1989),Vogel's Textbook of Quantitative Chemical Analysis, John Wiley and Sons.
8. Svehla, G. (1996), Vogel's Qualitative Inorganic Analysis, Prentice Hall.

B.Sc. Semester – I
BCH1T02
Organic Chemistry-1 (Fundamentals, stereochemistry and hydrocarbons)
Theory 2 credits + Practical 1 credit

Course Outcomes

On completion of the course, the student will be able to:

1. *Understand and explain the different nature and behaviour of organic compounds based on fundamental concepts learnt.*
2. *Formulate the mechanism of organic reactions by recalling and correlating the fundamental properties of the reactants involved.*
3. *Learn and identify many organic reaction mechanisms including Free Radical Substitution, Electrophilic Addition and Electrophilic Aromatic Substitution.*
4. *Understand the fundamental concepts of stereochemistry.*
5. *Elaborate various properties of aliphatic and aromatic hydrocarbons.*
6. *Experimentally identify extra element and functional group in the given organic compound.*
7. *Synthesize various organic compounds making use of selective reagents.*

Unit – I: 7.5h

A) Structure and Bonding : Hybridization in case of Methane, Ethane, Ethylene and acetylene, Bond lengths, bond angles and bond energies. Inductive effect, Electromeric effect. Resonance effect. Hyperconjugation definition, examples and application of these effects. Hydrogen bonding in organic compounds (with reference to alcohol, phenols, amines, acids) and **c**onsequences.

B) Mechanism of Organic Reactions : Homolytic and heterolytic bond breaking examples and factors favouring the bond fission. Electrophiles and nucleophiles definition and example both neutral and charged. Types of organic reactions addition, substitution, elimination, rearrangement. Energy consideration. Reactive intermediates carbocations, carbanions, free radicals, carbenes, formation, geometry, stability and reactions given by these intermediates.

Unit - II: 7.5h

A) Stereochemistry of Organic Compounds : Concept of isomerism. Types of isomerism with suitable examples. Optical isomerism-elements of symmetry, molecular chirality, enantiomers, stereogenic centre(lactic acid as example). Optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres (Tartaric acid) diastereomers, mesocompound. Resolution of enantiomers biological and chemical methods. Inversion retention and racemisation. Asymmetric synthesis. Relative and absolute configuration, sequence rules, D and L and R and S system of nomenclature.

B) Geometrical isomerism : *E* and *Z* system of nomenclature, geometric isomerism in alkenes with examples, maleic acid and fumaric acid, 2-butene.

Conformational isomerism : Conformational analysis of ethane, *n*-butane and substituted *n*-butane, conformations of Cyclohexane, axial and equatorial bonds. Newman's projection and sawhorse formulae. Difference between configuration and conformation.

Unit - III: 7.5h

A) Alkanes: IUPAC nomenclature of branched and unbranched alkanes. Alkyl group, Isomerism in alkanes. Methods of formation (Ethane)– Wurtz reaction, Kolbe reaction, decarboxylation of carboxylic acid. Physical properties and chemical reactions of alkanes-halogenation, nitration, sulphonation, isomerization, cyclization, aromatization, pyrolysis and cracking oxidation, L.P.G., Octane number. Mechanism of free radical halogenation of alkane.

B) Cycloalkanes : Nomenclature, methods of formation of cyclohexane from dihalides, benzene and cyclohexanone, chemical reactions of cyclohexane oxidation, aromatization, chlorination, Baeyer's strain theory and its limitations. Ring strain in small rings cyclopropane and cyclobutane. Theory of strainless rings.

C) Alkenes : Nomenclature of alkenes, methods of formation- dehydrogenation, dehydrohalogenation of alkyl halides, dehydration of alcohol dehalogenation of dihalides. Mechanism of dehydration of alcohol and dehydrohalogenation of Alkyl halides. Saytzeff rule, Hofmann elimination reaction. Chemical reactions of alkenes- hydroboration, oxidation $KMnO_4$, HIO_4, Epoxidation, Ozonolysis, Hydroxylation, Polymerization Substitution in allylic and vinylic position of alkenes. Industrial applications of ethylene and propylene. Markownikoff Rule and peroxide effect. Ionic Mechanism of addition of Br_2 to ethene and HBr to propene. Free radical mechanism of addition of HBr to propene. Stereochemistry of bromine and $KMnO_4$ addition to alkene.

Unit - IV: 7.5h

A) Dienes: Nomenclature and classification of dienes Methods of formation of 1, 3 - butadiene. 1,2 and 1,4 addition reactions of substituted 1,3-butadiene, Diels-Alder reaction.

B) Alkynes: Nomenclature, structure and bonding in Alkynes. Methods of formation of acetylene from - calcium carbide, dehydrohalogenation of dihalides Chemical reaction - hydroboration, oxidation metal ammonia reduction and polymerization. Oxyacetylene flame. Acidity of alkynes.

C) Aromatic Compounds and Aromaticity: Nomenclature of Benzene derivatives, structure of benzene, Molecular formula and Kekule structure. Resonance structure, MO picture, Huckel rule, aromatic ions (cyclopentadienyl anion and cycloheptatrienyl cation). Aromatic electrophillic substitution mechanism with energy profile diagram (eg. nitration and sulphonation).

Organic Chemistry Practical (1 credit)

A) Qualitative Analysis:
1. Element detection (N, S and halogens)
2. Identification of functional groups (-COOH, Phenolic –OH, -CHO, $-NH_2$, $-NO_2$, $-CONH_2$)
3. Melting and Boiling Points

B) Preparations and determination of yield (%) and melting points of products:
1. Hydrolysis : Preparation of Benzoic acid from Benzamide
2. Oxidation: Preparation of Benzoic acid from Benzaldehyde
3. Bromination of Phenol

Reference books

1. Morrison, R. N.; Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1& 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Chandra, R. ; Singh, S.; Singh, A. (2019), Basic Organic Chemistry, Arcler Press.
4. Eliel, E. L.; Wilen, S. H.(1994),Stereochemistry of Organic Compounds; Wiley: London.
5. Singh, S.P.; Prakash, O.,(2017), Reaction Mechanism in organic chemistry, Laxmi
6. Mann, F. G.; Saunders, B. C. (2009), Practical Organic Chemistry, Pearson Education.
7. Ahluwalia, V.K.; Dhingra, S. (2004),Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press.
8. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R.(2012),Vogel's Textbook of Practical Organic Chemistry, Pearson.
9. Leonard, J.; Lygo, B.; Procter, G. Advanced Practical Organic Chemistry, CRC Press.

B.Sc. Semester – I

Vocational Skill Course (VSC)

BVS1P01: Soap, detergent and disinfectant Technology

Practical 2 credits

Course Outcomes

By the end of this course, students will be able to:

1. *Gain an understanding of the history and influences behind modern soap creation processes and projected trends in the future of soap.*
2. *The analytical approach of this course is to enhance the reasoning and to understand the mechanical part of the industry.*
3. *Learn the most common formulations of soap products by exploring compositions and physical chemistry.*
4. *Understand the different aspects of industrial processes of Manufacturing disinfectants.*
5. *Optimise use of limited resources of harmful chemicals.*
6. *Suggest remedial measures for surfactant quality and threshold quantity improvement.*

List of Experiments

1. Brief History of Soap and Soap-Making Processes, Formulation and Marketing Challenges
2. Sustainable development in cleaning action of disinfectant technology and Innovations in advances and Mechatronic Solutions for Soap Manufacturing Technology from Saponification Systems.
3. Determination of the surface tension of given liquid in the presence of surfactant.
4. Determination of alkali content of soap.
5. Determination of pH of water samples and surfactant (Soap, detergent, Toiletries)
6. Estimation of hardness of water by titration with soap solution.
7. Determination of CMC of various soaps and detergents in market.
8. Comparison of cleansing actions of various commercial soaps and detergents.
9. Preparation of hand sanitizer.
10. Preparation of Soap, Detergents / Surfactants, Cleaners / Cleaning Powder.
11. Preparation of Laundry Care / fabric care / wash.
12. Preparation of Household and Industrial Detergent.
13. Preparation of Liquid Soaps/ Liquid Detergents / Acid Slurry.

Note: Minimum 10 experiments should be performed.

References

1. Ahluwalia,V.K. and Aggarwal,R. Comprehensive Practical Organic Chemistry, Preparation and Quantitative Analysis ,University Press, New Delhi.
2. Sharma, R.K., Sidhwani,I.T., Chaudhari,M.K. (2013),Green Chemistry Experiments: A monograph, I.K. International Publishing House Pvt Ltd. New Delhi.
3. Vermani, O. P.; Narula, A. K. (2004), Industrial Chemistry, Galgotia Publications Pvt. Ltd., New Delhi.
4. https://www.aocs.org/stay-informed/aocs-continuing-education-program/soap-fundamentals?SSO=True#brief-history-of-soap-and-soapmaking-processes
5. Bhatia, S. C. (2004), Chemical Process Industries, Vol. I & II, CBS Publishers, New Delhi.
6. Jain, P. C.; Jain, M. (2013), Engineering Chemistry, Dhanpat Rai & Sons, Delhi.
7. Gopalan, R. Venkappayya, D.; Nagarajan, S. (2004), Engineering Chemistry, Vikas Publications. 5. Sharma, B. K. (1997), Engineering Chemistry, Goel Publishing House, Meerut.

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr

P.U. Meshram, Allied Publishers, New Delhi.

8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

B.Sc. Semester – II
BCH2T03
Organic Chemistry-2 (Functional group chemistry)
Theory 2 credits + Practical 1 credit

Course Outcomes

On completion of the course, the student will be able to:

1. *Understand preparation, properties and reactions of haloalkanes, haloarenes and oxygen containing functional groups.*
2. *Use the synthetic chemistry learnt in this course to do functional group transformations.*
3. *To propose plausible mechanisms for various reactions.*
4. *Suggest synthesis routes for desired product from initial reactant.*
5. *Identify given organic compound by systematic chemical analysis.*
6. *Synthesize derivatives of given organic compound.*

Unit-I : 7.5h

Orientation : Activating (–OH, $–NH_2$) and deactivating (–Cl, $–NO_2$, –COOH) substituents, their orientation and directive influence on further electrophilic substitution, o/p ratio. Methods of formation and chemical reactions of alkyl benzene (Toluene) and biphenyl.

Alkyl halides : Nomenclature, classification, methods of formation, chemical reactions. Mechanism of nucleophilic substitution reactions of alkyl halides S_N1 and S_N2 with energy profile diagrams. Factors affecting S_N1 and S_N2 mechanisms.

Polyhalogen compounds : Chloroform and carbon tetrachloride – formation and chemical reactions.

Nuclear and side chain halogen derivatives of benzene: Halobenzene and benzyl halide preparation and reactions.

Unit-II: 7.5h

A) Alcohols : Classification and nomenclature,

Monohydric alcohols : Methods of formation by reduction of aldehydes, ketones using H_2/Ni, hydrolysis of alkyl halides, addition of Grignard reagent to aldehydes and ketones. Reactions of alcohol.

Dihydric alcohols : Methods of formation, chemical reactions of vicinal glycols, oxidative cleavage ($Pb(OAc)_4$ and HIO_4) and Pinacol – pinacolone rearrangement.

Trihydric alcohols : Methods of formation, chemical reactions of glycerol.

B) Phenols : Structure and bonding, Preparation of phenols from cumene, chlorobenzene (Dows and Raschig process) and diazonium salts. Physical properties and acidic character, Resonance stabilization of phenoxide ion, Reactions of phenols, Electrophilic aromatic substitution, acetylation and carboxylation, Claisen rearrangement, Gatterman synthesis reaction Mechanism of (i) Fries Rearrangement, (ii) Reimer-Tiemann reaction.

Unit-III: 7.5h

Aldehydes and ketones : Nomenclature and structure of the carbonyl group, synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides and ketones from nitriles. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensation, Wittig reaction, Mannich reaction, oxidation of aldehydes (by $KMnO_4$, Tollen's reagent and Fehling solution), Baeyer-Villiger oxidation of Ketones, Cannizzaro reaction with mechanism, MPV, Clemmensen, Wolf-Kishner, $LiAlH_4$ and $NaBH_4$ reductions,

Unit-IV: 7.5h

A) Carboxylic Acids : Nomenclature, structure and bonding, Physical properties, acidity of carboxylic acids, effect of substituents on acid strengths preparation of carboxylic acids(from G.R. and cyanides), Reactions of carboxylic acids, Hell-Volhard-Zelinsky reactions. Reduction of carboxylic acids, Mechanism of decarboxylation. Methods of formation and chemical reactions of unsaturated monocarboxylic acids (crotonic acid and cinnamic acid).

Dicarboxylic acids : Methods of formation and effect of heat and dehydrating agents. (Succinic acid, Phthalic acid).

B) Carboxylic acid derivatives : Structure and nomenclature of acid chlorides, esters, amides and acid anhydrides. Interconversion of acid derivatives by nucleophilic acyl substitution. Preparation of carboxylic acid derivatives, Chemical reactions, Mechanism of esterification and hydrolysis (acidic and basic).

Organic Chemistry Practical (1 credit)

Complete analysis of simple organic compound involving following steps:

1. Preliminary examination
2. Detection of elements
3. Detection of functional group
4. Determination of melting point/ boiling point.
5. Preparation of derivative and its melting point/ boiling point.
6. Performance of specific test, if any.

Note: At least eight compounds should be analyzed.

Reference books

1. Morrison, R. N.; Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Janice Smith, Organic Chemistry, 7th Edition, McGraw Hill with solution manual
4. Bruice, P. Y. Organic Chemistry, 6th Edition, Pearson Education with solution manual
5. Francis A. Carey, Robert M. Giuliano Organic Chemistry, 8th Edition McGraw Hill with solution manual
6. Marc Loudon, Jim Parise 7th Edition, W. H. Freeman with solution manual
7. David Klein Organic Chemistry, John Wiley & Sons Inc with solution manual
8. Ahluwalia, V.K.; Bhagat, P.; Aggarwal, R.; Chandra, R. (2005), Intermediate for Organic Synthesis, I. K. International.
9. Solomons, T. W. G.; Fryhle, C. B. ; Snyder, S. A. (2016),Organic Chemistry, 12th Edition, Wiley.
10. Chandra, R. ; Singh, S.; Singh, A. (2019), Organic reactions and their nomenclature, Arcler Press.
11. Mann, F. G.; Saunders, B. C. (2009),Practical Organic Chemistry, Pearson Education.
12. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R.(2012),Vogel's Textbook of Practical Organic Chemistry, Pearson.
13. Ahluwalia, V.K.; Aggarwal, R.(2004),Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press.

B.Sc. Semester – II
BCH2T04
Physical Chemistry-1 (Thermodynamics, gaseous and liquid states)
Theory 2 credits + Practical 1 credit

Course Outcomes

By the end of the course, students will be able to:

1. *Solve fundamental mathematical function based problems in chemistry.*
2. *Understand the three laws of thermodynamics, concept of State and Path functions, extensive and intensive properties.*
3. *Derive the expressions of ΔU, ΔH, ΔS, ΔG, ΔA for ideal gases under different conditions.*
4. *Evaluate thermodynamics of various physical and chemical processes.*
5. *Analyse and explain properties of ideal gas, real gas and liquids.*
6. *Evaluate thermodynamic constants through calorimetric studies.*
7. *Use various properties of liquids for determination of their concentration and composition.*

Unit-I : 7.5h

Mathematical concepts and Introduction to Thermodynamics

(A) Mathematical concepts for Chemists: Logarithmic relations, Curve sketching, Linear graphs calculation of slopes, Differentiation of functions like kx, e^x, x^n, sin x, log x, etc., Maxima and Minima, Partial differentiation, Integration of useful/relevant functions, Permutations and combinations (introductory), Factorials, Concept of units with reference to C.G.S. and S.I. units, Inter-conversion of units.

(B) Introduction to Thermodynamics: Definitions of some common thermodynamic terms: system, surrounding, etc. Types of system (closed, open and isolated), Homogeneous and heterogeneous systems, intensive and extensive properties, thermodynamic processes (isothermal, adiabatic, isobaric, isochoric, cyclic, reversible and irreversible) State function and path functions and their differentiation, concept of heat and work.

Unit-II: 7.5h

Fundamentals of Thermodynamics and Thermochemistry

(A) Statements of first law of thermodynamics, definition of internal energy and enthalpy, heat capacity, heat capacity at constant volume and at constant pressure, Joule-Thomson experiment, Joule-Thomson coefficient and inversion temperature, calculations of w, q , E and H for expansion of gases for isothermal and adiabatic conditions for reversible process.

(B)Thermochemistry : Standard states, standard enthalpy of formation, enthalpy of combustion, enthalpy of solution, enthalpy of dilution, enthalpy of neutralization, enthalpy of ionization, Hess's law of constant heat of summation and its applications, Heat of reaction, relation between heat of reaction at constant volume and constant pressure. Average bond energy, bond dissociation energy and its calculations from thermochemical data. Numerical problems.

Unit- III: 7.5h

Gaseous State

(A) Postulates of kinetic theory of gases, derivation of kinetic gas equation, deduction of various gas laws from kinetic gas equation (Boyle's law, Charle's law, Avogadro's law, Grahams law, Daltons law. Qualitative discussion of the Maxwell- Boltzmann distribution of molecular velocities. Effect of temperature on molecular velocities. Different types of molecular velocities (most probable, R.M.S. and average and expressions for them), their inter relationships. Definitions of collision diameter, collision number, mean free path.

(B) Ideal gas and real gases, behavior of real gases, deviations from ideal behavior, explanation of the terms - Compressibility factors and Boyle temperature. Causes of deviation from ideal behaviors. Vander Waal's equation of state, explanation of behaviour of real gases on the basis of van der Waal equation. Andrew's

experiment on critical phenomenon of CO_2. Continuity of states. The isotherms of Van der Waals equation, Relation between critical constants and Van der Waals constants. Reduced equation of state and law of corresponding states. Numerical problems.

Unit- IV: 7.5h

Liquid State

(A) Intermolecular forces, structure of liquids (a qualitative description), structural differences between solids, liquids and gases, liquid crystals, Classification, structure of Nematic and Cholesteric phases, Thermography, liquid crystal display and seven segment cell.

(B) Properties of liquid :

i) Surface tension : Explanation, methods of determination, Capillary rise method and drop number method, Parachor value and its application.

ii) Viscosity : Explanation, coefficient of viscosity, Effect of temperature on Viscosity, relative viscosity, specific viscosity and intrinsic viscosity and reduced viscosity. Method of determination by Ostwald viscometer.

iii) Refractive index : specific refraction, molar refractions and chemical constitution. Method of determination by Abbe's Refractometer. Numerical problems.

Physical Chemistry Practical (1 credit)

1. To determine the heat of solution of potassium nitrate calorimetrically
2. To determine heat of ionization of acetic acid calorimetrically.
3. To determine solubility of benzoic acid at different temperatures and hence to determine heat of solution of benzoic acid.
4. Determination of relative viscosity of unknown liquid by Ostwald viscometer.
5. To determine the percentage composition of given binary mixture (Ethanol-water) by viscosity method.
6. Determination of surface tension of a given liquid by drop number method (Stalagmometer method)
7. To compare cleansing power of two samples of detergent.
8. To determine parachor value of $-CH_2$ group by surface tension method.
9. To determine refractive index, specific and molar refraction of given liquid by Abbe's refractometer.

Note: At least eight experiments should be performed.

Reference books

1. Peter, A.; Paula, J. de. (2011), Physical Chemistry, 9th Edition, Oxford University Press.
2. Castellan, G. W. (2004), Physical Chemistry, 4th Edition, Narosa.
3. Kapoor, K.L.(2015), A Textbook of Physical Chemistry, Vol 2, 6th Edition, McGraw Hill Education.
4. Kapoor, K.L.(2013), A Textbook of Physical Chemistry, Vol 3, 3rd Edition, McGraw Hill Education.
5. McQuarrie, D. A.; Simon, J. D. (2004),Molecular Thermodynamics, Viva Books Pvt. Ltd. Levine, I.N.(2010),Physical Chemistry, Tata Mc Graw Hill.
6. Assael, M. J.; Goodwin, A. R. H.; Stamatoudis, M.; Wakeham, W. A.; Will, S.(2011),Commonly asked Questions in Thermodynamics. CRC Press.
7. Khosla, B.D.; Garg, V.C.; Gulati, A. (2015),Senior Practical Physical Chemistry, R. Chand & Co, New Delhi.
8. Kapoor, K.L. (2019),A Textbook of Physical Chemistry, Vol.7, 1st Edition, McGraw Hill Education.
9. Garland, C. W.; Nibler, J. W.; Shoemaker, D. P.(2003),Experiments in Physical Chemistry, 8th Edition, McGraw-Hill, New York.

B.Sc. Semester – II
Vocational Skill Course (VSC)
BVS2P03: Drug synthesis and analysis
Practical 2 credits

Course Outcomes

By the end of this course, students will be able to:

1. *A foundational understanding of the principles and concepts of medicinal chemistry, including drug design and development.*
2. *Gaining practical experience in common laboratory techniques used in medicinal chemistry, such as synthesis and purification.*
3. *Ability to design and perform experiments to test the effectiveness of potential drug candidates, including assays.*
4. *Develop an understanding of the Physico-Chemical properties of drugs through fundamentals of volumetric analytical skills.*

List of Experiments

(A) Synthesis of pharmaceuticals

- 1. Paracetamol from p-nitro phenol
- 2. Benzocaine from p-nitro benzoic acid
- 3. Acetanilide from aniline
- 4. Diphenylhydantoin from Benzoin.
- 5. Diclofenac sodium from aniline.
- 6. Aspirin from Salicylic acid.
- 7. Methyl Salicylate from Salicylic Acid.

(B) Estimation of pharmaceuticals

- 1. Estimation of vitamin B_{12} in commercial tablet.
- 2. Estimation of vitamin C in commercial tablet.
- 3. Estimation of alkali in antacid tablet.
- 4. Estimation of paracetamol in commercial tablet.
- 5. Estimation of aspirin in commercial tablet.
- 6. Estimation of Ibuprofen.
- 7. Estimation of Fe in hematinic tablet.

Note: Minimum 10 experiments should be performed.

References:

1. Patrick, G. (2017), Introduction to Medicinal Chemistry, Oxford University Press.
2. Singh H.; Kapoor V.K. (1996), Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan.
3. Foye, W.O.; Lemke, T. L.; William, D.A. (1995),Principles of Medicinal Chemistry, B.I. Waverly Pvt. Ltd.
4. Kjonaas, R.A.; Williams, P.E.; Counce, D.A.; Crawley, L.R. Synthesis of Ibuprofen. J. Chem. Educ., 2011, 88 (6), pp 825–828 DOI: 10.1021/ed100892p.
5. Marsh, D.G.; Jacobs, D.L.; Veening, H. Analysis of commercial vitamin C tablets by iodometric and coulometric titrimetry. J. Chem. Educ., 1973, 50 (9), p 626. DOI: 10.1021/ed050p626
6. Kar, Ashutosh (2005),Textbook of Medicinal Chemistry, New Age International.
7. Eric Marsault and Mark L. Peterson (2017), Practical Medicinal Chemistry with Macrocycles, Wiley.
8. D. Sriram and P. Yogeswari (2010), Medicinal Chemistry, Pearson.

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin%20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus
Bachelor of Science (Computer Science)

Submitted by

Board of Studies,
Bachelor of Science (Computer Science)

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)

(Computer Science - Major)

Four Year (Eight Semester Degree Course)

Teaching and Examination Scheme

B.Sc. Sem-I (Computer Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Programming in 'C'	BCS1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Programming in 'C'	BCS1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Computer Fundamentals	BCS1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Computer Fundamentals	BCS1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Office Automation	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Computer Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Object Oriented Programming using 'C ++'	BCS2T03	2	-	-	2	3	80	20	40	-	-	-
	DSC	Object Oriented Programming using 'C ++'	BCS2P03	-	-	2	1					25	25	25
2	DSC	Operating Systems	BCS2T04	2	-	-	2	3	80	20	40	-	-	-
	DSC	Operating Systems	BCS2P04	-	-	2	1	-	-	-	-	-	50	25
3	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
4	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
5	VSC	Computer Animation	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
6	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
7	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
8	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
9	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
10	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-III (Computer Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Data Structures	BCS3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Data Structures	BCS3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Linux Operating System	BCS3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Linux Operating System	BCS3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Computer Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Java Programming	BCS4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Java Programming	BCS4P07			2	1	-	-	-	-	25	25	25
3	DSC	Software Engineering	BCS4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Software Engineering	BCS4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Computer Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Advanced JAVA Programming	BCS5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advanced JAVA Programming	BCS5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Database Management System	BCS5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Database Management System	BCS5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Data Communication and Networks	BCS5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Data Communication and Networks	BCS5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BCS5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BCS5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Computer Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Cyber Security	BCS6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Cyber Security	BCS6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	SQL and PL/SQL	BCS6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	SQL and PL/SQL	BCS6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Python Programming	BCS6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Python Programming	BCS6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BCS6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BCS6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Computer Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Artificial Intelligence	BCS7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Artificial Intelligence	BCS7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Compiler Construction	BCS7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Compiler Construction	BCS7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Neural Network	BCS7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Neural Network	BCS7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Data Mining	BCS7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Data Mining	BCS7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3	BCS7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BCS7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BCS7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BCS7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Computer Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Cloud Computing	BCS8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Cloud Computing	BCS8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Machine Learning	BCS8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Machine Learning	BCS8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	R-Programming	BCS8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	R-Programming	BCS8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Computer Graphics	BCS8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Computer Graphics	BCS8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BCS8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BCS8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Computer Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Artificial Intelligence	BCS7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Artificial Intelligence	BCS7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Compiler Construction	BCS7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Compiler Construction	BCS7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Neural Network	BCS7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Neural Network	BCS7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BCS7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BCS7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BCS7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BCS7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Computer Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Cloud Computing	BCS8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Cloud Computing	BCS8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Machine Learning	BCS8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Machine Learning	BCS8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	R-Programming	BCS8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	R-Programming	BCS8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BCS8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BCS8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2+1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Computer Science)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Office Automation	Computer Science	**BVS1P01**
II	**VSC**	Computer Animation	Computer Science	**BVS2P03**
III	**VSC**	Web design using HTML and DHTML	Computer Science	**BVS3P05**
V	**VSC**	Web Development using Java	Computer Science	**BVS5P07**
VI	**VSC**	Shell Programming	Computer Science	**BVS6P08**

Basket for <u>ELECTIVE</u> (DSE) Category Courses (Computer Science)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Web Technology	BCS5T12
		B. E-Commerce	
VI	Elective 2	A. ASP.NET	BCS6T16
		B. Embedded System	
VII (Honors)	Elective 3	A. Discrete Mathematics	BCS7T21
		B. Digital Electronics and Microprocessor	
VIII (Honors)	Elective 4	A. Computer Architecture and Organization	BCS8T27
		B. PHP	
VII (Research)	Elective 3	A. Data Mining	BCS7T20R
		B. Soft Computing	
VIII (Research)	Elective 4	A. Digital Image Processing	BCS7T25R
		B. Internet of Things	

'R' in the subject code indicates 'Research'.

Bachelor of Science (Honors/Research)
(Computer Science - Major)
Four Year (Eight Semester Degree Course)

The objectives of the Program

1. The primary objective of this program is to provide a foundation of computing principles for effectively using information systems and enterprise softwares.

2. It helps students analyze the requirements for system programming and exposes students for information systems

3. This programme provides students with options to specialize in various software system.

4. To produce outstanding Computer Scientists who can apply the theoretical knowledge into practice in the real world and develop standalone live projects themselves

5. To provide opportunity for the study of modern methods of information processing and its applications.

6. To develop among students the programming techniques and the problem solving skills through programming

7. To prepare students who wish to go on to further studies in computer science and related subjects.

8. To acquaint students to Work effectively with a range of current, standard, Office Productivity software applications

PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. Discipline knowledge: Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity
2. Problem Solving: Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.
3. Design and Development of Solutions: Ability to design and development of algorithmic solutions to real world problems.
4. Programming a computer: Exhibiting strong skills required to program a computer for various issues and problems of day-to-day scientific applications.
5. Application Systems Knowledge: Possessing a minimum knowledge to practice existing computer application software.
6. Communication: Must have a reasonably good communication knowledge both in oral and writing.
7. Ethics on Profession, Environment and Society: Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer-based solutions for problems.
8. Lifelong Learning: Should become an independent learner. So, learn to learn ability.
9. Motivation to take up Higher Studies: Inspiration to continue educations towards advanced studies on Computer Science.

B.Sc. Sem-I (Computer Science - Major)
SC-DSC (Paper I)
BCS1T01

PROGRAMMING IN 'C'

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1.To formulate simple algorithms for arithmetic and logical problems.
2.To translate the algorithms to programs (in C language).
3.To test and execute the programs and correct syntax and logical errors.
4.To implement conditional branching, iteration and recursion.
5. To implement operations on arrays, strings , structures, unions , functions and file handling.

Course Outcomes :

After completing this course satisfactorily, a student will be able to:
1. Write simple algorithms for arithmetic and logical problems.
2. Write the C code for a given problem
3. Perform input and output operations using programs in C
4. Write programs that perform operations on arrays, strings , structures, unions , functions and file handling.

UNIT I

Programming Structure: Sequence, Selection, Iteration and Modular. Problem Solving techniques: Development Tools: Algorithm, Flowcharts and Pseudo code (Definition and its characteristics) Developing Algorithm and Drawing flowcharts

UNIT II

C Character set, Tokens, Identifier, Keywords, Variables, Data types, Qualifiers. Operators and Expressions: Arithmetic, Relational, Logical, Bit-Wise, Increment, Decrement, Conditional and Special operators. typedef, Type Conversion, Constants, Declaring Symbolic Constants, Character Strings, Enumerated Data Types, Operator Precedence and Associativity. Library functions: Maths, string handling Functions. Control Structure: Compound Statement, Selection Statement: if, if-else, Nested if, switch. Iteration statement: for, while, do...while, Nested loops, Jump statements: break, continue, goto (Special emphasis on problem solving)

UNIT III

Arrays: Need, Types: Single and Two Dimensional Array.
Strings: Strings Manipulation, Arrays of Strings, Evaluation order
Function: Function Components, Return Data type, Parameter Passing, Return by Reference, Default Arguments, Recursive Functions, Arrays with Functions, Storage Classes. (Special emphasis on problem Solving)

UNIT IV

Structure: Declaration, Definition, Accessing structure members, Initialization, Nesting of Structures.
Union: Unions, Differences between Structure and Union
Pointer: Introduction, Address Operator (&), Pointer variables, void pointers, Pointer Arithmetic, Pointers to Pointers.

File handling: Hierarchy of File Stream Classes, Opening & closing a file, Testing for errors, File Modes, File pointers and their manipulations, Sequential Access, Random Access, Command Line arguments.

Books

1. The Art of programming through flowcharts & algorithm by Anil B. Chaudhari Firewall Media, Laxmi publication, New Publication.
2. Programming in C by E. Balagurusamy TMH Publications.
3. C Programming – KernighenRitche
4. Programming with C – Y. Kanetkar.
5. C Programming – Holzner, PHI Publication.
6. Programming in C – Ravichandran.

B.Sc. Sem-I (Computer Science - Major)
SC- DSC (Paper II)
BCS1T02

COMPUTER FUNDAMENTALS

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1.To understand the basic digital components of computer.
2.To understand the working of peripheral devices.
3.To understand the number systems and logical gates.
4.To understand the network topologies.

Course Outcomes :

After completing this course satisfactorily, a student will be able to:
1.Confidently operate computers to carry out computational tasks
2.Understand working of Hardware and Software and the importance of operating systems
3.Understand number systems, peripheral devices, networking, multimedia and internet concepts

UNIT I

Basic Components of Digital Computers: Block Diagram**.**
CPU: Functions of Each Unit: Primary Memory, ALU and CU: Fetch and Execution cycle, Execution of Instructions in Single Address CPU.
Memory: RAM, ROM, PROM, EPROM, EEPROM and Cache. CISC and RISC Technology
Bus: Data, Control and Address Bus, Bus Organization.
Language Evolution: Generation of Languages: Machine, Assembly, High Level Languages. Characteristics of Good Language
Translators: Compiler, Interpreter and Assembler. Source and Object Program.

UNIT II

Storage Devices: Hard Disk and Optical Disk. Pen Drive, SD Card, Cloud as storage.
Input Devices: Keyboard, Mouse, Light Pen, Touch Screen, Voice Input, MICR, OCR, OMR, Barcode Reader and Flatbed Scanner. **Output Devices**: VDU, Printers: Dot Matrix, Laser and Inkjet. Plotters: Drum, Flat-Bed and Inkjet.

UNIT III

Number Systems: Binary, Octal, Decimal, Hexa-Decimal, Their Conversions, Binary Arithmetic. ASCII, BCD, EBCDIC**.**
Logic Gates: Truth table, properties and symbolic representation of NOT, AND, OR, NOR, NAND, EXOR, EXNOR gates. NOR and NAND gates as a universal gates.
Binary Arithmetic: Binary addition, binary subtraction using 1's and 2's compliment.

UNIT IV

Network: Network terminology, **Topologies**: Linear, Circular, Tree and Mesh. **Types of Networks**: LAN, WAN, MAN.**Networking Devices**: Repeaters, Bridges, Routers and Gateway. Modem for Communication between pc's, wi-fi network, Introduction of Bluetooth and Infrared devices. Network Architecture**:** Peer-to-Peer, Client/Server
Internet Protocols: TCP/IP, FTP, HTTP, HTTPS, Internet Addressing: IP Address, Domain Name, URL.

Books

1. Information Technology Concepts by Dr. Madhulika Jain, Shashank & Satish Jain, [BPB Publication, New Delhi.]
2. Fundamentals of Information Technology By Alexis And Mathews Leon
[Leon Press, Chennai &Vikas Publishing House Pvt. Ltd, New Delhi]
3. Fundamental of Micropocessor by B Ram

B.Sc. Sem-I (Computer Science)

OFFICE AUTOMATION (BVS1P01)

Credits : 2 **Duration : 60 Hours**

Course Objectives:

1.To understand functionality of Operating Systems and its applications.
2.To understand the working with the user interface.
3.To understand Word Processing, their usage, details of word processing screen, Opening, saving and printing a document
4.To understand Worksheet creation, inserting and editing data in cells..

Course Outcomes :

After completing this course satisfactorily, a student will be able to:
1. understand functionality of Operating Systems and its applications.
2. Working with the user interface.
3. prepare documents, letters and do necessary formatting of the document.
4. Worksheet creation, inserting and editing data in cells.
5. Opening/saving a presentation and printing of slides and handouts.

UNIT I

Introduction to windows Operating System Advantages of windows operating system, using different windows applications simultaneously, operating with windows, GUI, use of help features, starting an application, essential accessories, creating shortcuts, windows explorer, control panel, my computer, my documents, recycle bin, finding folders and files, changing system settings, system tools, use of run command, setting peripherals, drivers, editing graphics in windows.

UNIT II

Introduction, basics, starting Word, creating document, parts of Word window, mouse and keyboard operations, designing a document; Formatting- selection, cut, copy, paste; Toolbars, operating on text; Printing, saving, opening, closing of document; Creating a template; Tables, borders, pictures, text box operations; Mail Merge.

UNIT III

Introduction to MS EXCEL, navigating, Excel toolbars and operations, Formatting; copying data between worksheets; entering formula, chart creation; data forms, data sort; Functions in ExcelROUND( ), SQRT ( ), MAX( ), MIN( ), AVERAGE( ), COUNT( ), SUMIF( ), SUMIF( ), ABS( ), ROMAN( ), UPPER( ), LOWER( ), CELL( ), TODAY( ), NOW( ).

UNIT IV

Introduction to MS POWER POINT Working with Power Point Window, Standard Tool Bar, Formatting tool bar, Drawing tool Bar, Moving the Frame, Inserting Clip Art, Picture, Slide, Text Styling, Send to back, Entering data to graph, Organization Chart, Table,Design template, Master Slide, Animation Setting, Saving and Presentation , auto Content Wizard.

Books

1.MS Office XP for Everyone By Sanjay Saxena (Vikas Publi, Noida)
2.MS-Office 2000(for Windows) By Steve Sagman
3.A First Course in Computers – Sanjay Saxena

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr **P.U. Meshram, Allied Publishers, New Delhi.**
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

B.Sc. Sem -II (Computer Science - Major)

SC- DSC (Paper I)
BCS2T03

OBJECT ORIENTED PROGRAMMING USING 'C++'

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1. To provide basic characteristics of OOP through C++.
2. To impart skills on various kinds of overloading and inheritance.
3. To introduce pointers and file handling in C++ together with exception handling mechanism.

Course Outcomes:

After completion of this course, students will be able to:

1. Realize the need and features of OOP and idealize how C++ differs from C.
2. Infer knowledge on various types of overloading.
3. Choose suitable inheritance while proposing solution for the given problem.
4. Handle pointers and effective memory management.
5. Illustrate application of pointers in virtual functions.

UNIT I

Object Oriented Methodology: Elements of Object Oriented programming, Objects, Classes, OOPs features. **Classes & Objects:** Specifying a Class, Creating Objects, Accessing Class members, Defining member function, Outside Member Functions as inline, Accessing Member Functions within the class, Static data member, Access specifiers: private, protected and public Members.

UNIT II

Constructors & Destructors: Introduction, Parameterized Constructors, Constructor Overloading, Constructors with Default Arguments, Copy Constructor, Destructor, Order of Construction and Destruction, Static data members with Constructor and Destructors.

Operator Overloading: Definition, Overloadable Operators, Unary Operator Overloading, Unary & Binary overloading, Rules for Operators Overloading.

UNIT III

Dynamic Objects: Pointers to Objects, Creating and Deleting Dynamic Objects: New and Delete operators, Array of Objects, Array of Pointers to Objects, Pointers to Object Members, this Pointer**.**

Inheritance: Defining, Abstract classes, Single, Multilevel, Multiple, Hierarchical, Hybrid Inheritance, Constructor and Destructor in Derived Classes.

UNIT IV

Virtual Functions: Need for Virtual Functions, definition, Pure Virtual Functions, Abstract Classes, Rules for Virtual Functions.

Exception Handling: Exception Handling Model, List of Exceptions, Handling Uncaught Exceptions, Fault Tolerant Design Techniques, Memory Allocation Failure Exception, Rules for Handling Exception Successfully.

Books

1. Mastering C++ by K R Venugopal Tata McGraw-Hill, New Delhi.
2. The C++ Programming Language –Bjarne Stroustrup
3. Programming with C++ - Ravichandran
4. Programming with C++ - Robert Lafore
5. Object Oriented Programming with C++ by E. Balagurusamy, McGraw Hill

B.Sc. Sem -II (Computer Science - Major)

SC- DSC (Paper II)
BCS2T04

OPERATING SYSTEMS

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1. To introduce the Operating system concepts and designs to provide the skills required to implement the OS services.
2. To describe the trade-offs between contradictory objectives in large scale OS system design.
3. To develop the knowledge for application of the various OS design issues and services.

Expected Course Outcome:

1. Describe the various OS functionalities, structures and layers.
2. Usage of system calls related to OS management and interpreting different stages of various process states.
3. Design CPU scheduling algorithms to meet and validate the scheduling criteria.
4. Apply and explore the communication between inter process and synchronization techniques.
5. Implement memory placement strategies, replacement algorithms related to main memory and virtual memory techniques.
6. Differentiate the file systems; file allocation, access techniques along with virtualization concepts and designing of OS with protection and security enabled capabilities.

UNIT I

Structure of Operating System, Operating System functions, Characteristics of Modern OS. **Process Management**: Process states, Creation, Termination, Operations on Process, Concurrent process, Processes Threads, Multithreading, Micro Kernels **CPU Scheduling**: Schedulers, Scheduling Methodology, CPU Scheduling Algorithms: FCFS, SJF, RR, Priority Scheduling.

UNIT II

Performance comparison: Deterministic Modelling, Queuing analysis, Simulators. **Deadlock and Starvation:** Resource Allocation Graph, Conditions for Dead Lock, Dead Lock Prevention, Dead Lock Detection, Recovery from Deadlock.

UNITIII

Memory Management: Logical Vs. Physical Address Space, Swapping, Memory Management Requirement, Dynamic Loading and Dynamic Linking, Memory Allocation Method: Single Partition allocation, Multiple Partitions, Compaction, paging, segmentation, Segmentation with paging, Protection.

UNIT IV

I/O Management: I/O hardware, I/O Buffering, Disk I/O, Raid, Disk Cache. **File Management:** File Management system, File Accessing Methods, File Directories, File Allocation Methods, File Space Management, Disk Space Management, Record blocking. **Protection Mechanisms**: Cryptography, Digital Signature, User Authentication.

Books

1. Operating Systems by P. Balakrishna Prasad [Scitech Publication]
2. Operating System Concept - Silbershaz (Addision Education)
3. Operating Systems - H. M. Deitel - Addision Wesley.
4. Operating Systems- John J. Donoven.
5. Operating System - A. S. Godbole (TMH)
6. Modern Operating Systems - Tanenbaum (Pearson Education)
7. Operating System - Peterson.

B.Sc. Sem-II (Computer Science)
BVS2P03
COMPUTER ANIMATION

Credits : 2 **Duration : 60 Hours**

Course Objectives:

1. To Understand the concept of 2D and 3D Animation.
2. To Execute creative concepts and ideas through a variety and combination of techniques including hand drawn, computer generated, 2D and 3D storyboards and animatics.
3. To Understand how animation works.
4. To Understand the basic concepts of multimedia technology which will help them to get started easily in multimedia.

Course Outcome: After completion of this course, students will be able to:
1. Get knowledge about various terms like, images, text, fonts, file formats. Understanding these things is very necessary.
2. produce traditional style animation as well as puppet animation and the knowledge of the principles of animation to be built upon in subsequent courses leading up to the Portfolio course.
3. apply skills learned in this class in other areas including motion graphics, stop motion and basic traditional animation

Unit I
Animation, Introduction to 2D and 3D Animation. Advantages of animation, Different tools of 2D Animation.
GIMP Features and Capabilities, Toolbox, Image Window, Dialog and Docking, Working with images,
Pencil2D , Overview of Pencil2D, Traditional Animation Workflows, How to rotate image, Scrolling background in Camera layer

Unit II
Opentoonz , Production Workflow, Interface Overview, Managing Projects,Setting Up a Scene, Scanning Paper Drawings, Cleaning-up Scanned Drawings, Drawing Animation Levels, Editing Animation Levels, Managing Palettes and Styles, Painting Animation Levels, Working in Xsheet/Timeline, Creating Movements, Editing Using Spreadsheet and Curves, Creating Cutout Animation, Create animations using Plastic tool, Applying Effects, Using the Particles Effect, Previewing and Rendering

Unit III
Blender, History and Installation, Interface : Blender Interface, Adding New Objects, Moving Things Around, Modeling : Mesh, Edit Mode, Sculpt Mode, Retopology
Lighting and Procedural Textures : Setting Up a Basic Scene, The Scene Camera, Procedural Materials and Textures., UV Mapping : Creating a UV Map, Texture Painting, Projection Painting, Normal Maps and Bump Maps
Curves and NURBS : Metaballs, Curves, Spins, Nurbs,

Unit IV
Basic Rigging and Animation : Keyframing with the Timeline, The Dopesheet ., Parenting, Graph Editor, Pivot Point: The Center of Rotation, Basic Tracking: Eyes That Follow, Rigging with Bones,

Rigging a Simple Character, Advanced Rigging ..: Forward Kinematics vs. Inverse Kinetics, Blender 2.5 Rigs, Walk Cycles., Shape Keys, Lip Syncing.
Making Movies : Disabling, Color Management, Rendering Formats, Alpha, Lighting Adjustments, The Video Sequence Editor, Crash Management and Rendering Speed, Introduction to Game Engine.

Books :
https://docs.gimp.org/odftest/en.pdf
https://opentoonz.readthedocs.io/en/latest/using_the_toonz_farm.html
https://www.pencil2d.org/doc/tutorials
Beginning Blender Open Source 3D Modelling, Animation, and Game Design, Lance Flavell, Apress.
https://www.academia.edu/7984869/Beginning_Blender_Open_Source_3D_Modeling_Animation_and_Game_Design_Companion_eBook_Available_Full_Color_Inside_BOOKS_FOR_PROFESSIONALS_BY_PROFESSIONALS_Beginning_Blender_Open_Source_3D_Modeling_Animation_and_Game_Design
Reference Book :
Learning Blender A Hands-On Guide to Creating 3D Animated Characters, Oliver Villar
Blender Basics Classroom Tutorial Book 4th Edition, James Chronister.
https://www.cdschools.org/cms/lib04/pa09000075/centricity/domain/81/blenderbasics_4thedition2011.pdf
Blender 3D Basics Beginner's Guide: A quick and easy-to-use guide to create 3D modeling and animation using Blender 2.7, Gordon Fisher

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin%20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

Bachelor of Computer Application

Submitted by

Board of Studies,

Bachelor of Computer Application

FYUGP-Scheme I-VIII Semester
Bachelor of Computer Application (Honors/Research)
(Computer Application-Major)
Four Year (Eight Semester Degree Course)
Teaching and Examination Scheme

BCA Sem-I (Computer Application-Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Programming in 'C'	BCA1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Programming in 'C'	BCA1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Computer Fundamentals	BCA1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Computer Fundamentals	BCA1P02	-	-	2	1	-	-	-	-	25	25	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Office Automation	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

BCA Sem-II (Computer Application - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Object Oriented Programming using "C ++"	BCA2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Object Oriented Programming using "C ++"	BCA2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Operating Systems and Linux	BCA2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Operating Systems and Linux	BCA2P04	-	-	2	1	-	-	-	-	25	25	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Computer Animation	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

BCA Sem-III (Computer Application - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Data Structures	BCA3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Data Structures	BCA3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Java Programming	BCA3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Java Programming	BCA3P06	-	-	2	1	-	-	-	-	25	25	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

BCA Sem-IV (Computer Application - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Advanced Java Programming	BCA4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advanced Java Programming	BCA4P07			2	1	-	-	-	-	25	25	25
3	DSC	Software Engineering	BCA4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Software Engineering	BCA4P08			2	1	-	-	-	-	25	25	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

BCA Sem-V (Computer Application - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min.
1	DSC	Python Programming	BCA5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Python Programming	BCA5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Database Management System	BCA5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Database Management System	BCA5P10	-	-	2	1	-	-	-	-	25	25	25
5	DSC	Data Communication and Networks	BCA5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Data Communication and Networks	BCA5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BCA5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BCA5P12	-	-	2	1	-	-	-	-	25	25	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

BCA Sem-VI (Computer Application - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Cyber Security	BCA6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Cyber Security	BCA6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	SQL and PL/SQL	BCA6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	SQL and PL/SQL	BCA6P14	-	-	2	1	-	-	-	-	25	25	25
5	DSC	Android Programming	BCA6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Android Programming	BCA6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BCA6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BCA6P16	-	-	2	1	-	-	-	-	25	25	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

BCA Sem-VII (Honors) (Computer Application - Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Compiler Construction	BCA7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Compiler Construction	BCA7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	E-Commerce	BCA7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	E-Commerce	BCA7P18	-	-	2	1	-	-	-	-	25	25	25
5	DSC	Data Mining	BCA7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Data Mining	BCA7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Software Testing	BCA7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Software Testing	BCA7P20	-	-	2	1	-	-	-	-	25	25	25
9	DSE	Elective 3	BCA7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BCA7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BCA7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BCA7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

BCA Sem-VIII (Honors) (Computer Application - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Cloud Computing	BCA8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Cloud Computing	BCA8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Blockchain Technology	BCA8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Blockchain Technology	BCA8P24	-	-	2	1	-	-	-	-	25	25	25
5	DSC	Cryptography	BCA8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Cryptography	BCA8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Embedded System	BCA8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Embedded System	BCA8P26	-	-	2	1	-	-	-	-	25	25	25
9	DSE	Elective 4	BCA8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BCA8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

BCA Sem-VII (Research) (Computer Application - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Compiler Construction	BCA7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Compiler Construction	BCA7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	E-Commerce	BCA7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	E-Commerce	BCA7P18R	-	-	2	1	-	-	-	-	25	25	25
5	DSC	Data Mining	BCA7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Data Mining	BCA7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BCA7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BCA7P20R	-	-	2	1	-	-	-	-	25	25	25
9	RM	Research Methodology	BCA7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BCA7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

BCA Sem-VIII (Research) (Computer Application - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Cloud Computing	BCA8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Cloud Computing	BCA8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Blockchain Technology	BCA8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Blockchain Technology	BCA8P23R	-	-	2	1	-	-	-	-	25	25	25
5	DSC	Cryptography	BCA8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Cryptography	BCA8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BCA8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BCA8P25R	-	-	2	1	-	-	-	-	25	25	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2 +1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

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Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Computer Application)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Office Automation	Computer Science	**BVS1P01**
II	**VSC**	Computer Animation	Computer Science	**BVS2P03**
III	**VSC**	Web design using HTML and DHTML	Computer Science	**BVS3P05**
V	**VSC**	Web Development using Java	Computer Science	**BVS5P07**
VI	**VSC**	Shell Programming	Computer Science	**BVS6P08**

Basket for ELECTIVE (DSE) Category Courses (Computer Application)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. ASP.NET	BCA5T12
		B. Discrete Mathematical Structure	
VI	Elective 2	A. Web Technology	BCA6T16
		B. Statistical Methods	
VII (Honors)	Elective 3	A. Computer Graphics	BCA7T21
		B. Operation Research	
VIII (Honors)	Elective 4	A. Pattern Recognition	BCA8T27
		B. PHP	
VII (Research)	Elective 3	A. Soft Computing	BCA7T20R
		B. Machine Learning	
VIII (Research)	Elective 4	A. Cloud Computing	BCA7T25R
		B. Design and Analysis of Algorithm	

'R' in the subject code indicates 'Research'.

Bachelor of Computer Application (Honors/Research)
(Computer Application-Major)
Four Year (Eight Semester Degree Course)

The objectives of the Program

1. The primary objective of this program is to provide a foundation of computing principles for effectively using information systems and enterprise softwares.
2. It helps students analyze the requirements for system programming and exposes students for information systems
3. This programme provides students with options to specialize in various software system.
4. To produce outstanding Computer Scientists who can apply the theoretical knowledge into practice in the real world and develop standalone live projects themselves
5. To provide opportunity for the study of modern methods of information processing and its applications.
6. To develop among students the programming techniques and the problem solving skills through programming
7. To prepare students who wish to go on to further studies in computer science and related subjects.
8. To acquaint students to Work effectively with a range of current, standard, Office Productivity software applications

PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. Discipline knowledge: Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity
2. Problem Solving: Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.
3. Design and Development of Solutions: Ability to design and development of algorithmic solutions to real world problems.
4. Programming a computer: Exhibiting strong skills required to program a computer for various issues and problems of day-to-day scientific applications.
5. Application Systems Knowledge: Possessing a minimum knowledge to practice existing computer application software.
6. Communication: Must have a reasonably good communication knowledge both in oral and writing.
7. Ethics on Profession, Environment and Society: Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer-based solutions for problems.
8. Lifelong Learning: Should become an independent learner. So, learn to learn ability.
9. Motivation to take up Higher Studies: Inspiration to continue educations towards advanced studies on Computer Science.

BCA Sem-I (Computer Application-Major)
SC-DSC (Paper I)
BCA1T01
PROGRAMMING IN 'C'

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1.To formulate simple algorithms for arithmetic and logical problems.
2.To translate the algorithms to programs (in C language).
3.To test and execute the programs and correct syntax and logical errors.
4.To implement conditional branching, iteration and recursion.
5. To implement operations on arrays, strings , structures, unions , functions and file handling.

Course Outcomes :

After completing this course satisfactorily, a student will be able to:
1. Write simple algorithms for arithmetic and logical problems.
2. Write the C code for a given problem
3. Perform input and output operations using programs in C
4. Write programs that perform operations on arrays, strings , structures, unions , functions and file handling.

UNIT I

Programming Structure: Sequence, Selection, Iteration and Modular. Problem Solving techniques: Development Tools: Algorithm, Flowcharts and Pseudo code (Definition and its characteristics) Developing Algorithm and Drawing flowcharts

UNIT II

C Character set, Tokens, Identifier, Keywords, Variables, Data types, Qualifiers. Operators and Expressions: Arithmetic, Relational, Logical, Bit-Wise, Increment, Decrement, Conditional and Special operators. typedef, Type Conversion, Constants, Declaring Symbolic Constants, Character Strings, Enumerated Data Types, Operator Precedence and Associativity. Library functions: Maths, string handling Functions. Control Structure: Compound Statement, Selection Statement: if, if-else, Nested if, switch. Iteration statement: for, while, do...while, Nested loops, Jump statements: break, continue, goto (Special emphasis on problem solving)

UNIT III

Arrays: Need, Types: Single and Two Dimensional Array.
Strings: Strings Manipulation, Arrays of Strings, Evaluation order
Function: Function Components, Return Data type, Parameter Passing, Return by Reference, Default Arguments, Recursive Functions, Arrays with Functions, Storage Classes. (Special emphasis on problem Solving)

UNIT IV

Structure: Declaration, Definition, Accessing structure members, Initialization, Nesting of Structures.
Union: Unions, Differences between Structure and Union
Pointer: Introduction, Address Operator (&), Pointer variables, void pointers, Pointer Arithmetic, Pointers to Pointers.
File handling: Hierarchy of File Stream Classes, Opening & closing a file, Testing for errors, File Modes, File pointers and their manipulations, Sequential Access, Random Access, Command Line arguments.

Books

1. The Art of programming through flowcharts & algorithm by Anil B. Chaudhari Firewall Media, Laxmi publication, New Publication.
2. Programming in C by E. Balagurusamy TMH Publications.
3. C Programming – KernighenRitche
4. Programming with C – Y. Kanetkar.
5. C Programming – Holzner, PHI Publication.
6. Programming in C – Ravichandran.

BCA Sem-I (Computer Application-Major)
SC- DSC (Paper II)
BCA1T02

COMPUTER FUNDAMENTALS

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1.To understand the basic digital components of computer.
2.To understand the working of peripheral devices.
3.To understand the number systems and logical gates.
4.To understand the network topologies.

Course Outcomes :

After completing this course satisfactorily, a student will be able to:
1.Confidently operate computers to carry out computational tasks
2.Understand working of Hardware and Software and the importance of operating systems
3.Understand number systems, peripheral devices, networking, multimedia and internet concepts

UNIT I

Basic Components of Digital Computers: Block Diagram**.**
CPU: Functions of Each Unit: Primary Memory, ALU and CU: Fetch and Execution cycle, Execution of Instructions in Single Address CPU.
Memory:RAM, ROM, PROM, EPROM, EEPROM and Cache. CISC and RISC Technology
Bus: Data, Control and Address Bus, Bus Organization.
Language Evolution: Generation of Languages: Machine, Assembly, High Level Languages. Characteristics of Good Language
Translators: Compiler, Interpreter and Assembler. Source and Object Program.

UNIT II

Storage Devices: Hard Disk and Optical Disk. Pen Drive, SD Card, Cloud as storage.
Input Devices: Keyboard, Mouse, Light Pen, Touch Screen, Voice Input, MICR, OCR, OMR, Barcode Reader and Flatbed Scanner. **OutputDevices**: VDU, Printers: Dot Matrix, Laser and Inkjet. Plotters: Drum, Flat-Bed and Inkjet.

UNIT III

Number Systems: Binary, Octal, Decimal, Hexa-Decimal, Their Conversions, Binary Arithmetic. ASCII, BCD, EBCDIC**.**
Logic Gates: Truth table, properties and symbolic representation of NOT, AND, OR, NOR, NAND, EXOR, EXNOR gates. NOR and NAND gates as a universal gates.
Binary Arithmetic: Binary addition, binary subtraction using 1's and 2's compliment.

UNIT IV

Network: Network terminology, Topologies: Linear, Circular, Tree and Mesh. Types of Networks: LAN, WAN, MAN.Networking Devices: Repeaters, Bridges, Routers and Gateway. Modem for Communication between pc's,wi-fi network, Introduction of Bluetooth and Infrared devices. Network Architecture: Peer-to-Peer, Client/Server

Internet Protocols: TCP/IP, FTP, HTTP, HTTPS, Internet Addressing: IP Address, Domain Name, URL.

Books

1. Information Technology Concepts by Dr.Madhulika Jain, Shashank & Satish Jain, [BPB Publication, New Delhi.]
2. Fundamentals of Information Technology By Alexis And Mathews Leon
[Leon Press, Chennai &Vikas Publishing House Pvt. Ltd, New Delhi]
3. Fundamental of Micropocessor by B Ram

BCA Sem-I (Computer Application)

OFFICE AUTOMATION (BVS1P01)

Credits : 2 **Duration : 60 Hours**

Course Objectives:

1.To understand functionality of Operating Systems and its applications.
2.To understand the working with the user interface.
3.To understand Word Processing, their usage, details of word processing screen, Opening, saving and printing a document
4.To understand Worksheet creation, inserting and editing data in cells..

Course Outcomes :

After completing this course satisfactorily, a student will be able to:

1. understand functionality of Operating Systems and its applications.
2. Working with the user interface.
3. prepare documents, letters and do necessary formatting of the document.
4. Worksheet creation, inserting and editing data in cells.
5. Opening/saving a presentation and printing of slides and handouts.

UNIT I

Introduction to windows Operating System Advantages of windows operating system, using different windows applications simultaneously, operating with windows, GUI, use of help features, starting an application, essential accessories, creating shortcuts, windows explorer, control panel, my computer, my documents, recycle bin, finding folders and files, changing system settings, system tools, use of run command, setting peripherals, drivers, editing graphics in windows.

UNIT II

Introduction, basics, starting Word, creating document, parts of Word window, mouse and keyboard operations, designing a document; Formatting- selection, cut, copy, paste; Toolbars, operating on text; Printing, saving, opening, closing of document; Creating a template; Tables, borders, pictures, text box operations; Mail Merge.

UNIT III

Introduction to MS EXCEL, navigating, Excel toolbars and operations, Formatting; copying data between worksheets; entering formula, chart creation; data forms, data sort; Functions in ExcelROUND( ), SQRT ( ), MAX( ), MIN( ), AVERAGE( ), COUNT( ), SUMIF( ), SUMIF( ), ABS( ), ROMAN( ), UPPER( ), LOWER( ), CELL( ), TODAY( ), NOW( ).

UNIT IV

Introduction to MS POWER POINT Working with Power Point Window, Standard Tool Bar, Formatting tool bar, Drawing tool Bar, Moving the Frame, Inserting Clip Art, Picture, Slide, Text Styling, Send to back, Entering data to graph, Organization Chart, Table,Design template, Master Slide, Animation Setting, Saving and Presentation , auto Content Wizard.

Books

1.MS Office XP for Everyone By Sanjay Saxena (Vikas Publi, Noida)
2.MS-Office 2000(for Windows) By Steve Sagman
3.A First Course in Computers – Sanjay Saxena

BCA SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr **P.U. Meshram, Allied Publishers, New Delhi.**
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

BCA Sem-II (Computer Application-Major)
SC- DSC (Paper I)
BCA2T03

OBJECT ORIENTED PROGRAMMING USING 'C++'

Credits : 2 **Duration : 30 Hours**

Course Objectives:
1. To provide basic characteristics of OOP through C++.
2. To impart skills on various kinds of overloading and inheritance.
3. To introduce pointers and file handling in C++ together with exception handling mechanism.

Course Outcomes:
After completion of this course, students will be able to:
1. Realize the need and features of OOP and idealize how C++ differs from C.
2. Infer knowledge on various types of overloading.
3. Choose suitable inheritance while proposing solution for the given problem.
4. Handle pointers and effective memory management.
5. Illustrate application of pointers in virtual functions.

UNIT I

Object Oriented Methodology: Elements of Object Oriented programming, Objects, Classes, OOPs features. **Classes & Objects:** Specifying a Class, Creating Objects, Accessing Class members, Defining member function, Outside Member Functions as inline, Accessing Member Functions within the class, Static data member, Access specifiers: private, protected and public Members.

UNIT II

Constructors & Destructors: Introduction, Parameterized Constructors, Constructor Overloading, Constructors with Default Arguments, Copy Constructor, Destructor, Order of Construction and Destruction, Static data members with Constructor and Destructors.
Operator Overloading: Definition, Overloadable Operators, Unary Operator Overloading, Unary & Binary overloading, Rules for Operators Overloading.

UNIT III

Dynamic Objects: Pointers to Objects, Creating and Deleting Dynamic Objects: New and Delete operators, Array of Objects, Array of Pointers to Objects, Pointers to Object Members, this Pointer**.**
Inheritance: Defining, Abstract classes, Single, Multilevel, Multiple, Hierarchical, Hybrid Inheritance, Constructor and Destructor in Derived Classes.

UNIT IV

Virtual Functions: Need for Virtual Functions, definition, Pure Virtual Functions, Abstract Classes, Rules for Virtual Functions.
Exception Handling: Exception Handling Model, List of Exceptions, Handling Uncaught Exceptions, Fault Tolerant Design Techniques, Memory Allocation Failure Exception, Rules for Handling Exception Successfully.

Books

1. Mastering C++ by K R Venugopal Tata McGraw-Hill, New Delhi.
2. The C++ Programming Language –Bjarne Stroustrup
3. Programming with C++ - Ravichandran
4. Programming with C++ - Robert Lafore
5. Object Oriented Programming with C++ by E. Balagurusamy, McGraw Hill

BCA Sem-II (Computer Application-Major)
SC- DSC (Paper II)
BCA2T04

OPERATING SYSTEMS AND LINUX

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1. To introduce the Operating system concepts and designs to provide the skills required to implement the OS services.
2. To describe the trade-offs between contradictory objectives in large scale OS system design.
3. To develop the knowledge for application of the various OS design issues and services.
4. To understand structure of Linux OS and commands.

Course Outcome: After completion of this course, students will be able to:
1. Describe the various OS functionalities, structures and layers.
2. Usage of system calls related to OS management and interpreting different stages of various process states.
3. Design CPU scheduling algorithms to meet and validate the scheduling criteria.
4. Apply and explore the communication between inter process and synchronization techniques.
5. Implement memory placement strategies, replacement algorithms related to main memory and virtual memory techniques.
6. Differentiate the file systems; file allocation, access techniques along with virtualization concepts and designing of OS with protection and security enabled capabilities.
7. Working on Linux OS.

UNIT I

Structure of Operating System, Operating System functions, Characteristics of Modern OS. Process Management: Process states, Creation, Termination, Operations on Process, Concurrent process, Processes Threads, Multithreading, Micro Kernels CPU Scheduling: Schedulers, Scheduling Methodology, CPU Scheduling Algorithm: FCFS, SJF, RR, Priority Scheduling.

UNIT II

Performance comparison : Deterministic Modeling , Queuing analysis, Simulators. Deadlock and Starvation: Resource Allocation Graph, Conditions for Dead Lock, Dead Lock Prevention, Dead Lock Detection, Recovery from Deadlock.

UNIT III

Memory Management: Logical Vs. Physical Address Space, Swapping, Memory Management Requirement, Dynamic Loading and Dynamic Linking, Memory Allocation Method: Single Partition allocation, Multiple Partitions, Compaction, paging, segmentation, File Management: File Management system, File Accessing Methods, File Directories, File Allocation Methods

UNIT IV

Anatomy of Linux OS, Directory Structure, /usr Directory, File Types: User datafiles, System data files, Executable files. Naming files and directories. Shell: Creating User Account, Shell Program, bash shell, Changing shell prompt. Commands: Basic Syntax for a command, Exploring the Home Directory, ls, mkdir, rmdir, stat, cat, rm, mv, cp, Managing users accounts, Changing Password, Creating group accounts.

Books:

1) Operating Systems by P. Balakrishna Prasad [Scitech Publication]
2) Operating System Concept :Silbershaz (Addision Education)
3) Operating System :A.S.Godbole (TMH)
4) Modern Operating Systems :Tenenenbaum (Pearson Education)
5) SAMS Teach Yourself Linux by Craig and Coletta Witherspoon [Techmedia]

BCA Sem-II (Computer Application)
BVS2P03
COMPUTER ANIMATION

Credits : 2 **Duration : 60 Hours**

Course Objectives:

1. To Understand the concept of 2D and 3D Animation.
2. To Execute creative concepts and ideas through a variety and combination of techniques including hand drawn, computer generated, 2D and 3D storyboards and animatics.
3. To Understand how animation works.
4. To Understand the basic concepts of multimedia technology which will help them to get started easily in multimedia.

Course Outcome: After completion of this course, students will be able to:
1. Get knowledge about various terms like, images, text, fonts, file formats. Understanding these things is very necessary.
2. produce traditional style animation as well as puppet animation and the knowledge of the principles of animation to be built upon in subsequent courses leading up to the Portfolio course.
3. apply skills learned in this class in other areas including motion graphics, stop motion and basic traditional animation

Unit I
Animation, Introduction to 2D and 3D Animation. Advantages of animation, Different tools of 2D Animation.
GIMP Features and Capabilities, Toolbox, Image Window, Dialog and Docking, Working with images,
Pencil2D , Overview of Pencil2D, Traditional Animation Workflows, How to rotate image, Scrolling background in Camera layer

Unit II
Opentoonz , Production Workflow, Interface Overview, Managing Projects,Setting Up a Scene, Scanning Paper Drawings, Cleaning-up Scanned Drawings, Drawing Animation Levels, Editing Animation Levels, Managing Palettes and Styles, Painting Animation Levels, Working in Xsheet/Timeline, Creating Movements, Editing Using Spreadsheet and Curves, Creating Cutout Animation, Create animations using Plastic tool, Applying Effects, Using the Particles Effect, Previewing and Rendering

Unit III
Blender, History and Installation, Interface : Blender Interface, Adding New Objects, Moving Things Around, Modeling : Mesh, Edit Mode, Sculpt Mode, Retopology
Lighting and Procedural Textures : Setting Up a Basic Scene, The Scene Camera, Procedural Materials and Textures., UV Mapping : Creating a UV Map, Texture Painting, Projection Painting, Normal Maps and Bump Maps
Curves and NURBS : Metaballs, Curves, Spins, Nurbs,

Unit IV
Basic Rigging and Animation : Keyframing with the Timeline, The Dopesheet ., Parenting, Graph Editor, Pivot Point: The Center of Rotation, Basic Tracking: Eyes That Follow, Rigging with Bones, Rigging a Simple Character, Advanced Rigging ..: Forward Kinematics vs. Inverse Kinetics, Blender

2.5 Rigs, Walk Cycles., Shape Keys, Lip Syncing.
Making Movies : Disabling, Color Management, Rendering Formats, Alpha, Lighting Adjustments, The Video Sequence Editor, Crash Management and Rendering Speed, Introduction to Game Engine.

Books :

https://docs.gimp.org/odftest/en.pdf
https://opentoonz.readthedocs.io/en/latest/using_the_toonz_farm.html
https://www.pencil2d.org/doc/tutorials
Beginning Blender Open Source 3D Modelling, Animation, and Game Design, Lance Flavell, Apress.
https://www.academia.edu/7984869/Beginning_Blender_Open_Source_3D_Modeling_Animation_and_Game_Design_Companion_eBook_Available_Full_Color_Inside_BOOKS_FOR_PROFESSIONALS_BY_PROFESSIONALS_Beginning_Blender_Open_Source_3D_Modeling_Animation_and_Game_Design

Reference Book :

Learning Blender A Hands-On Guide to Creating 3D Animated Characters, Oliver Villar
Blender Basics Classroom Tutorial Book 4th Edition, James Chronister.
https://www.cdschools.org/cms/lib04/pa09000075/centricity/domain/81/blenderbasics_4thedition2011.pdf
Blender 3D Basics Beginner's Guide: A quick and easy-to-use guide to create 3D modeling and animation using Blender 2.7, Gordon Fisher

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin%20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

Bachelor of Science (Data Science)

Submitted by

Board of Studies,

Bachelor of Science (Data Science)

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)
(Data Science - Major)
Four Year (Eight Semester Degree Course)
Teaching and Examination Scheme

B.Sc. Sem-I (Data Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Linear Algebra	BDS1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Linear Algebra	BDS1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Programming with 'C++'	BDS1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Programming with 'C++'	BDS1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Office Automation	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Data Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Data Structure	BDS2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Data Structure	BDS2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Probability and Statistics	BDS2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Probability and Statistics	BDS2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Computer Animation	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-III (Data Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	JAVA Programming	BDS3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	JAVA Programming	BDS3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Digital Electronics and Microprocessor	BDS3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Digital Electronics and Microprocessor	BDS3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Data Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Operating System and Linux	BDS4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Operating System and Linux	BDS4P07			2	1	-	-	-	-	25	25	25
3	DSC	Database Management System	BDS4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Database Management System	BDS4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Data Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	SQL and PL/SQL	BDS5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	SQL and PL/SQL	BDS5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Data Communication and Networks	BDS5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Data Communication and Networks	BDS5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Statistical Inference	BDS5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Statistical Inference	BDS5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BDS5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BDS5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Data Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Python Programming	BDS6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Python Programming	BDS6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Artificial Intelligence	BDS6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Artificial Intelligence	BDS6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Cyber Security	BDS6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Cyber Security	BDS6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BDS6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BDS6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Data Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Machine Learning	BDS7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Machine Learning	BDS7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Compiler Construction	BDS7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Compiler Construction	BDS7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Computer Graphics	BDS7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Computer Graphics	BDS7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Operation Research	BDS7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Operation Research	BDS7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3	BDS7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BDS7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BDS7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BDS7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Data Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Advance Java Programming	BDS8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advance Java Programming	BDS8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Time Series Analysis	BDS8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Time Series Analysis	BDS8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Soft Computing	BDS8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Soft Computing	BDS8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	R-Programming	BDS8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	R-Programming	BDS8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BDS8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BDS8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Data Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Machine Learning	BDS7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Machine Learning	BDS7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Compiler Construction	BDS7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Compiler Construction	BDS7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Computer Graphics	BDS7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Computer Graphics	BDS7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BDS7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BDS7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BDS7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BDS7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Data Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Advance Java Programming	BDS8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advance Java Programming	BDS8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Time Series Analysis	BDS8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Time Series Analysis	BDS8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Soft Computing	BDS8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Soft Computing	BDS8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BDS8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BDS8P25R	-	-	2	1	-	-	-	-	-	50	25
5	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2+1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Data Science)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Office Automation	Inter disciplinary program in Science (Data Science)	**BVS1P01**
II	**VSC**	Computer Animation	Inter disciplinary program in Science (Data Science)	**BVS2P03**
III	**VSC**	Web design using HTML and DHTML	Inter disciplinary program in Science (Data Science)	**BVS3P05**
V	**VSC**	Web Development using Java	Inter disciplinary program in Science (Data Science)	**BVS5P07**
VI	**VSC**	Shell Programming	Inter disciplinary program in Science (Data Science)	**BVS6P08**

Basket for <u>ELECTIVE</u> (DSE) Category Courses (Data Science)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Data Mining	BDS5T12
		B. Microcontroller and Embedded Systems	
VI	Elective 2	A. Business Analytics	BDS6T16
		B. Design and Analysis of Algorithm	
VII (Honors)	Elective 3	A. Big Data Analytics	BDS7T21
		B. Internet of Things	
VIII (Honors)	Elective 4	A. Social Media Analytics	BDS8T27
		B. Predictive Modelling Analysis	
VII (Research)	Elective 3	A. R-Programming	BDS7T20R
		B. Data Visualization	
VIII (Research)	Elective 4	A. Health Care Analytics	BDS7T25R
		B. Natural Language Processing	

'R' in the subject code indicates 'Research'.

Bachelor of Science (Honors/Research)
(Data Science - Major)
Four Year (Eight Semester Degree Course)

The objectives of the Program

1. The primary objective of this program is to provide a foundation of computing principles for effectively using information systems and enterprise softwares.

2. It helps students to demonstrate proficiency with statistical analysis of data.

3. This programme provides students with options to specialize in various software system.

4. To produce outstanding Computer Scientists who can apply the theoretical knowledge into practice in the real world and develop standalone live projects themselves

5. To provide opportunity for statistical analyses with professional statistical software

6. To develop among students the programming techniques and the problem solving skills through programming

7. To prepare students to apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

8. To acquaint students to Work effectively with a range of current, standard, Office Productivity software applications

PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. Discipline knowledge: Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity
2. Problem Solving: Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.
3. Design and Development of Solutions: Ability to to prepare students to apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively
4. Programming a computer: Exhibiting strong skills required to program a computer for various issues and problems of day-to-day scientific applications.
5. Application Systems Knowledge: Possessing a minimum knowledge to practice existing computer application software. Provide opportunity for statistical analyses with professional statistical software
6. Communication: Must have a reasonably good communication knowledge both in oral and writing.
7. Ethics on Profession, Environment and Society: Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer-based solutions for problems.
8. Lifelong Learning: Should become an independent learner. So, learn to learn ability.
9. Motivation to take up Higher Studies: Inspiration to continue educations towards advanced studies on Computer Science.

B.Sc. Sem-I (Data Science –Major)
SC-DSC (Paper I)
BDS1T01

Linear Algebra

Credits : 2 **Duration :30 Hours**

Course Objectives:

1.To cover certain solution of system of linear equations, vector space and orthogonality concepts for analyzing problems that arise in physical science.
2. To analyze the problems connected Eigen value, Hermitian and Unitary linear transformations.
3. To solve QR and LU decomposition and to learn the applications of linear algebra in computer science.

Course Outcomes: At the end of the course the student should be able to

1. Observe the various types of matrix, determinant and its properties.
2. Understand the concepts of system of linear equations and solving by various methods.
3. Understand the concepts of vector space, subspace and basis.
4. Understand the concepts of orthogonality, Hermitian and unitary transformations.

Unit - I

Matrix and Basic properties of matrix & vectors:
Matrix, scalar multiplication, linear transformation, transpose, conjugate, rank, determinant, Inner and outer products, matrix multiplication rule and various algorithms, matrix inverse, square matrix, identity matrix, triangular matrix, idea about sparse and dense matrix, unit vectors, symmetric matrix, Hermitian, skew-Hermitian and unitary matrices.

Unit – II

Special matrices and Vector Space:
Matrix factorization concept/LU decomposition, Gaussian/Gauss-Jordan elimination, solving Ax=b linear system of equation, vector space, subspaces, basis, span, dimension of subspace, orthogonality, orthonormality, linear least square, Eigenvalues, eigenvectors, and diagonalization.

Unit - III

Linear Transformations:
Definition and example of linear transformation, Null space, range, rank and nullity of linear transformation, matrix representation of a linear transformation, dual space, dual basis, doubledual, composition of linear transformation and matrix multiplication.

Unit – IV

Numerical Techniques:
Diagonalizability, matrix Limits and Introduction to Markov Chains and the Caley- Hamilton Theorem,
Numerical Linear Algebra:

Regularization, Introduction to Principal ComponentAnalysis, Singular-Value Decomposition, Latent Semantic Analysis,
Case Studies:
Recommender Systems, Page Ranking.

Books:

1. Linear Algebra, Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, 4th Ed., Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
2. Linear Algebra and its Applications, David C. Lay, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
3. Introduction to Linear Algebra, S. Lang, 2nd Ed., Springer, 2005.
4. Linear Algebra and its Applications, Gilbert Strang, Thomson, 2007.
5. Introduction to Algebra, A.I. Kostrikin, Springer Verlag, 1984.
6. Theory and Problems of Matrix Operations, Richard Bronson, Tata McGraw Hill, 1989.

B.Sc. Sem-I (Data Science –Major)
SC-DSC (Paper II)
BDS1T02

PROGRAMMING USING 'C++'

Credits : 2 **Duration :30 Hours**

Course Objectives:
1. To provide basic characteristics of OOP through C++.
2. To impart skills on various kinds of overloading and inheritance.
3. To introduce pointers and file handling in C++ together with exception handling mechanism.

Course Outcomes:
After completion of this course, students will be able to:
1. Realize the need and features of OOP and idealize how C++ differs from C.
2. Infer knowledge on various types of overloading.
3. Choose suitable inheritance while proposing solution for the given problem.
4. Handle pointers and effective memory management.
5. Illustrate application of pointers in virtual functions.

UNIT I

Introduction to Object Oriented Programming: Introduction, Characteristics of OOPs, Advantages of OOPs, Disadvantages of OOPs, **Data Types, Operators and Expressions:** Identifiers & Keywords, Data Types, C++ Operators, Type Conversion. **Input and Output Streams:** Comments, Declaration of Variables, Simple C++ Programs, Manipulator Functions, Input and Output (I/O) **Control Statements:** Conditional Expressions, Loop Statements, Nested Control Structures, Breaking Control Statements.

UNIT II

Function and Program Structures: Introduction, Defining a Function, Return Statement, Types of Functions, Actual & Formal Arguments, Local & Global Variables, Default Arguments, Structure of C++ Program, Order of the Function Declaration, Scope Rules, Storage Class Specifiers, Recursive Function **Arrays:** Introduction, Array Notation, Array Declaration, Array Initialization, Processing with Arrays, Character Array. **Pointers and Strings:** Introduction, Pointer Arithmetic, Pointers and Functions, Pointers and Arrays, Pointer and Strings.

Structures and Unions Introduction, Declaration of Structure, Processing with Structures, Initialization of Structures, Functions and Structures, Array of Structure, Pointer and Structure, Unions.

UNIT III

Classes and Objects: Introduction, Structures and Classes, Declaration of Class, Member Functions, Defining the Object of a Class, Accessing a Member of Class, Array of Class Objects, Pointer and Classes. **Special Member Function:** Introduction, Constructors, Destructors, Inline Member Functions, Static Class Members, Friend Function, This Pointer. **Single and Multiple Inheritance:** Introduction, Single Inheritance, Types of Base Classes, Type of Derivation, Multiple Inheritance, Member Access Control.

UNIT IV

Overloading Functions and Operators: Function Overloading, Operator Overloading, Overloading of Binary Operators, Overloading of Unary Operators. **Polymorphism and Virtual Functions:** Polymorphism, Virtual Functions, Pure Virtual Functions, Abstract Base Classes, Virtual Base Classes.

Books:

1. D. Ravichandran, Programming with C++, McGraw-Hill.
2. E. Balaguruswamy, Object Oriented Programming with C++, McGraw-Hill.
3. RohitKhurana, Object Oriented Programming with C++, Vikas Publishing House Pvt. Ltd.
4. Anirban Das, GoutamPanigrahi, Object Oriented Programming with C++, Vikash Publishing House Pvt. Ltd.
5. Herbert Schildt, The Complete Reference – C++, McGraw-Hill.

B.Sc. Sem-I (Data Science)

BVS1P01

OFFICE AUTOMATION

Credits : 2 **Duration : 60 Hours**

Course Objectives:

1.To understand functionality of Operating Systems and its applications.
2.To understand the working with the user interface.
3.To understand Word Processing, their usage, details of word processing screen, Opening, saving and printing a document
4.To understand Worksheet creation, inserting and editing data in cells..
.

Course Outcomes :

After completing this course satisfactorily, a student will be able to:
1. understand functionality of Operating Systems and its applications.
2. Working with the user interface.
3. prepare documents, letters and do necessary formatting of the document.
4. Worksheet creation, inserting and editing data in cells.
5. Opening/saving a presentation and printing of slides and handouts.

UNIT I

Introduction to windows Operating System Advantages of windows operating system, using different windows applications simultaneously, operating with windows, GUI, use of help features, starting an application, essential accessories, creating shortcuts, windows explorer, control panel, my computer, my documents, recycle bin, finding folders and files, changing system settings, system tools, use of run command, setting peripherals, drivers, editing graphics in windows.

UNIT II

Introduction, basics, starting Word, creating document, parts of Word window, mouse and keyboard operations, designing a document; Formatting- selection, cut, copy, paste; Toolbars, operating on text; Printing, saving, opening, closing of document; Creating a template; Tables, borders, pictures, text box operations; Mail Merge.

UNIT III

Introduction to MS EXCEL, navigating, Excel toolbars and operations, Formatting; copying data between worksheets; entering formula, chart creation; data forms, data sort; Functions in ExcelROUND( ), SQRT ( ), MAX( ), MIN( ), AVERAGE( ), COUNT( ), SUMIF( ), SUMIF( ), ABS( ), ROMAN( ), UPPER( ), LOWER( ), CELL( ), TODAY( ), NOW( ).

UNIT IV

Introduction to MS POWER POINT Working with Power Point Window, Standard Tool Bar, Formatting tool bar, Drawing tool Bar, Moving the Frame, Inserting Clip Art, Picture, Slide, Text Styling, Send to back, Entering data to graph, Organization Chart, Table,Design template, Master Slide, Animation Setting, Saving and Presentation , auto Content Wizard.

Books

1.MS Office XP for Everyone By Sanjay Saxena (Vikas Publi, Noida)
2.MS-Office 2000(for Windows) By Steve Sagman
3.A First Course in Computers – Sanjay Saxena

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto- cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr **P.U. Meshram, Allied Publishers, New Delhi.**
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

B.Sc. Sem-II (Data Science –Major)
SC-DSC (Paper I)
BDS2T03

DATA STRUCTURES

Credits : 2 **Duration :30 Hours**

Course Objectives:
1. To understand basic data structures arrays, records, linked structures, stacks, queues, trees, and graphs
2. To understand algorithms for arrays, records, linked structures, stacks, queues, trees, and graphs
3. To understand the computational efficiency of the principal algorithms for sorting and searching

Course Outcomes (COs): After completing this course satisfactorily, a student will be able to:
1.Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms
2. Describe common applications for arrays, records, linked structures, stacks,queues, trees, and graphs
3.Write programs that use arrays, records, linked structures, stacks, queues, trees, and graphs
4. Demonstrate different methods for traversing trees
5. Compare alternative implementations of data structures with respect to performance
6.Describe the concept of recursion, give examples of its use
7.Discuss the computational efficiency of the principal algorithms for sorting and searching

UNIT I

Linked List: Linked List, Representation of Single, Double, Header, Circular Single and Double Linked list, All possible operations on Single and Double linked List using Dynamic representation, Polynomial Representation and its Manipulation.

UNIT II

Stacks: Stacks terminology, Representation of Stacks in Memory, Operation on Stacks, Polish Notations, Translation of infix to postfix & prefix expression, Infix to Postfix Conversion, Evaluation of Postfix Expression, Recursion, Problems on Recursion, Quick Sort and Tower of Hanoi Problem.

UNIT III

Queue: Representation of Queues in Memory, Circular Queue, Dequeue and Priority Queue. Operations of above Structure using Array and Linked Representation.**Sorting and Searching:** Selection Sort, Insertion Sort, Merge Sort, Efficiency of Sorting Methods, Big-O Notations. Hash Tables, Hashing Technique, Collision Resolution Technique.

UNIT IV

Trees: Basic Terminologies, Representation of Binary Trees in Memory, Traversing of Binary tree, Binary Search Tree, Operation on Binary Search Tree, Heap Tree, Operation on Heap Tree, Heap Sort Method
Graphs: Basic Terminologies, Definition and Representation of Graphs in Memory: Linked List and Matrix Representation. Traversing graphs: BSF, DFS Method.

Reference Books

1. Classical Data Structures: D. Samanta, PHI, New Delhi.

2. Data Structure: SchaumLipschutz, Outline Series
3. Data structure Using C++: Y. Kanetkar
4. Data Structures Using C++: Tanenbaum
5. Data structures by Tremblay Sorenson
6. Data structures by Bhagatsingh Naps

B.Sc. Sem-II (Data Science –Major)
SC-DSC (Paper II)
BDS2T04
Probability and Statistics

Credits : 2 **Duration :30 Hours**

Course Objectives:
1. To provide students with a framework that will help them choose the appropriate descriptive methods in various data analysis situations.
2. To analyse distributions and relationships of real-time data.
3. To apply estimation and testing methods to make inference and modeling techniques for decision making.

Course Outcomes : At the end of this course the students are expected to
1. Have an understanding of the probability concepts.
2. Analyze the problems connected with statistics.
3. Understand how to make the transition from a real problem to a probability model for that problem.
4. Expose students to practical applications.

Unit I
Descriptive Statistics
Statistics and Measures of Central Tendency:
Mean, Median, Mode, Weighted mean, Geometric Mean and Harmonic Mean Measures ofDispersion:Range, Mean Deviation, Standard Deviation, Quartile Deviation, Co-efficient of variationSkewness and Kurtosis :Absolute Measures of skewness, relative measures of skewness, Karl Pearson's co-efficient ofskewness, Bowley's Co-efficient of skewness and Kurtosis

Unit II
Correlation and Regression
Concept of correlation, Types of correlation, Karl Pearson's co-efficient of correlation, Probableerror, Interpretation of "r", Rank correlation method. Concept of regression, Lines of Regression,Co-efficient of Regression

Unit III
Probability
Definition of Probability—Classical and relative frequency approach to Probability. Richard VonMises, Cramer and Kolmogorov's approaches to Probability.Random Experiment, sample space, an event, mutually exclusive and exhaustive events.Axiomaticdefinition of probability.Conditional Probability, independence of events,

UNIT IV
Random Variable and its Probability distribution
Random variables, Types of random variable and its distribution.expectation of a random variableand its properties. Moments, Moment Generating Function and its properties.

Books
1. Business Management and Statistics,N G Das, J K Das, McGraw-Hill.
2. Statistical Methods, S.P.Gupta (2014), Sultan Chand & sons
3. Fundamentals of Mathematical Statistics, Gupta,S.C. and Kapoor, V.K.(2000): 10/e, Sultan

Chand and Sons.
4. Principals of mathematical Analysis, Walter Rudin, McGraw-Hill.
5. StatisticalTechniquesDr.Pramod Fating, Dr. Milind Gulhane, Dr. Vijay Badge, Dr.SarangJavkhedkar – Sir Sahitya Kendra, Nagpur
6. Business Mathematics and Statistics, Dr. S. R. Arora, Dr.Kavita Gupta, Business Mathematicsand Statistics, Taxmann.
7. Business Mathematics,Mrintunjay Kumar, Vikas Publishing House Pvt. Ltd.
8. Mathematics & Statistics, Ajay Goel, AlkaGoel, Taxmann.

B.Sc. Sem-II (Data Science)
BVS2P03
COMPUTER ANIMATION

Credits : 2 **Duration : 60 Hours**
Course Objectives:

1. To Understand the concept of 2D and 3D Animation.
2. To Execute creative concepts and ideas through a variety and combination of techniques including hand drawn, computer generated, 2D and 3D storyboards and animatics.
3. To Understand how animation works.
4. To Understand the basic concepts of multimedia technology which will help them to get started easily in multimedia.

Course Outcome: After completion of this course, students will be able to:
1. Get knowledge about various terms like, images, text, fonts, file formats. Understanding these things is very necessary.
2. produce traditional style animation as well as puppet animation and the knowledge of the principles of animation to be built upon in subsequent courses leading up to the Portfolio course.
3. apply skills learned in this class in other areas including motion graphics, stop motion and basic traditional animation

Unit I
Animation, Introduction to 2D and 3D Animation. Advantages of animation, Different tools of 2D Animation.
GIMP Features and Capabilities, Toolbox, Image Window, Dialog and Docking, Working with images,
Pencil2D , Overview of Pencil2D, Traditional Animation Workflows, How to rotate image, Scrolling background in Camera layer

Unit II
Opentoonz , Production Workflow, Interface Overview, Managing Projects,Setting Up a Scene, Scanning Paper Drawings, Cleaning-up Scanned Drawings, Drawing Animation Levels, Editing Animation Levels, Managing Palettes and Styles, Painting Animation Levels, Working in Xsheet/Timeline, Creating Movements, Editing Using Spreadsheet and Curves, Creating Cutout Animation, Create animations using Plastic tool, Applying Effects, Using the Particles Effect, Previewing and Rendering

Unit III
Blender, History and Installation, Interface : Blender Interface, Adding New Objects, Moving Things Around, Modeling : Mesh, Edit Mode, Sculpt Mode, Retopology
Lighting and Procedural Textures : Setting Up a Basic Scene, The Scene Camera, Procedural Materials and Textures., UV Mapping : Creating a UV Map, Texture Painting, Projection Painting, Normal Maps and Bump Maps
Curves and NURBS : Metaballs, Curves, Spins, Nurbs,

Unit IV
Basic Rigging and Animation : Keyframing with the Timeline, The Dopesheet ., Parenting, Graph Editor, Pivot Point: The Center of Rotation, Basic Tracking: Eyes That Follow, Rigging

with Bones, Rigging a Simple Character, Advanced Rigging ..: Forward Kinematics vs. Inverse Kinetics, Blender 2.5 Rigs, Walk Cycles., Shape Keys, Lip Syncing.
Making Movies : Disabling, Color Management, Rendering Formats, Alpha, Lighting Adjustments, The Video Sequence Editor, Crash Management and Rendering Speed, Introduction to Game Engine.

Books :

https://docs.gimp.org/odftest/en.pdf
https://opentoonz.readthedocs.io/en/latest/using_the_toonz_farm.html
https://www.pencil2d.org/doc/tutorials
Beginning Blender Open Source 3D Modelling, Animation, and Game Design, Lance Flavell, Apress.
https://www.academia.edu/7984869/Beginning_Blender_Open_Source_3D_Modeling_Animation_and_Game_Design_Companion_eBook_Available_Full_Color_Inside_BOOKS_FOR_PROFESSIONALS_BY_PROFESSIONALS_Beginning_Blender_Open_Source_3D_Modeling_Animation_and_Game_Design

Reference Book :

Learning Blender A Hands-On Guide to Creating 3D Animated Characters, Oliver Villar
Blender Basics Classroom Tutorial Book 4th Edition, James Chronister. https://www.cdschools.org/cms/lib04/pa09000075/centricity/domain/81/blenderbasics_4thedition2011.pdf
Blender 3D Basics Beginner's Guide: A quick and easy-to-use guide to create 3D modeling and animation using Blender 2.7, Gordon Fisher

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

Bachelor of Science (Electronics)

Submitted by

Board of Studies,

Bachelor of Science (Electronics)

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)

(ELECTRONICS - Major)

Four Year (Eight Semester Degree Course)

Teaching and Examination Scheme

B.Sc. Sem-I (ELECTRONICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Semiconductor Theory & Devices	BEN1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Semiconductor Theory & Devices	BEN1P01			2	1	-	-	-	-	25	25	25
3	DSC	Digital Electronics	BEN1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Digital Electronics	BEN1P02			2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Basic Electronics Components & Instruments	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (ELECTRONICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Network Analysis	BEN2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Network Analysis	BEN2P03			2	1	-	-	-	-	25	25	25
3	DSC	Programming in C	BEN2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Programming in C	BEN2P04			2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Arduino and applications	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-III (ELECTRONICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Analog Electronic Circuits	BEN3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Analog Electronic Circuits	BEN3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Micro-controller 8051 Family	BEN3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Micro-controller 8051 Family	BEN3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (ELECTRONICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Linear Integrated Circuits	BEN4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Linear Integrated Circuits	BEN4P07			2	1	-	-	-	-	25	25	25
3	DSC	Signals and Systems	BEN4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Signals and Systems	BEN4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (ELECTRONICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Instrumentation system	BEN5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Instrumentation system	BEN5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Communication System	BEN5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Communication System	BEN5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Advanced Microcontrollers and Applications	BEN5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Advanced Microcontrollers and Applications	BEN5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1 A. Digital Design and VHDL B. Control System	BDS5T12 BDS5T13	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1 A. Digital Design and VHDL B. Control System	BDS5P12 BDS5P13	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (ELECTRONICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Industrial Instrumentation	BEN6T14	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Industrial Instrumentation	BEN6P14	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Digital Signal Processing	BEN6T15	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Digital Signal Processing	BEN6P15	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Bio-Medical Instrumentation	BEN6T16 BEN6T17	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Bio-Medical Instrumentation	BEN6P16 BEN6P17	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2 A. Power Electronics B. Reliability of Electronic Equipment	BEN6T18 BEN6T19	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2 A. Power Electronics B. Reliability of Electronic Equipment	BEN6P18 BEN6P19	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (ELECTRONICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Reconfigurable Electronics	BEN7T20	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Reconfigurable Electronics	BEN7P20	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Antenna and Advance Communication	BEN7T21	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Antenna and Advance Communication	BEN7P21	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Computer Networks &Internet of Things	BEN7T22	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Computer Networks &Internet of Things	BEN7P22	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Automotive Electronics & Optoelectronics	BEN7T23	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Automotive Electronics & Optoelectronics	BEN7P23	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3 A. Wearable Technology B. Smart Sensors	BEN7T24 BEN7T25	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3 A. Wearable Technology B. Smart Sensors	BEN7P24 BEN7P25	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BEN7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BEN7T22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (ELECTRONICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Mechatronics	BEN8T29	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Mechatronics	BEN8P29	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Nanoscience and Nanotechnology	BEN8T30	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Nanoscience and Nanotechnology	BEN8P30	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Design of Electronics instruments	BEN8T31	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Design of Electronics instruments	BEN8P31	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Medical Imaging	BEN8T32	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Medical Imaging	BEN8P32	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4 A. Hardware design of AL& ML B. Automation & Robotics	BEN8T33 BEN8T34	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4 A. Hardware design of AL& ML B. Automation & Robotics	BEN8P33 BEN8P34	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (ELECTRONICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Reconfigurable Electronics	BEN7T20	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Reconfigurable Electronics	BEN7P20	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Antenna and Advance Communication	BEN7T21	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Antenna and Advance Communication	BEN7P21	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Computer Networks &Internet of Things	BEN7T22	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Computer Networks &Internet of Things	BEN7P22	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3 A. Wearable Technology B. Smart Sensors	BEN7T24 BEN7T25	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3 A. Wearable Technology B. Smart Sensors	BEN7P24 BEN7P25	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BIT7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BIT7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (ELECTRONICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Mechatronics	BEN8T29	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Mechatronics	BEN8P29	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Nanoscience and Nanotechnology	BEN8T30	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Nanoscience and Nanotechnology	BEN8P30	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Design of Electronics instruments	BEN8T31	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Design of Electronics instruments	BEN8P31	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4 A. Hardware design of AL& ML B. Automation & Robotics	BEN8T33 BEN8T34	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4 A. Hardware design of AL& ML B. Automation & Robotics	BEN8P33 BEN8P34	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2+1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Electronics)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Basic Electronics Components & Instruments	Electronics	**BVS1P01**
II	**VSC**	Arduino and applications	Electronics	**BVS2P03**
III	**VSC**	Simulation and Modelling of Electronic Circuits 2	Electronics	**BVS3P05**
V	**VSC**	Electronic Product Design and Entrepreneurship	Electronics	**BVS5P07**
VI	**VSC**	Manual Drafting and Design of Electronic Gadgets	Electronics	**BVS6P08**

Basket for ELECTIVE (DSE) Category Courses (Electronics)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Digital Design and VHDL B. Control System	BDS5T12 BDS5T13
VI	Elective 2	A. Power Electronics B. B. Reliability of Electronic Equipment	BEN6T18 BEN6T19
VII (Honors)	Elective 3	A. Wearable Technology B. Smart Sensors	BEN7T24 BEN7T25
VIII (Honors)	Elective 4	A. Hardware design of AL& ML B. Automation & Robotics	BEN8T33 BEN8T34
VII (Research)	Elective 3	A. Wearable Technology B. Smart Sensors	BEN7T24 BEN7T25
VIII (Research)	Elective 4	A. Hardware design of AL& ML B. Automation & Robotics	BEN8T33 BEN8T34

Semester – 1; Paper – 1: Semiconductor Devices and Circuits

Course outcome:

At the end of this course students will demonstrate the ability to

1. Understand the fundamentals of semiconductor components such as diode, BJT, FET and MOSFET.
2. Plot V-I characteristics of electronic components to observe its performance parameters.
3. Understand the simple applications of circuit made using these semiconductor components.
4. Analyse and solve circuits of electronic devices.

Unit 1: Diode and Circuits:

V-I Characteristics of P-N Junction Diode, load line concepts, DC Analysis and models of P-N Junction Diode, types of special diodes, Applications of PN junction diode ─ Rectifier, Clipper, Clamper; Zener Diode circuits ─ shunt regulator, DC power supply.

Unit 2: Transistor and Circuits

BJT Construction and working, Current Components in BJT, Input-Output and Transfer characteristics in CB, CC and CE configuration, Load line concept, Biasing techniques, Bias Stability, small signal model of BJT, Applications of BJT, BJT Logic inverter, TTL.

Unit 3: FET and MOSFET

FET, MOSFET – Classification, Construction, working, Volt-Ampere Characteristics, DC operating point, biasing the MOSFET; small signal model of the MOSFET, small signal analysis, Applications of MOSFET: Switch, Amplifier, Digital Logic Inverter, CMOS inverter.

Unit 4: Amplifier

Classification of amplifiers, distortions in amplifiers, Single-stage and multi-stage transistor amplifiers, low frequency and high frequency response, effect of emitter (or source) bypass capacitor on the frequency response of amplifier, High frequency model of the MOSFET, Miller's theorem.

Practical – 1 Student will have to perform at least 6 practical.

1. Study of VI Characteristics of Silicon and Germanium diode, LED, and Zener diode.
2. Study of Diode as clipper and clamper.
3. Construction and study of Zener diode regulated power supply
4. Study of characteristics of BJT in CE mode.
5. Study of characteristics of BJT in CB mode.
6. Study of characteristics of FET transfer and drain characteristics.
7. Study of characteristics of MOSFET (D and E Type) transfer and drain characteristics.
8. Study of BJT as switch and amplifier
9. Study of BJT as amplifier and find the gain of amplifier and plot its frequency response.
10. To calculate the total harmonic distortion in transistor amplifier

Books:

1. J. Millman and C. C. Halkias, Integrated Electronics: Tata McGraw Hill (2001).
2. David A. Bell, 5th Edition 2015, Electronic Devices and Circuits, Oxford University Press.
3. B. L. Theraja, Basic Electronics (Solid State): S. Chand & Company, 2000.
4. R. S. Sedha, A Textbook of Applied Electronics:, S. Chand Publications.
5. Bhargava and Gupta, Basic Electronics and linear circuits, TMH.
6. D.L. Schilling and C. Belove, Electronic Circuits: Discrete and Integrated, TMH.
7. A. S. Sedra, K.C. Smith, A.N. Chandorkar, Learning Microelectronic circuits:, 2014

Semester – 1; Paper – 2: Digital Electronics

Course outcome:

At the end of this course students will demonstrate the ability to

1. Understand number systems conversions and apply the principles of Boolean algebra to manipulate, minimize and design logic circuits using logic gates.
2. Demonstrate knowledge of various combinational logic circuits like code converters, multiplexers, adders.
3. Demonstrate knowledge of sequential logic circuits elements like latches, flip-flops and use them in the design and analysis of counters, registers.
4. Demonstrate knowledge of design and analysis of complex combinational and simple finite state machine and similar circuits.

Unit 1: Number System and Gates

Binary Arithmetic, Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Logic Gates, combinational Logic Optimization Techniques.

Unit 2: Combinational Circuits

Comparators, Multiplexers, Demultiplexer, Encoder, Decoder, Arithmetic Circuit Design, ALU.

Unit 3: Sequential Circuits

Latches, Flip flop – S-R, JK, D, T and Master-Slave JK FF, counters, Shift registers.

Unit 4: K Map and its applications

K-Maps, application of k-maps in building combinational circuits. Finite state machines & their implementation.

Practical – 1 Student will have to perform at least 6 practical with TTL or CMOS logic ICs.

1. Study of logic gates.
2. Verification of NAND and NOR as universal gates.
3. Verification of De Morgan's theorem.
4. Study of comparator
5. Study of multiplexer and demultiplexer
6. Study of ALU
7. Study of SRFF, Clocked SRFF, DFF.
8. Study of JKFF and JKMSFF.
9. Study of binary up-down counter.
10. Study of shift register.
11. Use of K-Map to design and verify combinational logic circuit. (On Software)
12. Use of K-Map to design various counters using various flipflops. (On Software)

Books:

1. A. Anand Kumar, Fundamentals of digital circuits, Prentice-Hall of India
2. R.P. Jain, Modern digital Electronics, Tata McGraw Hill
3. Malvino, Digital Electronic Principles, PHI, 3rd Edition.
4. Venugopal, Digital Circuits and systems, Tata McGraw Hill.
5. R. J. Tocci, N. S. Widmer, Digital Systems: Principles & Applications
6. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia
7. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill

Semester – 1: VSC

Basic Electronic Components and Instruments (BVS1P01)

Course outcome:

At the end of this course students will have ability to

1. Identify various passive and active components
2. Make series and parallel combinations of components.
3. Design various types of simple linear power supply.
4. Demonstrate knowledge and use of various instrument used in electronics lab.

Syllabus

1. Components Identification: Resistor, Capacitor, Inductor, Transformer, Switches, Semiconductors, IC types and Packages.
2. Serial and parallel connection of Resistor, capacitor, and inductor.
3. Working with LED. Design of Zener regulated power supply. 3 terminal fixed and variable power supply. Voltmeter, ammeter.
4. Study and application of CRO, Function Generator, Multimeter.

Books:

1. Charles Platt, Make: Electronics, O'Reilly Publications
2. Paul Scherz, Practical Electronics for Invertors, McGraw-Hills Publications
3. J. M. Hughes, Practical Electronics, O'Reilly Publications
4. B. L. Theraja, Basic Electronics (Solid State): S. Chand & Company

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto- cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr P.U. Meshram, Allied Publishers, New Delhi.
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

Semester – 2; Paper – 1: Network Analysis

Course outcome:

At the end of this course students will demonstrate the ability to

1. Understand basics electrical circuits with nodal and mesh analysis.
2. Apply network theorems for the analysis of electrical circuits.
3. Apply Laplace Transform for steady state and transient analysis.

Unit 1: Node and Mesh Analysis:

Types of sources, source transformation and duality, KVL, KCL, Node and mesh analysis,

Unit 2: Network Theorems

Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer theorem, compensation and Tallegen's theorem (Proof not required)

Unit 3: Behaviors of L, C and R circuit

Time Domain and frequency domain analysis of LR, CR, Series and Parallel LCR circuit. Introduction to filters.

Unit 4: Laplace transform and its application to circuits

Review of Laplace Transform, Partial fractions, singularity functions, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, evaluation of initial conditions. Transformed network with initial conditions, waveform synthesis, and analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms.

Practical – 1 Student will have to perform at least 6 practical

1. Study of current source and voltage source.
2. Verification KVL and KCL
3. Verification Superposition position.
4. Verification of Thevenin's Theorem
5. Verification of Norton's Theorem
6. Verification of Maximum power transfer Theorem
7. Verification of reciprocity theorem.
8. Time domain and frequency domain analysis of LR circuit (on simulation software).
9. Time domain and frequency domain analysis of CR circuit (on simulation software).
10. Time domain and frequency domain analysis of series LCR circuit (on simulation software).
11. Time domain and frequency domain analysis of Parallel LCR circuit (on simulation software).

Books:

1. M. E. Van Valkenburg, Network Analysis, Prentice Hall, 2006.

2. D. Roy Choudhury, Networks and Systems, New Age International Publications, 1998.
3. Mahmood Nahvi, Joseph A. Edminister, Theory and Problems of Electric Circuits, Schaum Series
4. Mahadevan and Chitra, Electrical Circuit Analysis, PHI
5. John Bird, Electrical Circuit Theory and Technology, Newnes Publications.
6. Network analysis by G. K. Mittal
7. James W. Nilsson & Susan A Riedel, Electric Circuits, Prentice Halls.
8. Sudhakar, A., Shyammohan, S. P.; Circuits and Network; Tata McGraw-Hill New Delhi, 1994
9. C. K. Alexander and M. N. O. Sadiku, Electric Circuits, McGraw Hill Education, 2004.
10. K. V. V. Murthy and M. S. Kamath, Basic Circuit Analysis, Jaico Publishers, 1999.

Semester – 2; Paper – 2: Programming in C

Course Outcome:

At the end of this course students will demonstrate the ability to

1. To formulate simple algorithms and translate the algorithms to programs (in C language), test and execute the programs and correct syntax and logical errors.
2. To implement conditional branching, iteration, and recursion, to decompose a problem into functions and synthesize a complete program using divide and conquer approach.
3. To use arrays to solve various matrix operation, searching, sorting and Pointers, Structures for the formulation of algorithm and Programs.

Unit 1: Programming Language

Introduction to C language: Keywords, Constant, Variable, Data types, Operators, Types of Statements, Pre-processor Directives, Decision Control Statement-if, if-else, Nested if-else statement, Switch case, Loops and Writing and evaluation of conditionals and consequent branching.

Unit 2: Arrays and Basic Algorithms Arrays

1-D, 2-D, Character arrays and Strings. Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 3: Functions and Recursion

User defined and Library Functions, Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference. Recursion: As a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Quick sort or Merge sort.

Unit 4: Pointers and Structures

Structures, defining structures, Array of Structures, Introduction to pointers, Defining pointers, Pointer arithmetic, pointer operators, Use of Pointers.

Practical – 2 Student will have to perform at least 6 practical.

1. Multiplication, square, cube table or any other table.
2. Bubble, Insertion, and selection Sorting algorithm
3. Finding roots of quadratic equation
4. Finding out the impedance table and frequency response table of RL or RC or LCR circuit.
5. Find out the table of phase angle of LR or CR or LCR circuit for different frequencies.
6. 1D and 2D array
7. Use of functions, parameter passing in function, call by value, call by reference.
8. Finding factorial, Fibonacci series.
9. Quick sort or merge sort.
10. Application of pointer.

Books

1. Let us C Y Kanetkar
2. Mastering C: K. R. Venugopal and S. R. Prasad, Tata McGraw Hill
3. C in depth Shrivastava BPB publication
4. Programming in ANSI C Balgurusamy Tata McGraw Hill
5. Programming with C Byron Gottfried Schaums outline series TMH

Semester – 2; VSC – 2:

Arduino and applications (BVS2P03)

Course Outcome:

At the end of this course students will demonstrate the ability to

1. Understand the architecture of a Arduino boards & comparison
2. Understand the operation and interfacing with peripheral devices.
3. Implement various applications

Syllabus :

1. Introductction to arduino, Pin configuratuion and architecture, Device and platform features, concept of digital and analog ports, familiarizing with Arduino interfacing boards, introduction to embedded C and arduino platform
2. Review of Basic concepts and Arduino I/O Functions : Arduino Data types, Variables and constants, Operators, Control Statements, Arrays, Functions Pins configured as INPUT and OUTPUT, PinMode() Function, digital write(), analogRead() Function, Arduino Interrupts
3. Arduino Sensors: Humidity sensor, temperature sensor, Water level sensor, PIR sensor, Ultrasonic sensor, Connecting switches,
4. Arduino Communication and Interfacing: parallel and serial communication, Display devices, rf module, wifi module, bluetooth module, GSM/GPRS interfacing

Books:

1. Arduino made simple by Ashwin pajankar
2. Arduino-based Embedded Systems by Rajesh singh, Anita Gehlot, Bhupendra Singh and Sushabhan Choudhary
3. https://www.arduino.cc/en/Tutorial/HomePage

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus
Bachelor of Science (Environmental Science)

Submitted by

Board of Studies,
Bachelor of Science (Environmental Science)

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)
(Environmental Science - Major)
Four Year (Eight Semester Degree Course)
Teaching and Examination Scheme

B.Sc. Sem-I (Environmental Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Fundamentals of Environmental Science	BES1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Fundamentals of Environmental Science	BES1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Environmental Biology	BES1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Environmental Biology	BES1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Environmental Chemistry and Instrumentation	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Home Science/ Computer Application	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Environmental Science- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Basics of Environmental Pollution	BES2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Basics of Environmental Pollution	BES2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Forest, Wildlife and Biodiversity and it's conservation	BES2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Forest, Wildlife and Biodiversity and it's conservation	BES2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Operation and Maintenance of Water and Wastewater Treatment Plant	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-III (Environmental Science - Major)

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SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Atmospheric Science, Meteorology and Climatology	BES3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Atmospheric Science, Meteorology and Climatology	BES3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Natural Resources and Management	BES3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Natural Resources and Management	BES3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Environmental Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Solid and Hazardous Waste Management	BES4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Solid and Hazardous Waste Management	BES4P07			2	1	-	-	-	-	25	25	25
3	DSC	Water and Waste water Quality Monitoring	BES4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Water and Waste water Quality Monitoring	BES4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Environmental Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Air and Noise Pollution Control Technology	BES5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Air and Noise Pollution Control Technology	BES5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Water and Wastewater Treatment Technology	BES5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Water and Wastewater Treatment Technology	BES5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC		BES5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC		BES5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BES5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BES5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Environmental Science - Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Soil Pollution and Environmental Toxicology	BES6T13	2	-	-	2	3	80	20	40	-	-	-

2	DSC	Soil Pollution and Environmental Toxicology	BES6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Remote Sensing and Geographical Information System (GIS) and it's Application	BES6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Remote Sensing and Geographical Information System (GIS) and it's Application	BES6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	?????	BES6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	??????	BES6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BES6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BES6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Environmental Science - Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.

1	DSC	Environmental Microbiology, Environmental Biotechnology and Environmental Statistics	BES7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Environmental Microbiology, Environmental Biotechnology and Environmental Statistics	BES7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Introduction to Environmental Impact Assessment (EIA) and Environmental Audit (EA)	BES7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Introduction to Environmental Impact Assessment (EIA) and Environmental Audit (EA)	BES7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	?????	BES7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	?????	BES7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	?????	BES7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	?????	BES7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3	BES7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BES7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BES7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BES7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Environmental Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.

1	DSC	Sustainable and Environmental Management System	BES8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Sustainable and Environmental Management System	BES8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Climate Change its consequences and Mitigation.	BES8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Climate Change its consequences and Mitigation.	BES8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	?????	BES8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	?????	BES8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	?????	BES8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	?????	BES8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BES8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BES8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honors Degree in Major and Minor with 160-176 Credits

B.Sc. Sem-VII (Research) (Environmental Science Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.

1	DSC	Environmental Microbiology, Environmental Biotechnology and Environmental Statistics	BES7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Environmental Microbiology, Environmental Biotechnology and Environmental Statistics	BES7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Introduction to Environmental Impact Assessment (EIA) and Environmental Audit (EA)	BES7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Introduction to Environmental Impact Assessment (EIA) and Environmental Audit (EA)	BES7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	????	BES7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	?????	BES7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BES7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BES7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BES7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BES7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Environmental Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme	
				(Th)	TU	P		Theory	Practical

								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Sustainable and Environmental Management System	BES8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Sustainable and Environmental Management System	BES8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Climate Change its consequences and Mitigation.	BES8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Climate Change its consequences and Mitigation.	BES8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	????	BES8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	????	BES8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BES8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BES8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2+1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: /Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Environmental Science)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Environmental Chemistry and Instrumentation	Environmental Science	**BVS1P01**

II	**VSC**	Operation and Maintenance of Water and Wastewater Treatment Plant	Environmental Science	**BVS2P03**
III	**VSC**	Sanitary Engineering	Environmental Science	**BVS3P05**
V	**VSC**	Watershed Management	Environmental Science	**BVS5P07**
VI	**VSC**	Organic Farming	Environmental Science	**BVS6P08**

Basket for <u>ELECTIVE</u> (DSE) Category Courses (Environmental Science)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Environmental and Society B. Urban Planning and Development	BES5T12
VI	Elective 2	A. Circular Economy B. Wetland Conservation and Management.	BES6T16
VII (Honors)	Elective 3	A. Green Technologies B. Eco-restoration and Development	BES7T21
VIII (Honors)	Elective 4	A. Industrial Waste Treatment Technology B. Environmental Entrepreneurship	BES8T27
VII (Research)	Elective 3	A. Green Technologies B. Eco-restoration and development	BES7T20R
VIII (Research)	Elective 4	A. Industrial Waste Treatment Technology B. Environmental Entrepreneurship	BES7T25R

R' in the subject code indicates 'Research'.

The examination shall comprise two theory papers of 3 hours duration of 80 marks.
Theory paper is divided into four units. Each Unit shall be covered in 7.5 hours

B.Sc Semester 1

Paper - I

Fundamentals of Environmental Science

Unit–I: Basics of Environmental Science

A) Introduction to Environmental Science: Definition, Types, Classification, Characteristics, Components and Principle of Environment, Multidisciplinary Nature of environmental science.

B) Components of Environment: Atmosphere- Definition, structure and composition. **Hydrosphere -** Definition, distribution of water, hydrological cycle and global water balance. **Lithosphere-** definition, internal structure of earth. Rocks –types and their formation. **Biosphere –** definition, boundaries of biosphere. **(7 Periods)**

Unit –II: Aquatic Chemistry

A) Physical parameters of water: Solvency, colour, temperature, turbidity, taste, conductivity, odour, viscosity, Transparency, Density, pH, Forms of precipitation.

B) Chemical parameters of water: Salinity, CO_2, O_2, Alkalinity, Acidity, Hardness, Chlorides, Dissolved oxygen. Principle and method of estimation, prescribed limit of potable water as per WHO guidelines. **(7 Periods)**

Unit –III: Soil Chemistry

A) **Soil:** Definition, Composition of soil, Type of soil, soil formation, soil profile, soil structure, soil organism.

B) Properties of Soil –Physical- soil density, Soil texture, soil colour, porosity, soil temperature, soil air, soil water. **Chemical –** soil components (Inorganic and organic), soil pH , soil humus, NPK in soil. **(8 Periods)**

Unit – IV: Environmental Education and Awareness

A) Environmental Education: Goals, objectives and principles of Environmental Education, Formal and Non-formal Education, Importance of Environmental Education.

B) Environmental Awareness: Environmental awareness programs , Celebration of Environmental Days, **Global environmental issues –** Acid rain ,Ozone depletion , Greenhouse effect , Global warming, El-Nino,La-Nino. **(8 Periods)**

Practical-I

1. Study of laboratory Instruments and Glasswares.
2. Water sampling for ground and surface water and its storage techniques.
3. Determination of odor and conductivity.

4. Estimation of Chloride in water sample by Argentometric method
5. Estimation of Alkalinity in water sample.
6. Estimation of Acidity in water sample.
7. Determination of pH in soil sample
8. Determination of moisture content of soil
9. Determination of bulk density of soil

Visit:

- Visit to water body to study Pond as an ecosystem.
- Visit to Nearby Forest to study the flora and fauna in its Natural Environment.

All students shall undertake field visits, soon after their visit, students shall submit study tour report which is certified by the HOD is to be submitted at the time of Annual practical examination.

Field Diary:

The students shall prepare their field diary under the following heads:

- Issue on Regional problems of Environmental interest (Case study).
- Issue on National interest (Case study).
- Famous personalities in Environmental Movements

Distribution of Marks:

1.	Long experiment (Any one)	:	08 Marks
2.	Short experiment (Any two)	:	08 Marks
3.	Viva – voce	:	03 Marks
4.	Tour report / field diary	:	03 Marks
5.	Practical Record	:	03 Marks

	Total Marks	**:**	**25 Marks**

Books for Reference (Practical)

1. A Manual of Water and Wastewater Analysis: Dr D.S.Ramteke and Dr C.A.Moghe,Published by NEERI,Nagpur,1996.
2. Laboratory Manual of Environmental Chemistry: Dr Snita Hooda and Dr Sumanjeet Kaur,S.Chand and Co.Ltd.New Delhi.1997.
3. Physico-chemical Examination of Water Industrial Effluents: N.Manivaskaram, Pragti Prakashan, Meerut (U.P) 1996.
4. Chemical and Biological Methods of Water Pollution Studies: R.K.Trevedi and P.K.Goel, Enviro Media Publication.

Book for Reference:

1. Text Book of Environment: K M Agrawal, P.K.Sikdar, and S.C.Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C.Dash and P.C.Mishra, Mc'Millan Publication, Mumbai.

3. Environmental Science: S.C.Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K.Asthana, S.Chand Publication,New Delhi.
5. Environmental Chemistry: S.S.Dara, S.Chand Publication,New Delhi.
6. Environmental Chemistry: B.K.Sharma, Goel Publication,Meerut.
7. Environmental Chemistry: A.K.Dey,New Age International Publishers,2001.
8. Man and Environment: P.R.Trivedi and Gurdeep Raj,Akashdeep Publishing House,New Delhi.
9. Fundamentals Concepts in Environmental Studies: Dr.D.D.Mishra, S.Chand Publication,New Delhi.
10. Climatology: D.S.Lal,Sharda Pustak Bhavan,Allahabad,2003.
11. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr P.U.Meshram,Allied Publishers, New Delhi.

B.Sc Semester 1
Paper II
ENVIRONMENTAL BIOLOGY

Unit -I : Ecology and Environmental factors

A) Ecology: Introduction of Ecology (Definition, sub-division branches and scope), application and significance of ecology to human being.

B) Abiotic factors: Temperature, light, fire, soil, Shelford law of tolerance, Liebig's law of minimum. **Biotic factor:** Mutualism, commensalism, parasitism, neutralism, predation, competition. **(7 Periods)**

Unit – II : Population and Community ecology

A) Population Ecology: Characteristics of population - Natality, Mortality, Population Density, Population dispersal, Population Fluctuation, Population dispersion, Population Growth Curves (S & J Shaped), Biotic potential, Environmental resistance

B) Community Ecology: Definition, characteristic of community, community structure, Ecological indicators, Ecotone and edge effect, Ecological Niche , Ecological succession. **(7 Periods)**

Unit -III : Ecosystem

A) Ecosystem: Components, structure and function of ecosystem; Major ecosystems (terrestrial and aquatic). Major biome of the world.

B) Food Chain: food chain and food webs; energy flow in ecosystem, ecological pyramids, pollutants and trophic level (Bio-magnification and Bio-accumulation) **(8 Periods)**

Unit- IV: Biogeochemical cycles

A) Biogeochemical Cycles: Hydrological, gaseous (carbon, oxygen, nitrogen) sedimentary cycle (phosphorus and sulphur).

B) Productivity: Definition and types, measurement of productivity (Light and dark bottle method) factors affecting primary productivity. **(8 Periods)**

Practical-II

1) To determine the primary productivity in a water body by Light and Dark bottle method.
2) To determine the chlorophyll content of the given plant material.
3) Determination of species diversity indices by Simpson and Shannon's Wiener index
4) To measure color and temperature of different water bodies.
5) Determination of turbidity of given water sample
6) Determination of pH of given water sample
7) Determination of carbon dioxide (CO_2) in polluted and unpolluted water bodies.
8) To study biotic and abiotic components of a pond and forest ecosystem.

9) Observation and monitoring of different inter-specific relationship from different local habitat.
10) Identification of ecological indicators

Visit:

- Visit to water body to study Pond as an ecosystem.
- Visit to Nearby Forest to study the flora and fauna in its Natural Environment.

All students shall undertake field visits, soon after their visit, students shall submit study tour report which is certified by the HOD is to be submitted at the time of Annual practical examination.

Field Diary:

The students shall prepare their field diary under the following heads:

- Issue on Regional problems of Environmental interest (Case study).
- Issue on National interest (Case study).
- Famous personalities in Environmental Movements

Distribution of Marks:

1.	Long experiment (Any one)	:	08Marks
2.	Short experiment (Any two)	:	08Marks
3.	Viva – voce	:	03 Marks
4.	Tour report / field diary	:	03 Marks
5.	Practical Record	:	03 Marks

	Total Marks	**:**	**25 Marks**

Books for Reference (Practical)

1. A Manual of Water and Wastewater Analysis: Dr D.S.Ramteke and Dr C.A.Moghe,Published by NEERI,Nagpur,1996.
2. Laboratory Manual of Environmental Chemistry: Dr Snita Hooda and Dr Sumanjeet Kaur,S.Chand and Co.Ltd.New Delhi.1997.
3. Physico-chemical Examination of Water Industrial Effluents: N.Manivaskaram, Pragti Prakashan, Meerut (U.P) 1996.
4. Chemical and Biological Methods of Water Pollution Studies: R.K.Trevedi and P.K.Goel, Enviro Media Publication.

Books for Reference:

1) Environmental Biology:Biswarup Mukherjee,Tata McGraw-Hill Publishing Company Ltd,New Delhi,1996
2. Animal Ecology and Distribution of Animals:Veer Bala Rastogi, Rastogi Publication,Meerut (U.P).
3. Ecology and Environment: P.D.Sharma, Rastogi Publication,Meerut (U.P).
4. Fundamentals of Environmental Biology: S.Arora,Kalyani Publishers.
5. Plant Ecology and Soil Science:R.S.Shukla and P.S.Chandel, S.Chand Publication,New Delhi.

6. Animal Ecology and Environmental Biology: H.R Singh,Vishal Publication.
7. Environmental Biology:P.S.Verma and V.K.Agrawal, S.Chand Publication,New Delhi.
8. Environmental Biology:P.K.G.Nair,Himalaya Publication.
9. Environmental Biology:K.C.Agrawal,Agro Botanical Publisher,Bikaner,1994.

VSC (BVS1P01)

Environmental Chemistry and Instrumentation

Unit 1

A. Types pollutants in the environment and their sources, general classifications of pollutants and their chemical structures, properties, concept of toxicity, units of measurement; Impacts of pollutants on human health,
B. Errors in quantitative analysis, precision and accuracy in measurement, accuracy, selectivity, sensitivity, role of r^2, sample preparation procedure for water, air, soil samples.

Unit 2

A. Titrimetric and colorimetric procedures, pH meter, conductivity meter, Nephelometer/Turbidity, working and applications.
B. Potentiometry and Voltammetry: Theory, instrumentation and applications of Colorimetry and Voltammetry. Electro-chemical techniques: Types, principle and working. Beer- Lambert's law, Flame photometry.

Unit 3

A. Absorption Spectrophotometry**:** Principle, working and applications of variousinstruments like UV-Visible Spectrophotometer, Infra-red (IR) Spectrophotometer, Nuclear Magnetic Resonance (NMR), Atomic Absorption Spectrophotometer (AAS), Flame Photometer
B. Chromatography: Introduction, Definition, theory of chromatographic separation, stationary and mobile phases, classification of chromatographic separations, Rf value**.** Types of Chromatography- Gas Chromatography (GC). High Performance Liquid Chromatography (HPLC)

Unit 4

A. Interpretation of mass spectra, basic GC/MS instrumentation, ion detectors, quantification, liquid-liquid extraction, solid phase extraction, ultrasonic extraction, supercritical fluid extraction; sample clean-up methods, ICP-MS, basic principle and its applications

B. Basic principle of High Volume Sampler its components, anemometer, weather station, adsorbent tubes, and canisters, solvent and thermal desorption techniques; Basic principle and applications of Total Organic Cabon analyser, X-Ray Fluorescence, X-Ray Diffraction.

Reference Books

1. A Technical Manual for Water and Wastewater Analysis, Sunil P Pande and Dr. LeenaDeshpande, Himalaya Publishing house 2012
2. Instrumental Methods of Environmental Analysis: Karan Sareen, (Sarup and SonsPublishers, New Delhi), 2001
3. Instrumental Methods of Chemical Analysis: B. K. Sharma, Goel Publishing House,Meerut (1996).
4. Standard Methods for the Examination of Water and Waste Water: (APHA, AWWA &WPCF), 1985
5. Willard. H., Merritt, L., Dean, D.A. and Settle F.A., 'Instrumental Methods ofAnalysis',7th edition, Wordsworth, New York, 1998.
6. Galen. W. Ewing, 'Instrumental Methods of Chemical Analysis 5th edition,McGraw Hill,New York., 1995.
7. Roger Reeve, Introduction to Environmental Analysis, John Wiley & SonsLtd,2002
8. Fundamentals of Analytical chemistry, D.A. Skoog, D.M. West and F.J.Holler,
9. Harcourt Asia PTE. Ltd., 7th edition, New Delhi,2001.
10. Manual of Water and Wastewater Analysis by Dr. D.S. Ramteke, C.A. Moghe &R.Sarin,NEERI, Nagpur
11. Our Environment Pollution Control and Future Strategies by M.P. Mishra, S.Chand&Company Ltd. New Delhi, 2000.
12. Principals of Environmental Science by H.V. Jadhav, Himalaya Publishing House, NewDelhi, 1994

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr **P.U. Meshram, Allied Publishers, New Delhi.**
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

The examination shall comprise two theory papers of 3 hours duration of 80 marks. Theory paper is divided into four units. Each Unit shall be covered in 7.5 hours

B.Sc Semester-II
Paper - I
Basics of Environmental Pollution

Unit-I: Environmental Pollution:

A) **Environmental Pollution:** Definition, types, Classification of Pollutants- on the basis of physical properties and forms of their existence, Primary and secondary pollutants, degradable and non-degradable pollutants.

B) **Air Pollution:** Sources, Effects (Human health, vegetation and animals, Building material and structures), Indoor pollution, vehicular pollution, Bhopal gas tragedy, Air Quality Standards- NAAQS, AQI, Air pollution control measures.

(7.5 Periods)

Unit-II: Water Pollution:

A) **Water Pollution:** sources, effect of water pollution on flora and fauna, human beings and materials, Eutrophicaton, Heavy metal pollution- Minamata episode, water, pollution control measures, water quality indices.

B) **Thermal Pollution**: Causes, effects and control measures. **Marine Pollution:** sources, causes and mitigation of marine pollution. **(7.5 Periods)**

Unit-III-Soil and Solid Pollution:

A) **Soil Pollution:** Sources and types, soil pollutants- metals, inorganic ion and salts, organic substances, effects of soil pollution on soil health and productivity, effects of pesticides, soil pollution control measures,

B) **Solid Waste Pollution:** sources, Classification and characteristics of solid waste, segregation, collection and transportation and disposal of solid waste, Solid Waste management, **Biomedical Waste**: Categories of biomedical waste, types of container used for the disposal of biomedical waste, biomedical waste management.

(7.5 Periods)

Unit-IV: Noise and Radiation Pollution:

A) Noise Pollution: Sources and effects, Decibel scale, control measures of noise pollution. Ambient noise level of monitoring.

B) Radioactive Pollution: Types and sources of radiations, biological effects and control measures of radiations, E-waste (sources and its health effect), recycling and disposal methods. **(7.5 Periods)**

Practical-I

1. Determination of total solids in polluted water sample.
2. Determination of free chlorine in water sample.
3. Estimation of Hardness in water sample
4. Determination of Dissolved Oxygen (DO) in polluted water sample.
5. To estimate the amount of dust (particulate matter) deposition on the leaves of roadside plants.
6. To measure settealable particles by dust fall jar.
7. Determination of Total Organic Carbon (TOC) and % organic matter in the soil sample.
8. Determination of noise levels of residential, institutional and industrial area.
9. Determination of moisture content municipal solid waste,
10. To segregate domestic solid waste into bio-degradable and non bio-degradable components.

All students shall undertake field visits, soon after their visit, students shall submit study tour report which is certified by the HOD is to be submitted at the time of Annual practical examination.

Field Diary:

The students shall prepare their field diary under the following heads:

- Issue on Regional problems of Environmental interest (Case study).
- Issue on National interest (Case study).
- Famous personalities in Environmental Movements

Distribution of Marks:

1.	Long experiment (Any one)	:	08 Marks
2.	Short experiment (Any two)	:	08 Marks
3.	Viva – voce	:	03 Marks
4.	Tour report / field diary	:	03 Marks
5.	Practical Record	:	03 Marks

	Total Marks	**:**	**25 Marks**

Book for Reference:

1.Text Book of Environment: K M Agrawal, P.K.Sikdar, and S.C.Deb, Mc'Millan Publication, Mumbai.
2.Man and Environment: M.C.Dash and P.C.Mishra, Mc'Millan Publication, Mumbai.
3.Environmental Science: S.C.Santra, New Central Book Pvt.Ltd, Kolkatta.
4.Environmental Problems and Solution: D.K.Asthana, S.Chand Publication,New Delhi.
5.A Text book of Environmental Chemistry and Pollution Control: S.S.Dara, S.Chand and Company Ltd,New Delhi.
6.Environmental Chemistry: B.K.Sharma, Goel Publication,Meerut.
10. Environmental Chemistry: A.K.Dey,New Age International Publishers,2001.
11. Man and Environment: P.R.Trivedi and Gurdeep Raj,Akashdeep Publishing House,New Delhi.

12. Fundamentals Concepts in Environmental Studies: Dr.D.D.Mishra, S.Chand Publication,New Delhi.
13. Environmental Pollution: Khitoliya,R.K**.** S.Chand Publication,New Delhi.
14. Air pollution and it's Control: Rao,M.N and Rao, H.V.N., Tata McGraw-Hill Publishing Company ,New Delhi.
15. Principles of Environmental Chemistry,3rd edition, J.E.Girard, Jones and Bartlett Learning Company, Burlington
16. The Science of Environmental Pollution,3rd edition, Frank.R.Spellman, CRC Press, Taylor and Francis Group.

B.Sc Semester II
Paper IV
Forest, Wildlife & Bio-diversity Conservation

Unit -I: Forest Conservation

A) Forest: Types of forest in India, Minor forest products, Significance of forest, Deforestation (causes, effects and control measures), forest fires.

B) Forest Conservation: Social forestry, National Forest Policy, Chipko Movenment, Afforestation, Forest Conservation Act,1988,Sustainable Forest Management (SFM), Joint Forest Management (JFM) **(7 Periods)**

Unit – II: Wildlife Conservation

A) **Wildlife:** Importance of wildlife, Rare, endangered, vulnerable and extinct species of wildlife, causes of wildlife depletion, wildlife management, man-animal conflicts,

B) Wildlife conservation: Necessity and mode of conservation of wildlife, Project Tiger, Wildlife Protection Act,1972, Role of IUCN, UNEP and WWF in wildlife conservation.

(7 Periods)

Unit -III: Biodiversity

A) Biodiversity: types, causes for the loss of biodiversity, preservation strategies for biodiversity, benefits of biodiversity, Hotspots of biodiversity, Measurement of biodiversity.

B) India as mega diversity nation, Biogeography zones of the country, Community Biodiversity Register (CBD), Biodiversity Act' 2002, Red Data Book. **(8 Periods)**

Unit- IV: Biodiversity Conservation

A) Biodiversity: Conservation: Approaches for Conservation of Biological Diversity, "In-situ' (Biosphere Reserves, National Park and Sanctuaries) conservation, "Ex-situ" conservation (Botanical and Zoological gardens, gene banks, seed and seedling bank).

B) Role of local communities and traditional knowledge in conservation; Biodiversity convention; International and national efforts to conserve biodiversity (CITES and WCU)

(8 Periods)

Practical-II

1. To determine the frequency of a species (plant) by Quadrate method.
2. To determine the density of a species (plant) by Quadrate method.
3. To determine the Abundance of a species (plant) by Quadrate method.
4. To study the water holding capacity of soil.
5. Identification of Zoo-planktons and Phyto-planktons.
6. Preparation of field report based on the survey of local flora (herbarium sheet).
7. To determine the Humidity by Psychrometer.
8. Identification of endangered species of flora and fauna
9. Preparation of Social Forestry Proposal
10. Study of adaptive features of hydrophytes and xerophytes.

All students shall undertake field visits, soon after their visit, students shall submit study tour report which is certified by the HOD is to be submitted at the time of Annual practical examination.

Field Diary:

The students shall prepare their field diary under the following heads:

- Issue on Regional problems of Environmental interest (Case study).
- Visit to Bio-Diversity Park.
- Famous personalities in Environmental Movements

Distribution of Marks:

1.	Long experiment (Any one)	:	08 Marks
2.	Short experiment (Any two)	:	08 Marks
3.	Viva – voce	:	03 Marks
4.	Tour report / field diary	:	03 Marks
5.	Practical Record	:	03 Marks

	Total Marks	**:**	**25 Marks**

Book for Reference:

1. Biodiversity – Strategies for Conservation – Dadhich.L.K. and A.P.Sharma, APH publishing corporation. New Delhi, 2002
2. Global Biodiversity Conservation measures – Khan. T.I and Dhari. N Al-Ajmi, pointer Publishers, Jaipur (1999)
3. An Advanced Text book on Biodiversity – Principles and Practice – Krishnamurthy. K.V, Oxford and IBH publishing, New Delhi (2003)
4. A Text Book of Ecology and Environment-P.C.Joshi and Namita Joshi, Himalaya Publihng House, First Edition (2005)
5. Environment and Ecology-S.N.Pandey and S,P.Mishra, Ane Books Pvt. Ltd. (2011).
6. A Text of Environmental Studies- Shashi Chawla, McGraw Hill Education (India) Private Ltd, New Delhi.(2012)
7. Environment and Ecology-Majid Husain, Access Publishing(India) Private Ltd, New Delhi.(2014)

Vocational and Skilled Based Education (VSE) (Environmental Science)

VSE-2: OPERATION & MAINTENANCE OF WATER & WASTE WATER TREATMENT PLANTS

Unit -1 : Introduction to Water Treatment Plant (WTP) & Waste Water Treatment Plants (WWTP) :

Objectives of WTP and WWTP. Role & duties of WTP / WWTP operator and Plant Incharge. Various units involved in WTP & WWTP. Operation of Pumps, Blowers, Agitators, Flow meters, valves, gear box, motors, MCC Panel

Sludge generation & Sludge handling system - Filter Press, Decanter, Screw Press, Belt Press. Handlingof filtrate and cakes

Layout , Hydraulic Profile and Piping &Instrumentation diagram of water and waste water treatment plant. Importance of spare list. Capital cost & Operational cost. Power (HP/kw) calculation of running plant.

Unit – 2 : Operation & Maintenance of Water Treatment Plant :

Water scarcity – Indian scenario. Depleting water resources. Per capita water supply, water supply schemes, Importance of water treatment plant and reuse.

Operation & Maintenance of intake well, check well, jack well, rising main, cascade aeration, flocculation and sedimentation, filters, Mass Balancing Reservoirs , Ground Storage Reservoirs, Elevated Service Reservoirs.

Advanced Water Treatment Technologies and it's operation & maintenance. Membrane filtration technology – Low & high pressure membrane, advanced oxidation, ultraviolet treatment, water softening.desalination plants, packaged drinking water and mineral water plants. Statutory guidelines for drinking water, Demineralization – cation exchangematerials – removal of ion, manganese, odour, colour taste – fluoridation, reverse osmosis

Unit – 3 : Operation & Maintenance of Primary & Biological Waste Water Treatment Plant :

Unit operations involved in Primary & Biological Treatment. Discharge norms. Zero liquid discharge (ZLD), treatment schemebased on discharge norms. Operation &maintenance of mechanical and manual screen , vibro separator, oil skimmer, plate heat exchanger, primary clarifier, agitator, coagulation &flocculation, dissolved air floatation unit, clarifloccculator, tube settler, gear box and motors.

Unit operation involved in Biological Treatment. Operation &maintenance of aerators, diffusers, blowers, pumps, secondary clarifier, lamella clarifier, aeration tank, anaerobic digesters – Media based, Upflow Anaerobic Sludge Blanket (UASB), Continuous Stirred Tank Reactors (CSTR).

Operation and maintenance of sludge dewatering units – Sludge thickener, filter press, decanters, screw press, belt press.

Unit -4 : Operation & Maintenance of Tertiary and Advanced Waste Water Treatment Plant:

Basics of advanced waste water treatment technologies – Dual Media Filters, Membrane Bio Reactor, HRSCC, Multi Effect Evaporators. Membrane based treatment technologies. Instrumentations and it's O & M – pressure gauge, hi and low Laval switch, DO meter, PH meter, flow meter, various types of valves. Cleaning of filters, backwashing.

Operation & Maintenance of Reverse Osmosis Plant, High Rate Solid Contact Clarifier (HRSCC), Membrane Bio Reactor (MBR), Moving Bed Biofilm Reactor (MBBR), Multi Effect Evaporators, Skid mounted STPs

Documentation, Interpretation and Commissioning: Preparation of operation and maintenance manual, record keeping, report preparation& documentation, Log-sheet, Routine analysis of various parameters. commissioning of waste water treatment plants. Preparation of quality assurance plan. Environment audit.

Reference Books:

1. Waste Water Engineering: Metcalf and Eddy, Tata McGraw Hill Publishing Company,New Delhi.
2. Waste Water Treatment for Pollution Control : Soli J. Arceivala (Tata Mc- GrewHill Publishing Company, New Delhi)
3. Water Supply and Sanitary Engineering : R. C. Rangwala and S. C. Rangwala (Charotal publishing house, Anand)
4. Waste Water Engineering By Parker R (2018).
5. Waste water treatments by S.S Jahagirdar, R.K Lad,V.S Rajamanya.
6. Water and Waste Water Systems – Poonam Ahluwalia
7. Waste Water Treatment : M. N. Rao, A. K. Datta (Oxford and IBH Publishing company, New Delhi)
8. Introduction to Environmental Engineering: Mackenzie L. Davis & David A. Cornwell, McGrew Hill Publishing Company, New Delhi.
9. Fundamentals of Water Treatment Unit Processes - Physical, Chemical, and Biological David Hendricks, CRC Press, ISBN: 978-1-4200-6191-8 (Hardback), 2011 Edition [DWH]
10. Industrial Waste Water Treatment by A.D Patwardhan
11. Water-Wastewater Engineering - Fair G.M., Geyer J.G and Okun.
12. Waste Water treatment and Water Management – Anamika Srivastava
13. Sewage Treatment & Disposal & Waste Water Engineering- P N Modi

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, VedangJyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of BhaskarAcharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

Bachelor of Forensic Science

Submitted by

Board of Studies,

Bachelor of Forensic Science

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research) (Forensic Science - Major)

Four Year (Eight Semester Degree Course)

Teaching and Examination Scheme

B.Sc. Sem-I (Forensic Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Forensic Science	BFS1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Forensic Science	BFS1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Digital & Cyber Forensic	BFS1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Digital & Cyber Forensic	BFS1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	A. Soap, Detergent, and Disinfectant Technology B. Basic Techniques in Forensic Biology C. Optical Laboratory	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Forensic Science- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Forensic Chemistry	BFS2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Forensic Chemistry	BFS2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Forensic Physics	BFS2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Forensic Physics	BFS2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	A. Documentation of Crime Scene B. Basics Techniques of Microbial Forensics C. Python Programming	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-III (Forensic Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Forensic Psychology	BFS3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Forensic Psychology	BFS3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Forensic Biology	BFS3P06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Forensic Biology	BFS3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Forensic Science – Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Forensic Biology	BFS4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Forensic Biology	BFS4P07			2	1	-	-	-	-	25	25	25
3	DSC	Forensic Science	BFS4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Forensic Science	BFS4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4P06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

B.Sc. Sem-V (Forensic Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min.
1	DSC	Forensic Chemistry	BFS5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Forensic Chemistry	BFS5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Forensic Biology	BFS5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Forensic Biology	BFS5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Forensic Science	BFS5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Forensic Science	BFS5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1 (Digital & Cyber Forensic/ Forensic Physics/ Forensic Psychology)	BFS5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1 (Digital & Cyber Forensic/ Forensic Physics/ Forensic Psychology)	BFS5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	NSS/ NCC/ Yoga/ Sports/ Cultural/ Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Forensic Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Forensic Science	BFS6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Forensic Science	BFS6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Forensic Biology	BFS6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Forensic Biology	BFS6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Digital & Cyber Forensics	BFS6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Digital & Cyber Forensics	BFS6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2 (Forensic Chemistry/ Forensic Physics/ Forensic Psychology)	BFS6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2 (Forensic Chemistry/ Forensic Physics/ Forensic Psychology)	BFS6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Forensic Science - Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Forensic Science	BFS7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Forensic Science	BFS7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Forensic Chemistry & Toxicology	BFS7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Forensic Chemistry & Toxicology	BFS7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Forensic Biology & Serology	BFS7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Forensic Biology & Serology	BFS7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Digital & Cyber Forensics	BFS7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Digital & Cyber Forensics	BFS7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3 (Forensic Physics/ Forensic Psychology/Law)	BFS7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3 (Forensic Physics/ Forensic Psychology/Law)	BFS7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BFS7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BFS7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Forensic Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Forensic Science	BFS8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Forensic Science	BFS8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Forensic Chemistry & Toxicology	BFS8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Forensic Chemistry & Toxicology	BFS8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Forensic Biology & Serology	BFS8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Forensic Biology & Serology	BFS8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Digital & Cyber Forensics	BFS8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Digital & Cyber Forensics	BFS8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4 (Forensic Physics/ Forensic Psychology/Law)	BFS8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4 (Forensic Physics/ Forensic Psychology/Law)	BFS8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Forensic Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Forensic Science	BFS7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Forensic Science	BFS7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Forensic Biology & Serology	BFS7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Forensic Biology & Serology	BFS7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Forensic Physics	BFS7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Forensic Physics	BFS7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3 (Digital & Cyber Forensics/ Forensic Chemistry & Toxicology/ Forensic Psychology)	BFS7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3 (Digital & Cyber Forensics/ Forensic Chemistry & Toxicology/ Forensic Psychology)	BFS7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BFS7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BFS7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Forensic Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Forensic Science	BFS8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Forensic Science	BFS8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Forensic Chemistry & Toxicology	BFS8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Forensic Chemistry & Toxicology	BFS8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Digital & Cyber Forensics	BFS8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Digital & Cyber Forensics	BFS8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4 (Forensic Physics/ Forensic Biology/ Forensic Psychology)	BFS8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4 (Forensic Physics/ Forensic Biology/ Forensic Psychology)	BFS8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2 +1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Forensic Science)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	A. Soap, Detergent, and Disinfectant Technology B. Basic Techniques in Forensic Biology C. Optical Laboratory	Forensic Science	**BVS1P01**
II	**VSC**	A. Documentation of Crime Scene B. Basics Techniques of Microbial Forensics C. Python Programming	Forensic Science	**BVS2P03**
III	**VSC**	Crime Scene Investigation	Forensic Science	**BVS3P05**
V	**VSC**	A. Practical Aspects of Forensic Journalism B. Forensic Biology C. Forensic Psychology	Forensic Science	**BVS5P07**
VI	**VSC**	A. Statistics in Forensic Science B. Forensic Biology C. Forensic Psychology	Forensic Science	**BVS6P08**

Basket for ELECTIVE (DSE) Category Courses (Forensic Science)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Digital & Cyber Forensic	BFS5T12
		B. Forensic Physics	
		C. Forensic Psychology	
VI	Elective 2	A. Forensic Chemistry	BFS6T16
		B. Forensic Physics	
		C. Forensic Psychology	
VII (Honors)	Elective 3	A. Forensic Physics	BFS7T21
		B. Forensic Psychology	
		C. Law	
VIII (Honors)	Elective 4	A. Forensic Physics	BFS8T27
		B. Forensic Psychology	
		C. Law	
VII (Research)	Elective 3	A. Digital & Cyber Forensics	BFS7T20R
		B. Forensic Chemistry & Toxicology	
		C. Forensic Psychology	
VIII (Research)	Elective 4	A. Forensic Physics	BFS7T25R
		B. Forensic Biology	
		C. Forensic Psychology	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-I (Forensic Science - Major)

DSC I (Forensic Science)

Paper (BFS1T01): Basics of Forensic Science

Course Outcomes: By the end of this Course, the learners will be able to:

1. Apply fundamental principles and laws of forensic science to analyze and interpret crime scene evidence.
2. Evaluate the historical development and contributions of forensic science, including key concepts and scientists' contributions.
3. Assess the setup, services, and functionalities of forensic science laboratories in India, including divisions and areas of specialization.
4. Apply crime scene investigation techniques, including crime scene classification, evidence preservation, collection, and documentation.
5. Understand the role and functions of investigation agencies in society, including their structure and modern techniques of interview and interrogation.

Unit I: **Introduction to Forensic Science and its Historical Development.**

Forensic Science: Definition, Nature, need and functions. Basic Principles and Laws of Forensic Science: Locard's Principle of Exchange, Law of Progressive Change, Law of Individuality, Law of Circumstantial Fact, Principle of Analysis, Law of Probability, and Law of Comparison. Corpus Delicti, Modus Operandi, Signature. Historical development in India and world, Specific contribution of scientists in the field of Forensic Science. Scope of Forensic Science in India and world.

Unit II: Development of Forensic Science

Educational setup of Forensic Science in India, Services and functionalities provided by various FSLs, Structure of the FSLs, Various divisions in the FSL – General Analytical and Instrumentation, Ballistics, Biology, Chemistry Documents, Physics, Psychology, Serology, Toxicology, Cyber Forensic, Tape Authentication and Speaker Identification (TASI), DNA division. Mobile Forensic Science Laboratories. Growth and development of Forensic Science Laboratories in India – Central and State level, GEQDs, Eminent scientists and Forensic Experts in India and their contributions to the field.

Unit III: **Crime Scene Investigation**

Types and classification of Crime Scene, Initial response, Securing the scene of crime, Various crime scene search methods, Various methods of preservation of crime scene: Photography, Sketching, Videography, Voice Recording, Notes taking. Collection methods and labelling, packing, and forwarding of evidences, documentation and chain of custody, Role of First Responding Officer and Investigating officer.

Unit IV: Investigation Agencies and Society

Structure, role and functions of CID, CBI, IB, RAW, NCRB, BPR&D, DFS, DFSS, and NICFS. Techniques of interview and interrogation and other modern techniques).

Practical (BFS1T01): Basics of Forensic Science

1. To conduct mock 'Crime Scene Investigation'.
2. To perform a crime scene survey of a given crime scene
3. Sketching of a Crime Scene using Triangulation method.
4. Sketching of a Crime Scene using Baseline method.
5. Preliminary examination of suspected bloodstains at the scene of crime.
6. Preliminary examination of suspected saliva stains.
7. Preliminary examination of suspected semen stains at the sexual assault crime scene.
8. To write forwarding letter for evidences encountered at murder crime scene.
9. To write forwarding letter for evidences encountered at hit and run crime scene.
10. To write forwarding letter for evidences encountered at sexual assault crime scene.

B.Sc. Sem-I (Forensic Science - Major)

DSC II (Digital and Cyber Forensic)

Paper (BFS1T02): Fundamentals of Computers

Course Outcomes: By the end of this Course, the learners will be able to:

1. Understand the meaning and basic components of a Digital computer system
2. Understand the concepts and need of primary, secondary memory and different storage devices
3. Explain input devices and output devices.
4. Understand the role and functionalities of operating system, its various types.
5. Explain Network concept, LAN, WAN and MAN, Network devices, networking architecture etc.

Unit I: Components of Digital Computer

Basic Components of Digital Computers: Block Diagram**.**

CPU: Functions of Each Unit: Primary Memory, ALU and CU: Fetch and Execution cycle, Execution of Instructions in Single Address CPU.

Memory: RAM, ROM, PROM, EPROM, EEPROM and Cache. CISC and RISC Technology

Unit II: Various types of devices

Storage Devices: Hard Disk, Optical Disk, Pen Drive, SD Card, and Cloud as storage.

Input Devices: Keyboard, Mouse, Light Pen, Touch Screen, Voice Input, MICR, OCR, OMR, Barcode Reader and Flatbed Scanner.

Output Devices: VDU, Printers: Dot Matrix, Laser and Inkjet, Plotters: Drum, Flat-Bed and Inkjet.

Unit III: Introduction to Operating System

Introduction of Operating System, Functions of OS, **Types of OS:** Single user, Multi-User, single tasking, multi-tasking, RTOS and Distributed, **Examples:** Windows, Linux, Unix, Dos, Mac and Android.

Unit IV: Network and Networking Systems

Network: Network terminology, **Topologies**: Linear, Circular, Tree and Mesh. **Types of Networks**: LAN, WAN and MAN, **Networking Devices**: Repeaters, Bridges, Routers and Gateway. Modem for Communication between PC's, Wi-Fi network, Bluetooth and Infrared devices, **Network Architecture:** Peer-to-Peer, Client/Server

Practical (BFS1T02): Fundamentals of Computers

1. Identify and explain the functions of each unit in the CPU, including the primary memory, ALU, and CU.
2. Investigate and compare storage devices such as hard disks, optical disks, pen drives, SD cards, and cloud storage.
3. Compare the usability and functionality of different input devices.
4. Set up and use output devices, including VDUs, laser printers, inkjet printers.
5. Explore different operating systems, including Windows, Linux, Unix, DOS, Mac, and Android.
6. Discuss the functions of an operating system, such as process management, memory management, file system management, and user interface.
7. Configure a LAN using appropriate networking devices, including repeaters, bridges, routers, and gateways.
8. Transfer files between computers on the LAN and demonstrate shared resources.
9. Set up small-scale networks using different topologies and analyze their advantages and limitations.
10. Set up a client/server network using appropriate networking devices and software.
11. Configure client and server systems and establish network communication.
12. Demonstrate the use of client/server architecture for file sharing and resource access.

B.Sc. Sem-I (Forensic Science - Major)

VSC (Forensic Chemistry)

VSC 1-A (BVS1P01): Soap, Detergent and Disinfectant Technology

Course Outcome: By the end of this Course, the learners will be able to:

1. Recall historical information, understand sustainable development in disinfectant technology,
2. Apply mechatronic solutions for soap manufacturing, and apply their knowledge to create different products.
3. Analyze various determinations and comparisons, evaluate different aspects related to soaps and detergents, and
4. They will have practical skills in soap and detergent manufacturing processes and an understanding of the principles behind them.

List of Practical

1. Brief History of Soap and Soap-Making Processes, Formulation and Marketing Challenges
2. Sustainable development in cleaning action of disinfectant technology and Innovations
3. in advances and Mechatronic Solutions for Soap Manufacturing Technology from
4. Saponification Systems.
5. Determination of the surface tension of given liquid in the presence of surfactant.
6. Determination of alkali content of soap.
7. Determination of pH of water samples and surfactant (Soap, detergent, Toiletries)
8. Estimation of hardness of water by titration with soap solution.
9. Determination of CMC of various soaps and detergents in market.
10. Comparison of cleansing actions of various commercial soaps and detergents.
11. Preparation of hand sanitizer.
12. Preparation of Soap, Detergents / Surfactants, Cleaners / Cleaning Powder.
13. Preparation of Laundry Care / fabric care / wash.
14. Preparation of Household and Industrial Detergent.
15. Preparation of Liquid Soaps/ Liquid Detergents / Acid Slurry.

B.Sc. Sem-I (Forensic Science - Major)

VSEC (Forensic Biology)

VSC 1-B (BVS1P01): Basic Techniques in Forensic Biology

Course Outcome: By the end of this Course, the learners will be able to:

1. Demonstrate knowledge and understanding of Neubauer's chamber and its application in forensic biology, including the ability to accurately count and analyze cells or particles.
2. Implement general safety guidelines and identify potential hazards in a forensic biology laboratory, ensuring a safe working environment for oneself and others.
3. Explain the basic concepts of laboratory equipment and apparatus used in forensic biology, including glassware and common laboratory instruments, and their appropriate usage.
4. Prepare different types of solutions, including molar normal formal and molal solutions, and determine their concentrations accurately using appropriate techniques.
5. Perform pH measurements of solutions used in forensic biology, interpret the results, and understand the implications of pH in various forensic applications.

List of Practical:

1. Study of Neubauer's chamber and its utility in forensic biology.
2. General guidelines for safety in a forensic biology laboratory, possible laboratory hazards.
3. General concept of basic equipment and apparatus (Glassware and laboratory instruments).
4. Preparation of molar normal Formal and molal solution (lower and higher range).
5. Determination of pH of solutions used in forensic biology.
6. Preparation of various microbial basal media.
7. Preparation of percent solution.
8. Preparation of various types of graphs used in forensic biology.
9. Sterilization of glassware and basal media.
10. Microbial culturing from the soil sample.
11. Preparation of various staining reagents used in forensic biology.
12. Preparation of temporary slides.

B.Sc. Sem-I (Forensic Science - Major)

VSEC (Forensic Physics)

VSC 1-C (BVS1P01): Optical Laboratory

Course Outcome: By the end of this Course, the learners will be able to:

1. Analyze and interpret experimental results to determine parameters such as dispersive power of a prism, focal length of lenses, resolving power of gratings, and magnification of microscopes.
2. Apply appropriate measurement techniques, such as using a spectrometer or Newton's rings, to determine angles, radii, and other optical properties.
3. Understand the concepts like Brewster's law, wavelength determination using transmission grating, and the working principles of compound, stereo, and comparison microscopes.
4. Develop skills in experimental setup, data collection, and analysis, enhancing their ability to conduct precise optical measurements.

List of Practical:

1. Determination of Dispersive Power of a Prism
2. Determination of Angle of Prism using Spectrometer
3. Determination of Focal Length of Concave Lenses
4. Determination of Focal Length of Convex Lenses
5. Determination of Focal Length of Combination of Lenses
6. Determination of Wavelength of Light using Plane Transmission Grating
7. Determination of Resolving Power of Grating
8. Determination of Radius of Curvature of Plano-Convex Lens by Newton’s Rings
9. Study of Brewster’s Law
10. Determination of R.I. of Glass by using Brewster’s Law
11. Determination of Resolving Power of Microscope
12. Determination of Magnification of Microscope
13. Study of Compound Microscope
14. Study of Stereo Microscope
15. Study of Comparison Microscope

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto- cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr P.U. Meshram, Allied Publishers, New Delhi.
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

B.Sc. Sem-II (Forensic Science - Major)

DSC I (Forensic Chemistry)

Paper (BFS2T03): Basics of Forensic Chemistry & Toxicology

Course Outcomes: By the end of this Course, learners will be able to:

1. Recall and describe the key concepts and principles in toxicology.
2. Develop a comprehensive understanding of the significance of toxicological findings in forensic investigations.
3. Apply the knowledge and techniques of isolation and extraction methods used in toxicology for the purpose of isolating and identifying poisons in forensic samples.
4. Analyze and interpret chromatographic techniques used in toxicology, including paper chromatography, thin-layer chromatography (TLC), high-performance thin-layer chromatography (HPTLC), and column chromatography, to separate and identify toxic compounds in forensic samples.
5. Evaluate the properties, classification, fractionation, commercial uses, adulteration, and forensic significance of petroleum products.

Unit I - Basics of Toxicology

Introduction, history, Classification of poisons, characteristics and modes of action of poisons, types of poisoning, fatal dose and fatal period, signs and symptoms of common poisoning and their antidotes. Significance of toxicological findings.

Unit II – Methods of Isolation and Extraction of Poison

Introduction, principle, working, applications, limitations, and forensic significance of distillation, fractional distillation, steam distillation, dialysis, electrodialysis, solvent extraction, dry ashing, etc.

Unit III – Chromatographic Techniques used in Toxicology

Introduction, principle, theory, stationary phases, mobile phases, retardation factor, applications and forensic significance of paper chromatography, TLC, HPTLC, column chromatography etc.

Unit IV – Petroleum Products

Introduction, classification, fractionation of petroleum products, commercial uses of different petroleum fractions, nature and purpose of dyes used in petroleum products, adulteration of petroleum products, forensic significance of petroleum products.

Practical Paper (BFS2T03): Basics of Forensic Chemistry & Toxicology

1. To determine the density of given liquid.
2. To determine relative viscosity of given organic liquids by viscometer.
3. To determine the surface tension of given liquid by Stalagmometer.
4. To study kinetics of acid catalysed ester hydrolysis.
5. Organic qualitative analysis.
6. To determine strength of given acid.
7. To standardize the given NaOH solution & find the strength of given HCl solution.
8. Paper chromatography of toxic metal ions.
9. Thin Layer Chromatography of organic poisons.
10. Identification of toxic metal ions in given solution by colour tests.
11. Identification of adulteration in petrol using density method.

B.Sc. Sem-II (Forensic Science - Major)

DSC II (Forensic Physics)

Paper (BFS2T04): Basics of Forensic Physics

Course Outcomes: By the end of this Course, the learners will be able to:

1. Recall and describe the primary causes and types of vehicular accidents, sources of information for accident investigation, methods for estimating vehicle speed from skid/scuff marks, and various aspects related to motor vehicle examination, including brake systems and steering failure.
2. Develop a comprehensive understanding of tools and tool marks, including the identification and documentation of different types of tool marks the collection and preservation of tool mark evidence, and the forensic examination of tool marks.
3. Apply knowledge and techniques related to glass evidence, including the composition of glass, methods for comparing glass fragments, classification of glass samples, analysis of glass fractures, and the proper collection and preservation of glass evidence.
4. Analyze different types of manufactured fibers, including their microscopic examination, dye composition, chemical composition, and other properties for examination.

Unit I: Vehicular Accidents

Primary Causes of Road Accident, Types of Road Accident, Sources of Information, Eye Witnesses, Tyre and Other Marks, Pedestrian Impacts and Vehicle Speed, Vehicle Condition, Vehicle Speed and Damage, Types of Skid Marks, Curved Scuffmarks, Speed Estimation from Skid/Scuffmarks. Time and Distance, Reaction Time and Peripheral Vision of a Driver, Photography and Plans, Brake System and Steering Failure, Motor Vehicle Examination.

Unit II: Tools & Tool Marks

Common Hand Tools, Marks Made by Hand Tools (Impression / Compression Marks, Dent, Saw Marks, Drill Marks and Holes, Punctures, Point to Point Blade Cut Marks, Scratch and Scour Marks), Collection, Documentation and Forensic Examination of Tool Marks.

Unit III: Glass Evidence

Composition of Glass, Comparison of Glass Fragments, Measuring and Comparing Density and Refractive Index of Glass, Classification of Glass Samples, Glass Fractures, Collection and Preservation of Glass Evidence.

Unit IV: Fibre Evidence

Types, Identification and Comparison of Manufactured Fibres (Microscopic Examination, Dye Composition, Chemical Composition, Other Properties for Examination), Significance of Match, Collection and Preservation of Fibre Evidence. Forensic Examination of Cloth and Cloth Fibres.

Practical (BFS2T04): Forensic Physics

1. Study of Hand Tools
2. Study of Tool Marks
3. Examination of Fibres under Microscope
4. Strength Measurements of Fibres
5. Comparison of Glass Fragments
6. Study of Glass Fractures
7. Measurement of Refractive Index of glass
8. Measurement of Density of glass
9. Examination of broken glass
10. Examination of skid marks
11. Forensic Examination of Cloth

B.Sc. Sem-II (Forensic Science - Major)

VSC (Forensic Science)

VSC I-A (BVS2P03): Documentation of Crime Scene

Course Outcome: By the end of this Course, the learners will be able to:

1. Recall techniques for crime scene photography and note-taking.
2. Comprehend the purpose and significance of different types of crime scene photography and sketching.
3. Apply photography techniques, note-taking skills, and sketching techniques to document crime scenes accurately.
4. Analyze crime scenes to determine appropriate photography angles and sketching details.
5. Evaluate the quality and effectiveness of crime scene photography, note-taking, and sketching.
6. Create comprehensive documentation of crime scenes through photography, note-taking, and sketching.

List of Practical

1. To perform an overview photography of the crime scene of outdoor crime scene.
2. To perform a midrange photography of the crime scene of outdoor crime scene.
3. To perform a close-up photography of the crime scene of outdoor crime scene.
4. To perform an overview photography of the crime scene of indoor crime scene.
5. To perform a midrange photography of the crime scene of indoor crime scene.
6. To perform a close-up photography of the crime scene of indoor crime scene.
7. Note-taking at the crime scene.
8. To draw a rough sketch of the crime scene.
9. To draw a fair sketch of the crime scene.
10. Taking videography of crime scene.

B.Sc. Sem-II (Forensic Science - Major)

VSEC

VSC I-B (BVS2P03): Basics Techniques in Microbial Forensics

Course Outcomes: By the end of this Course, the learners will be able to:

1. Apply the appropriate staining techniques to visualize and identify bacteria accurately.
2. Analyze and interpret growth curve data to understand the different phases of bacterial growth.
3. Demonstrate knowledge of the principles and procedures involved in isolating bacteria from various samples.
4. Prepare and differentiate between differential media and transport media for bacterial culturing.
5. Perform agarose gel electrophoresis to separate DNA samples and analyze the results for bacterial identification.

List of Practicals

1. Determination of the growth curve of bacteria.
2. To perform simple staining of bacteria.
3. To perform Gram staining of bacteria.
4. Isolation of bacteria from spoiled food samples using the streak plate method.
5. Isolation of bacteria from a water sample using pour plate method.
6. Preparation of differential media for bacterial culturing (MacConkey's Medium)
7. Preparation of transport media for bacterial culturing (Peptone water Medium)
8. Steam sterilization of media and glassware.
9. Determination of antibiotic sensitivity of bacteria.
10. Determination of oligodynamic activity on bacteria.
11. Isolation of DNA from Bacterial cell.
12. Separation of DNA on agarose gel electrophoresis.

B.Sc. Sem-II (Forensic Science - Major)

VSEC (Digital & Cyber Forensics)

VSC I-C (BVS2P03): Python Programming

Course Outcome: By the end of this Course, the learners will be able to:

1. Have an understanding of Python programming, including installation, basic syntax, variables, operators, conditional statements, looping, functions, data structures (lists, strings, dictionaries), file handling, and object-oriented concepts.
2. Create and utilize functions in Python, understanding their role in modular programming and code reusability.
3. Evaluate the usage of conditional statements (if, elif, else) in Python and demonstrate their effectiveness in controlling program flow.
4. They will be able to apply their knowledge to create and execute Python programs with various functionalities.

List of Practical

1. Installing python
2. Write a program in Python to display "Hello World" string on screen
3. Demonstration of constant and variables in python
4. Demonstration of operators in python
5. Demonstration of conditional statements in python
6. Demonstration of looping in python (for, while, nested)
7. Function in python
8. Working with lists in python
9. Working with strings in python
10. Working with dictionaries in python
11. Working with files in python
12. Python programming using object-oriented concepts

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

Bachelor of Geology

Submitted by

Board of Studies,

Bachelor of Geology

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)

(Geology - Major)

Four Year (Eight Semester Degree Course)

Teaching and Examination Scheme

B.Sc. Sem-I (Geology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Introduction to Geology	BGE1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Introduction to Geology	BGE1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Rock Forming Minerals	BGE1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Rock Forming Minerals	BGE1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Geological Mapping Techniques	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**	**-**	**530**	**170**	**-**	**150**	**250**	**-**

B.Sc. Sem-II (Geology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Physical Geology and General Geology	BGE2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Physical Geology and General Geology	BGE2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Optical Mineralogy and Crystallography	BGE2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Optical Mineralogy and Crystallography	BGE2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Evaluation to Landforms	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**	**-**	**530**	**170**	**-**	**150**	**250**	**-**

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-III (Geology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Igneous Rocks	BGE3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Igneous Rocks	BGE3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Sedimentary Rocks	BGE3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Sedimentary Rocks	BGE3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Geology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Metamorphic Rocks	BGE4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Metamorphic Rocks	BGE4P07			2	1	-	-	-	-	25	25	25
3	DSC	Palaeontology	BGE4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Palaeontology	BGE4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Geology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min.
1	DSC	Structural Geology	BGE5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Structural Geology	BGE5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Economic Geology	BGE5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Economic Geology	BGE5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Indian Stratigraphy	BGE5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Indian Stratigraphy	BGE5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BIT5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BIT5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Geology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Remote Sensing	BGE6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Remote Sensing	BGE6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Hydrogeology	BGE6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Hydrogeology	BGE6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Geomorphology	BGE6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Geomorphology	BGE6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BIT6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BIT6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Geology - Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Mineralogy	BGE7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Mineralogy	BGE7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Igneous Petrology	BGE7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Igneous Petrology	BGE7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Metamorphic Petrology	BGE7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Metamorphic Petrology	BGE7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Sedimentary Petrology	BGE7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Sedimentary Petrology	BGE7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3	BIT7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BIT7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BIT7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BIT7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Geology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Principles of Stratigraphy	BGE8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Principles of Stratigraphy	BGE8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Introduction to Geochemistry	BGE8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Introduction to Geochemistry	BGE8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Paleoclimates and Quaternary Geology	BGE8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Paleoclimates and Quaternary Geology	BGE8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Introduction to Micropaleontology and Mineral Exploration	BGE8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Introduction to Micropaleontology and Mineral Exploration	BGE8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BIT8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BIT8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Geology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Igneous Petrology	BGE7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Igneous Petrology	BGE7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Metamorphic Petrology	BGE7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Metamorphic Petrology	BGE7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Sedimentary Petrology	BGE7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Sedimentary Petrology	BGE7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BGE7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BGE7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BIT7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BIT7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Geology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Principles of Stratigraphy	BGE8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Principles of Stratigraphy	BGE8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Introduction to Geochemistry	BGE8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Introduction to Geochemistry	BGE8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Instrumentation Techniques, Geostatistics and Computer application in Geology	BGE8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Instrumentation Techniques, Geostatistics and Computer application in Geology	BGE8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BIT8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BIT8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2 +1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

ABBREVIATIONS: Generic/Open Electives: **OE**, Vocational Skills & Skill Enhancement Courses: **VSEC**, Vocational Skill Courses: **VSC**, Skill Enhancement Courses: **SEC**, Ability Enhancement Courses: **AEC**, Indian Knowledge Systems: **IKS**, Value Education Courses: **VEC**, On Job Training (Internship/Apprenticeship): **OJT**, Field Project: **FP**, Community Engagement & Service: **CEP**, Co-curricular Courses: **CC**, Research Methodology: **RM**, Research Project: **RP**

VSC Basket (Geology)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Geological Mapping Techniques	Geology	**BVS1P01**
II	**VSC**	Evaluation to Landforms	Geology	**BVS2P03**
III	**VSC**	Remote Sensing Data Acquisition and Application	Geology	**BVS3P05**
V	**VSC**	Understanding of Geohazards	Geology	**BVS5P07**
VI	**VSC**	Artificial Recharge of Groundwater	Geology	**BVS6P08**

Basket for ELECTIVE (DSE) Category Courses (Geology)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Introduction to Earth's Geological History	BGE5T12
		B. Introduction to Geodynamics and Tectonics	
VI	Elective 2	A. Introduction to Paleoclimates	BGE6T16
		B. Introduction to Watershed Management	
VII (Honors)	Elective 3	A. Introduction to Quaternary Geology	BGE7T21
		B. Introduction to Micropaleontology	
VIII (Honors)	Elective 4	A. Introduction to Mineral Exploration	BGE8T27
		B. Introduction to Environmental Geology and Geohazards	
VII (Research)	Elective 3	A. Introduction to Quaternary Geology	BGE7T20R
		B. Introduction to Micropaleontology	
VIII (Research)	Elective 4	A. Introduction to Mineral Exploration	BGE7T25R
		B. Introduction to Environmental Geology and Geohazards	

B.Sc. Geology Syllabus (CBCS) Revised in 2023-24 (DSC)

Program Outcomes (POs) for B. Sc. Programme

PO1. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2. Problem Solving: Solve problems from the disciplines of concern using the knowledge, skills and attitudes acquired from sciences/ mathematics/ social sciences/ humanities.

PO3. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO4. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in wide variety of settings.

PO5. Ethics: Understand multiple value systems including your own, the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and sustainability: Understand the impact of technology and business practices in societal and environmental contexts, and sustainable development.

PO7. Self-directed and life-long learning: Demonstrate the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

PO8. Design/Development of Solutions: Design solutions for complex science problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO9. Computational Thinking: Understand data-based reasoning through translation of data into abstract concepts using computing technology-based tools.

PO10. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO11. Global Perspective: Understand the economic, social and ecological connections that link the world's nations and people.

PO12. Aesthetic Engagement: Demonstrate and master the ability to engage with the arts and draw meaning and value from artistic expression that integrates the intuitive dimensions of participation in the arts with broader social, cultural and theoretical frameworks.

Semester I

Paper I: (Introduction to Geology)

Course Outcomes (COs)

1) Identify and describe various physical processes and understand branches of geology
2) Compare various domains of geological science.
3) Outline application of different terminologies of geological science.
4) Categorize applications and economic importance of geological science.
5) Justify selection of geological science to utilize in social benefit of human kind interms of wealth and culture.
6) Create a base to understand geological hazards and cope-up policy.

Program Specific Outcomes (PSOs)

(i) Understand fundamental concepts, principles and processes underlying the field of Geology, its different subfields and its linkage with related disciplinary areas/subjects

(ii) Demonstrate an understanding of a wide range of geological processes (e.g. genesis of rocks and formation of geological structures, formation of minerals and their alteration.)

(iii) Undertake field tour in any part of India with respect to lithology, structure and stratigraphy and produce geological maps

Unit I

Definition of Geology branches of geology and relation to other sciences: Physical geology Structural geology, Tectonic (Dynamic) geology, Mineralagy, Petrology, Historical geology, Palentology, Economic geology, Applied geology, Geophysics, Geochemistry, hydrogeology etc. Earth as a member of solar system. Gross features of the Earth. Brief idea about core, mantle, crust, hydrosphere, atmosphere, biosphere and elemental abundance in each constituent.

Unit II

Convection in Earths' core and production of its magnetic field. Causes of Earthquakes, classification of earthquakes based on depth, propagation of earthquake waves, measurement of earthquake intensity, seismograms and seisographs, distribution of earthquakes and seismic belts. Volcanoes, types of volcanoes: active, dormant, extinct, explosive, effusive and mixed volcanoes. Types of volcanic eruptions

Unit III

Origin of Earth, Different methods of age determination: physical, geophysical, biological, astronomical, chemical. Radiometric methods of determination of age of Earth, Internal structure and chemical composition of various layers. Application of geophysics in understanding dynamics of the earth.

Unit IV

Concept and theory of Isostasy. Palaeoclimates: Indicators, glacial periods- causes of glacial ages and glacial eustasy. Continental drift: continental matching, matching geology, past galciations, ancient plants and animals, polar wandering curves.

Books
Recommended:

1) Arthur Holmes (1978) Principles of Physical Geology
2) Emmons, Thiel, Staffer and Allison: Geology principles and Processes.
3) Gilluly,Water and Woodword: Principles of Geology
4) Robinson, E.S.(1982): Basic Physical Geology
5) Judson,Deffeyws and Hargrave,R.: Physical Geology.
6) Sanders J.E., Anderson Jr., A.Z., Carola: Physical Geology.
7) Cazen, Hatcher and Siemekowski: Physical Geology
8) Borges, Gwalani and Veena Rao: Fundamentals of Geology.
9) Patwardhan A.M.: The Dynamic Earth System.
10) Howell: Introduction to Geophysics.
11) Hamblin, Kenneth: The Earths' Dynamic System.
12) Sawkins, Chase, Darby and Rapp: The Evolving Earth: A Text Book in Physical Geology.
13) Mallory and Cargo: Physical Geology.
14) Judson Kauffman and Leet: Physical Geology.
15) Skinner and Porter: The Dynamic Earth: An introduction to Physical Geology.
16) Tarbuck and Lutgens: The Earth: An introduction to Physical Geology.
17) Manroe and Wicander: Physical Geology: Exploring the Earth

Practicals:

Study and preparation of charts, Preparation of bar graphs, seismographic divisions, distribution of continents at different time frames.

Paper II (Mineralogy)

Course Outcomes (COs)

1) Identify and describe various physical properties of megascopic specimens and optical properties of minerals under microscope.
2) Compare various crystals based on symmetry, symmetry functions and explain crystal system, mineral groups based on physical and optical properties.
3) Outline application of different micro analytical tools used in mineral analysis.
4) Categorize industrial applications and economic importance of various minerals.
5) Justify selection of microanalytical technique selected for the mineral analysis.
6) Prepare a report on a mineral sample by performing the necessary tests and suggest its applications in various fields.

Program Specific Outcomes (PSOs)

(i) Understand fundamental concepts, principles and processes of mineral forming processes and its linkage with related disciplinary areas/subjects
(ii) Demonstrate an understanding of a wide range of rock forming minerals.
(iii) Undertake the chemical compositions of various minerals, categorized as silicate mineral types.

Unit I

Chemical bonding and compound formation. Mineral composition of the earth's crust. Chemistry of minerals (Polymorphism, Isomorphism and Pseudomorphism). Various physical properties of the minerals.

Unit II

Properties dependent on magnetism, electricity and radioactivity. Silicate structures. Rock forming minerals- silicates, oxides and sulphides. Chemical and physical properties and geological occurrences of the following mineral groups: olivine, garnet and aluminous silicates.

Unit III

Chemical and physical properties and geological occurrences of the following rock forming mineral groups: quartz, feldspar, feldpathoids and zeolites.

Unit IV

Chemical and physical properties and geological occurrences of the following mineral groups: pyroxenes, amphiboles and micas.

Books Recommended:

1) Read : Rutley's Elements of Mineralogy.
2) Berry, Mason and Dietrich : Mineralogy
3) Dana and Ford: A Text book of Mineralogy
4) Deer, Howie and Zussman: An introduction to rock forming minerals.

Practicals :

Study of physical properties in hand specimen of the following minerals:
Quartz and its varieties, orthoclase, microcline, albite, labradorite, nepheline, leucite, sodalite, natrolite, stilbite, apophyllite, muscovite, biotite, chlorite, hypersthene, augite, diopside, hornblende, tremolite, actinolite, asbestos, olivine, garnet, kyanite, sillimanite, topaz, staurolite, tourmaline, epidote, serpentine, talc, rhodonite, rhodochrosite, aragonite, calcite, dolomite, magnesite, barite, gypsum, apatite, beryl, fluorite, corundum, kaolinite, zircon and halite.

SEMESTER- I

VSC: Geological Mapping Techniques (BVS1P01)

Practical:

Study and preparation of thematic maps (world, India) - Maps of India - political maps, physical map, rainfall trends, wind maps, drainage maps, soil and land-use maps, mineral deposits, food – crop maps, irrigation maps, agro-climatic zone maps, road and inland maps, railway maps, population maps, natural hazard maps

Books Recommended:

1) Macmillan Publishers India Private Limited (2021)
2) Survey of India toposheets
3) Compton, R.R. (1962) Manual of Field Geology, John Wiley and Sons, Inc.
4) Forrester, J.D. (1957) Principles of Field Geology and Mining Geology, John Wiley.
5) Lahi, F.H. (1987) Field Geology, CBS Publishers.
6) Mathur, S.M. (2001) Guide to Field Geology, Prentice-Hall, New Delhi

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr

P.U. Meshram, Allied Publishers, New Delhi.

8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, Motilal Banarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution of Civil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

Geology Semester II

Paper I: (Physical Geology and General Geology)

Unit I

Rock weathering and erosion. Geological work done by wind and river.

Unit II

Geological work done by underground water, glaciers and oceans. Brief idea about soil. formation and types of soil.

Unit III

Earth movements: Diastrophism (Orogeny and epeirogeny). Definition and types of geosynclines. Mountain building process and types of mountains. Evolution of continents and oceans.

Unit IV

Evolution of unified theory of plate tectonics. Nature and types of plate margins, sea-floor spreading. Origin and significance of mid-oceanic ridges and trenches; origin and distribution of island arcs.

Books Recommended:

1. Arthur Holmes (1978) Principles of Physical Geology
2. Emmons, Thiel, Staffer and Allison: Geology principles and Processes.
3. Gilluly,Water and Woodword: Principles of Geology
4. Robinson, E.S.(1982): Basic Physical Geology
5. Judson, Deffeyws and Hargrave, R.: Physical Geology.
6. Sanders J.E., Anderson Jr., A.Z., Carola: Physical Geology.
7. Cazen, Hatcher and Siemekowski : Physical Geology
8. Borges, Gwalani and Veena Rao: Fundamentals of Geology.
9. Patwardhan A.M.: The Dynamic Earth System.
10. Howell : Introduction to Geophysics.
11. Hamblin, Kenneth: The Earths' Dynamic System.
12. Sawkins, Chase, Darby and Rapp: The Evolving Earth: A Text Book in Physical Geology.
13. Mallory and Cargo: Physical Geology.
14. Judson Kauffman and Leet: Physical Geology.
15. Skinner and Porter: The Dynamic Earth: An introduction to Physical Geology.
16. Tarbuck and Lutgens: The Earth: An introduction to Physical Geology.
17. Manroe and Wicander: Physical Geology: Exploring the Earth

Paper II: (Optical Mineralogy and Crystallography)

Unit I

Petrological microscope: its parts and functioning. Elementary ideas about mineral optics.Critical angle, refractive index, determination of refractive index by i) Becke line method and ii) Abbe refractometer. Twinkling, birefringence, pleochroism, interference colours, extinction and extinction angle, twinning, isotropism and anisotropism. Phenomenon of double- refraction and nicol prism.

Unit II

Optical characters of the following rock forming minerals in ordinary and plane polarized light: Quartz, microcline, orthoclase, albite, labradorite, muscovite, biotite, chlorite, hornblende, hypersthene, augite, olivine, garnet, calcite, kyanite, sillimanite, tourmaline, epidote, tremolite and actinolite.

Unit III

Laws of Crystallography, constancy of interfacial angle, rationality of indices and symmetry. Elementary ideas about crystal structure, crystal faces, edges, solid angles and zone. Crystallographic axes and axial angles. Crystal notations, Miller's indices and WeissParameters. Crystal systems and classification of crystals into six systems. Study of Galena and Zircon class of symmetry.

Unit IV

Crystal symmetry. Study of Beryl, Barytes, Gypsum and Axinite classes of symmetry.

Books Recommended:

1. Read : Rutley's Elements of Mineralogy.
2. Berry, Mason and Dietrich : Mineralogy
3. Dana and Ford: A Text book of Mineralogy
4. Deer, Howie and Zussman: An introduction to rock forming minerals.
5. Smith: Minerals and Microscopes.
6. Roger and Kerr: Optical mineralogy

Practicals:

Study of optical characters of minerals listed for theory course using polarizing microscope.Study of elements of symmetry and description of various forms of crystals from normal classes of six crystal systems.

SEMESTER- II

VSC: Evaluation to Landforms (BVS2P03)

Practical:

Preparation of charts for atmosphere; hydrosphere; biosphere; plotting of major mountain chain of World and in India; plotting of drainage orders and major rivers of India; plotting of major rivers on World map; plotting of deserts on World map.

Recommended Books

1) Arthur Holmes (1978) Principles of Physical Geology
2) Emmons, Thiel, Staffer and Allison: Geology principles and Processes.
3) Hamblin, Kenneth: The Earths' Dynamic System.
4) Sawkins, Chase, Darby and Rapp: The Evolving Earth: A Text Book in Physical Geology.
5) Mallory and Cargo: Physical Geology.
6) Judson Kauffman and Leet: Physical Geology.
7) Skinner and Porter: The Dynamic Earth: An introduction to Physical Geology.
8) Tarbuck and Lutgens: The Earth: An introduction to Physical Geology.
9) Manroe and Wicander: Physical Geology: Exploring the Earth

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus
Bachelor of Science (Home Science)

Submitted by

Board of Studies,
Bachelor of Science (Home Science)

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)

(Home Science - Major)

Four Year (Eight Semester Degree Course)

Teaching and Examination Scheme

B.Sc. Sem-I (Home Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme Hrs.			Total Credits	Examination Scheme							
								Theory				Practical			
				TH	TU	P		Exam Hrs	SEE	CIE	Min	Exam Hrs	SEE	CIE	Min
1	DSC	Fundamentals of Food and Nutrition	BHS1T01	2	-	-	2	3	80	20	40	-	-	-	-
2	DSC	Fundamentals of Food and Nutrition	BHS1P01	-	-	2	1	-	-	-	-	3	25	25	25
3	DSC	Human Development-I (Infancy and Toddlerhood)	BHS1T02	2	-		2	3	80	20	40	-	-	-	-
4	DSC	Human Development-I (Infancy and Toddlerhood)	BHS1P02			2	1	-	-	-	-	3	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	1	-	-	1	2	40	10	20	-	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1P01			2	1	-	-	-	-	3	25	25	25
7	GE/OE	Refer GE/OE Basket	BGO1T02	1	-	-	1	2	40	10	20	-	-	-	-
8	GE/OE	Refer GE/OE Basket	BGO1P02			2	1	-	-	-	-	3	-	50	25
9	VSC	Basic Garments and Accessory Making	BVS1P01	-	-	4	2	-	-	-	-	50	50	50	
10	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50	
11	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-	
12	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-	
13	IKS	History of Home Science - 1	BIK1T01	2	-	-	2	3	80	20	40	-	-	-	
14	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50	
				12	-	20	**22**		**450**	**150**		**200**	**300**	12	

B.Sc. Sem-II (Home Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Textile and Sewing Techniques	BHS2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Textile and Sewing Techniques	BHS2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Interior Design	BHS2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Interior Design	BHS2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	1	-	-	1	2	40	10	20	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2P03	-	-	2	1	-	-	-	-	25	25	25
7	GE/OE	Refer GE/OE Basket	BGO2T04	1	-	-	1	2	40	10	20	-	-	-
8	GE/OE	Refer GE/OE Basket	BGO2P04	-	-	2	1	-	-	-	-	-	50	25
9	VSC	Food Preservation and Bakery Science	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
10	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
12	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
13	IKS	History of Home Science - 2	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
14	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**170**		**200**	**300**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-III (Home Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Fundamentals of Home Science Extension	BHS3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Fundamentals of Home Science Extension	BHS3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Nutrition through life Span	BHS3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Nutrition through life Span	BHS3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	1	-	-	1	2	40	10	20	-	-	-
10	GE/OE	Refer GE/OE Basket	BGO3P05	-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
12	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
13	FP	Field Project (FRM) Housing and Interior Decoration	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
14	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				11	-	22	**22**		**410**	**140**		**225**	**325**	

B.Sc. Sem-IV (Home Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Human Development- II (Childhood and Adolescent Development)	BHS4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Human Development- II (Childhood and Adolescent Development)	BHS4P07	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Surface Ornamentation Techniques	BHS4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Surface Ornamentation Techniques	BHS4P08	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	1	-	-	1	2	40	10	20	-	-	-
10	GE/OE	Refer GE/OE Basket	BGO4P06	-	-	2	1	-	-	-	-	25	25	25
11	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
12	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
13	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
14	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**170**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Name of Program - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Resource Management	BHS5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Resource Management	BHS5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Developmental Programme in India	BHS5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Developmental Programme in India	BHS5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Basic Dietetics	BHS5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Basic Dietetics	BHS5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BHS5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BHS5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Home Science Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Gerontology and Care of Elderly	BHS6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Gerontology and Care of Elderly	BHS6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Advanced Pattern Making	BHS6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Advanced Pattern Making	BHS6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Event Management and Entrepreneurship	BHS6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Event Management and Entrepreneurship	BHS6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BHS6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BHS6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Home Science - Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	FSN 1/HD 1/ T and C 1/ RM 1/ EXT ED 1	BHS7T7	2	-	-	2	3	80	20	40	-	-	-
2	DSC	FSN 1/HD 1/ T and C 1/ RM 1/ EXT ED 1	BHS7P7	-	-	2	1	-	-	-	-	25	25	25
3	DSC	FSN 2/HD 2/ T and C 2/ RM 2/ EXT ED 2	BHS7T8	2	-	-	2	3	80	20	40	-	-	-
4	DSC	FSN 2/HD 2/ T and C 2/ RM 2/ EXT ED 2	BHS7P8	-	-	2	1	-	-	-	-	-	50	25
5	DSC	FSN 3/HD 3/ T and C 3/ RM 3/ EXT ED 3	BHS7T9	2	-	-	2	3	80	20	40	-	-	-
6	DSC	FSN 3/HD 3/ T and C 3/ RM 3/ EXT ED 3	BHS7P9	-	-	2	1	-	-	-	-	25	25	25
7	DSC	FSN 4/HD 4/ T and C 4/ RM 4/ EXT ED 4	BHS7T0	2	-	-	2	3	80	20	40	-	-	-
8	DSC	FSN 4/HD 4/ T and C 4/ RM 4/ EXT ED 4	BHS7P0	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3	BHS7T1	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BHS7P1	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BHS7T2	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BHS7P2	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Home Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	FSN 1/HD 1/ T and C 1/ RM 1/ EXT ED 1	BHS8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	FSN 1/HD 1/ T and C 1/ RM 1/ EXT ED 1	BHS8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	FSN 2/HD 2/ T and C 2/ RM 2/ EXT ED 2	BHS8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	FSN 2/HD 2/ T and C 2/ RM 2/ EXT ED 2	BHS8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	FSN 3/HD 3/ T and C 3/ RM 3/ EXT ED 3	BHS8T225	2	-	-	2	3	80	20	40	-	-	-
6	DSC	FSN 3/HD 3/ T and C 3/ RM 3/ EXT ED 3	BHS8P225	-	-	2	1	-	-	-	-	25	25	25
7	DSC	FSN 4/HD 4/ T and C 4/ RM 4/ EXT ED 4	BHS8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	FSN 4/HD 4/ T and C 4/ RM 4/ EXT ED 4	BHS8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BHS8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BHS8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Home Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	FSN 1/HD 1/ T and C 1/ RM 1/ EXT ED 1	BHS7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	FSN 1/HD 1/ T and C 1/ RM 1/ EXT ED 1	BHS7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	FSN 2/HD 2/ T and C 2/ RM 2/ EXT ED 2	BHS7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	FSN 2/HD 2/ T and C 2/ RM 2/ EXT ED 2	BHS7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	FSN 3/HD 3/ T and C 3/ RM 3/ EXT ED 3	BHS7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	FSN 3/HD 3/ T and C 3/ RM 3/ EXT ED 3	BHS7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BHS7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BHS7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BHS7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BHS7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Home Science - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	FSN 1/HD 1/ T and C 1/ RM 1/ EXT ED 1	BHS8T2R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	FSN 1/HD 1/ T and C 1/ RM 1/ EXT ED 1	BHS8P2R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	FSN 2/HD 2/ T and C 2/ RM 2/ EXT ED 2	BHS8T2R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	FSN 2/HD 2/ T and C 2/ RM 2/ EXT ED 2	BHS8P2R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	FSN 3/HD 3/ T and C 3/ RM 3/ EXT ED 3	BHS8T2R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	FSN 3/HD 3/ T and C 3/ RM 3/ EXT ED 3	BHS8P2R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BHS8T2R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BHS8P2R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2 +1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Home Science)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Basic Garments and Accessory Making	Home Science	**BVS1P01**
II	**VSC**	Food Preservation and Bakery Science	Home Science	**BVS2P03**
III	**VSC**	Applied Chemistry - I	Home Science	**BVS3P05**
V	**VSC**	Textile Paintings and Embroidery	Home Science	**BVS5P07**
VI	**VSC**	Innovative Teaching Aids	Home Science	**BVS6P08**

Basket for ELECTIVE (DSE) Category Courses (Home Science)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Waste Management	BHS5T12
		B. Digital Communication Methods	
		C. Advanced Dietetics	
VI	Elective 2	A.Toy Based Paedology	BHS6T16
		B. Fashion Design	
		C. Work Simplification and Ergonomics	
		D. Food And Nutrition	
VII (Honors)	Elective 3	A. Food Science and Nutrition	BHS7T21
		B. Human Development	
		C. Textile & Clothing	
		D. Resource Management	
		E. Extension Education	
VIII (Honors)	Elective 4	A. Food Science and Nutrition	BHS8T27
		B. Human Development	
		C. Textile & Clothing	
		D. Resource Management	
		E. Extension Education	
VII (Research)	Elective 3	A. Food Science and Nutrition	BHS7T20R
		B. Human Development	
		C. Textile & Clothing	
		D. Resource Management	
		E. Extension Education	
VIII (Research)	Elective 4	A. Food Science and Nutrition	BHS7T25R
		B. Human Development	
		C. Textile & Clothing	
		D. Resource Management	
		E. Extension Education	

'R' in the subject code indicates 'Research'.

B.Sc. Home Science Semester –I (DSC)
BHS1T01
Fundamentals of Food and Nutrition

Total Marks	150
Theory	**Marks**
SEE	80
CIE	20
Practical	**Marks**
SEE	25
CIE	25

OBJECTIVES:

- To understand the functions of food and the role of various nutrients, their requirements and effect of deficiency and excess.
- To promote basic knowledge pertaining to various food groups and nutrients.
- To make students familiar with the different methods of cooking, their advantages and disadvantages.

COURSE CONTENT: THEORY

UNIT- I

I-Introduction to Food and Nutrition-

1. Basic terms used in Food and Nutrition-Definitions-Foods, Nutrition, Balanced Diet

2. Functions of food-Physiological, psychological and social

3. Characteristics of basic food groups and their contribution to the diet

II- Energy-1. Definition and factors affecting BMR.

2. Energy measurement of food (Bomb calorimeter)

III- MACRONUTRIENTS:

Carbohydrates – Definition classifications, functions, sources, deficiency states, and digestion-absorption.

UNIT- II

MACRONUTRIENTS:

I- **Proteins**- Definition, classifications, functions, sources, deficiency states and digestion-absorption.

II- **Fats**- Definition, classifications, functions, sources, deficiency states, and digestion-absorption.

UNIT- III

MICRONUTRIENTS:

I- Vitamins- Functions, Sources and Deficiency of:

a) Fat Soluble Vitamins:

i) Vitamin A; ii) Vitamin D; iii) Vitamin E; iv) Vitamin K

b) Water Soluble Vitamins:

i) Thiamine (B_1) ii) Riboflavin (B_2) iii) Niacin (B_3) iv) Cyanocobalamin (B_{12}) v) Vitamin C

II- Minerals- Functions, Sources and Deficiency of:

a) Major Mineral -i) Calcium ii) Iron iii) Iodine

b) Trace elements- i) Sodium ii) Potassium

Unit -IV

FIBRE, WATER and METHODS of COOKING

I-Fibre: Types of dietary fibre and sources.

II-Water: Functions of water in human body, water balance, sources of water

III- Methods of Cooking:

i. Objectives of cooking food.

ii. Advantages of cooking food.

iii. Different cooking methods and different cooking media.

iv. Effect of different cooking methods on nutritive value of food.

CIE

Total Marks	**20**

PRACTICAL: **(SEE-25 marks)**

1.Food Presentation and Table Setting.

2.Simple cooking- preparation, serving, calculation of cost and yield.

a) **Cereals:** – Plain Rice, Pulao, Sweet Rice Masale Bhat (any 2)

b) Chapati, Puri, Paratha, Missi Roti, Puran Poli, Bhakri (any 2).

c) **Pulse Preparatio**n: Whole, Dehusk and Sprouted (any 2).

d) **Vegetable Preparation**: Dry Curries and Baked (any 2).

SEE-Total Marks	**25**
Cooking	15
Presentation	05
Record	05
CIE	25

e) **Fruit Preparation:** Fresh, Dried Baked and Steamed (any 2).

f) **Milk Preparation**: Porridge, Desserts, Curds, and Paneer Preparation (any 2).

g) **Egg Preparation**: Boiled, Fried, Poached and Custard (any 2)

CIE **25 marks**

Any two of the following:

1. Market survey of the food commodities as per food groups and their cost.
2. Latest Kitchen appliances in the market-their use and upkeep.
3. Scrap Book: Related to food groups, sources, deficiencies of various nutrients.

REFERENCES:

1. Nutritive Value of Indian Foods: Gopalan C, Rama Shastri & Balasubramanin S.C., National Institute of Nutrition1993.
2. Food Science, Chemistry and Experimental Foods: Dr.M.Swaminathan,The Bangalore Printing and Publishing Co. Ltd. 1995.
3. Essentials of Food and Nutrition, Vol.I (Fundamental aspects): Dr. Swaminathan, 2nd edition BAPPCO, 2000.
4. Applied Nutrition: R. Rajlakshami Oxford & IBH Pub. Co.pvt Ltd,3rd edition, 1981.
5. Foods and Nutrition: The Educational Planning Group, Delhi, Arya Publishing House. 3rd edition, 1991.
6. B. Srilakshmi, Nutrition Science, sixth edition, new age international (P) Ltd, New Delhi (2018).
7. Joshi. A. S, "Nutrition & Dietetics", third edition, Tata McGraw hill education Pvt. Ltd., New Delhi (2010).
8. The book of Ingredients: Philip Dowell & Adrian Bailey, Michaey, Michael Joseph, Ltd, 1980.
9. Indian Food Composition Tables: Longvah T, Ananthan R,Bhaskarachary K and Venkaiah K. National Institute of Nutrition,2017.

B.Sc. Home Science Semester –I (DSC)
BHS1T02
Human Development – I (Infancy and Toddlerhood)

Total Marks	150
Theory	**Marks**
SEE	80
CIE	20
Practical	**Marks**
SEE	25
CIE	25

Objectives:

- To develop an understanding about the discipline of Human Development
- To acquire a detailed understanding of developmental milestones and domains from conception to middle childhood
- To gain insight on context specific cultural practices of development in children and explore the role of family and community in the life of children
- To make student aware of methods of studying human behaviour.

COURSE CONTENT: THEORY

UNIT I: Introduction to Human Development

• Definition, History, Interdisciplinary nature and scope of Human Development

• Domains, Stages and Context of Human Development

• Principles of Growth and Development

• Factors influencing Growth and Development

UNIT II: Prenatal, Birth and the Neonate

• Fertilization, Pregnancy – Signs, Symptoms, Complications, Discomforts

• Conception and Stages of Prenatal Development

• Child Birth - Process and types, Birth complications

• Reflexes and Care of the new-born

UNIT III: Infancy

• Characteristics of infancy

• Major adjustments of infancy

• Physical and Motor Development of infants

• Emotions and Vocalizations of infants

• Sensory capacities of infants

UNIT IV: Toddlerhood

- Developmental tasks and Characteristics
- Physical and Motor Development
- Social and Emotional Development
- Cognitive, Moral and Language Development

CIE **(25 marks)**

Preparation of Workbook (Any One)

- Developmental task
- Immunization
- Album on the stages of Pre-natal development
- Care during Pregnancy

Practicals:

1. Methods of child study –
   - Anthropometry, Observation, Interview, Questionnaire, Case study, Projective, Psychological tests, Sociometry, Longitudinal and Cross-sectional approach
2. A survey of cultural practices related to pregnancy
3. Plan & develop activities to facilitate development in different domains and submit a flip / album of activities.
4 Audio and video resources to study prenatal development, infancy and toddlerhood.

SEE -Total Marks	**25**
Preparation of activities on different domains	**15**
2 Questions	**05**
Record	**05**

References:

- Berk, L. (2013). *Child development*. 9th ed. Boston: Pearson.
- Rice, F. P. (1998). *Human Development: A Life-span Approach*. New Jersey: Prentice Hall.
- Santrock, J. W. (2011). *Life-span development*. New York: McGraw-Hill.
- Singh, A. (Ed.) 2015. *Foundations of Human Development*. New Delhi: Tata McGraw- Hill.

B.Sc. Home Science Semester –I (VSC)
BVS1P01
Basic Garments and Accessory Making

Total Marks	100
Practical	**Marks**
SEE	50
CIE	50

PRACTICALS

1. Demonstration of taking body measurements.
2. Introduction to Tools for Garment construction- Measuring tools, marking tools, Cutting tools, sewing tools, Pressing tools,
3. Sewing machine –parts, functions, care
4. Drafting, cutting & stitching of ;-Apron, Baby Frock
5. Make fashion accessory-Head gears, Hand bags and Jewellery,
6. Make samples of Surface ornamentation- Appliqué, Quilting, smoking,

CIE = 50 Marks

Total Marks - SEE	**50**
Drafting	10
Stitching-	15
Fashion Accessory	10
Surface Ornamentation	10
Record	05

References:

1. Complete Guide to Sewing-Readers Digest, The reader's digest association, 1976
2. Dorling Kindersley- The complete Book of Sewing, London, New York.
3. Complete Book of Sewing, Alison Smith Dorling Kindersley, 1999
4. Singer Sewing Book, Gladys Cunningham, The Singer Company
5. Aswani K.T. Fancy Weaving Mechanism, Mahajan Books, Ahmedabad.
6. Deulkar Durga - Household Textile and laundry work, Atmaram and sons, Delhi,

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto- cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr P.U. Meshram, Allied Publishers, New Delhi.
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

B.Sc. Home Science Semester –I (IKS)
BIK1TO1
Indian Knowledge System
History of Home Science- I

Total Marks	100
Theory	Marks
SEE	80
CIE	20

OBJECTIVES:

1) To unable the students to acquire the knowledge of food and nutrition.
2) To know the history of human development.
3) To impart knowledge about textile and clothing.
4) To gain the knowledge about resource management.
5) To assess the knowledge regarding home science extension.

Unit I

- History of nutrition.
- Nutrition research in India.
- Introduction, definition and importance of traditional foods.
- Introduction and benefit of satvik diet.
- Regional food patterns-Typical breakfast, meals and snacks foods of different regions of India.
- History of millets, types of millets and health benefits of millets.
- Nutrition composition of millets -Jowar, Bajara and Ragi.

Unit -II

- Manusmriti : Indian mental concepts of children (IMCC)
- About Children in Manusmriti: 16 Sanskaars
- Children's education, guru, student, and varna,
- Hinduism and Children, Jainism and Children, Buddhism and Children

Unit III

Traditional Costumes of Different States of India

- History and Accessories of Male and Female Costumes of Maharashtra,
- History and Accessories of Male and Female Costumes of Punjab,
- History and Accessories of Male and Female Costumes of Gujrat
- History and Accessories of Male and Female Costumes of Rajasthan,
- History and Accessories of Male and Female Costumes of Tamil Nadu

UNIT- IV RESOURCE MANAGEMENT

1. Concept of Housing, Need of Housing and Functions of housing
2. Evolution of Housing – The First shelter, Temporary shelter, Permanent shelter
3. Shelter in ancient civilization
4. Changes in housing needs and standards due to influence of services and modern amenities.
5. Factors affecting housing

UNIT-V HOME SCIENCE EXTENSION

- Home science extension in India, History, concept, characteristics.
- Role of home science extension in National development
- Teaching and learning Indian knowledge system through extension education
- Folk and traditional media: Meaning, Strength of the folk & traditional media, Limitations of folk and traditional media.
- Traditional folk media: Folk song, folk dance, powada, puppet show, street play.

References:

- B. Srilakshmi, Nutrition Science, Sixth Edition, New Age International (P) Ltd, New Delhi (2018).
- B. Srilakshmi, Food Science, Third Edition, New Age International (P) Ltd, New Delhi (2006)
- Joshi. A. S, "Nutrition & Dietetics", Third Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi (2010).
- Ambedkar BR. *Buddha and his Dhamm. (Hindi translation: Anand Kausalyayan)* Nagpur: Samata Sainik Dal; 1993. pp. 217–9.
- Kapur M, Mukundan H. Child care in ancient India from the perspective of developmental psychology and paediatrics. 1st ed. New Delhi: Sri Satguru Publications; 2002.
- Sitholey P, Agarwal V, Vrat S. Indian mental concepts on children and adolescents. Indian J Psychiatry. 2013 Jan;55(Suppl 2):S277-82. doi: 10.4103/0019-5545.105551. PMID: 23858268; PMCID: PMC3705696, retrived from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3705696/
- The compendium of eight branches of Ayurveda- Astangasamgraha, Vol. 3. New Delhi: Sri Satguru Publications; 1999. (Translated by a board of scholars).
- Vastrashastra: Prof. Vimal Adhau Maharashtra Vidhyapeeth Granth Nirmit Mandalasathi, Vidhya Books Aurangabad.
- William Watson - Textile Design and colour, Longman Green and Co. London.
- Agan T.C. – The House Oxford and I.B.H. publishing Co.
- Andreas, P (2019), Housing for all : Building Catalogue, Dom publishers
- Balchin, P & M Rhoden, (2003), Housing – The essential Foundation, Routledge.

- Castro, a & Hope (2015), Housing and Habitat in the Ancient Mediterranean: Cultural and Environmental responses, Peeters Pub and Booksellers.
- Deshpande R.S. – Modern Indian Homes in India, United Book Corporation, Poona 2nd Edition
- Dwivedi, R.M (2007), Urban Development and Housing in India: 1947 to 2007, New Century Publication
- Hiraskar, G.K. (2016), The Great Ages of World architecture, Dhanpat Rai Publication Limited, New Delhi.
- Modern Houses in India (2017) Creaivity Publishers.

- Dahama,O.P. and Bhatnagar O.P. Education and Communication for Development, Oxford & IBH Publishing Co., New Delhi.
- Supe, S.V. An Introduction to Extension education, Oxford Publishing Company, New Delhi & Kolkata, 1999.

B.Sc. Home Science Semester –II (DSC)
BHS2T03
Textile and Sewing Techniques

Total Marks	150
Theory	**Marks**
SEE	80
CIE	20
Practical	**Marks**
SEE	25
CIE	25

OBJECTIVES :

1. To get acquainted with basic knowledge of textile fibers.
2. To understand the importance and necessity of various construction techniques for different fabrics, and to acquire the skills to apply those construction techniques in a sample form
3. To acquire knowledge and skill regarding stitching techniques for various garment components such as plackets, pockets, cuffs, collars, and fasteners which are ultimately used for stitching of any garments
4. To acquire knowledge and skill regarding stitching techniques for various garment components

Unit I :

1. Importance of Clothing :.
2. Classification of textile fibers, General and essential properties of textile fibers
3. Manufacturing process of natural fibers.;-Cotton, silk, wool
4. Physical and chemical properties of natural fibres

Unit II :

1. Manufacturing process, of man made fibers :- viscose rayon, nylon, polyester
2. Physical and chemical properties of manmade fibres
3. Latest fibres :- Introduction and use of - Organic cotton , Bamboo , Soy, Lyocel, Metallic, Lycra(spandex)

Unit III :

1. Types of Yarn – Simple, novelty, textured yarns, Yarn twist,
2. Mechanical Spinning - Ring spinning,
3. Chemical spinning – Dry, wet, melt.

Unit IV :

1. Introduction to Seams –Plain ,French, Lapped Flat fell,
2. Tucks- Pin, Cord, Cross
3. Pleats – Knife, box, inverted.
4. Gathers – Machine and hand gathers
5. Types and uses of -Belts, Frills, Zipper, Buttons, Hooks and loops,
6. Types and uses of –Yokes ,Collars ,Pockets, Sleeves

PRACTICALS :

1. Drafting cutting and stitching of :-Baba suit, Romper
2. Make an album of :

   a..Seams : French, Lapped, Flat fell

   b. Tucks : Pin, Cross, Corded

   c. Pleats : Side, Box, Inverted

Total Marks SEE	**25**
Drafting	05
Stitching-	10
Sample Making	05
Record	05
CIE	**25**

References:

- Deulkar Durga - Household Textile and Laundry Work, Orient Longman, Delhi.
- Dantyagi S. - Fundamentals of Textile and their care. Orient Longman, Delhi.
- Dorling Kindersley- The complete Book of Sewing, London, New York.
- Dorothy Siegart, Lyle-Modem Textiles, John Wiley and Sons.lnc New York
- Doongaji. S and Deshpande R - Basic Process of Clothing Construction.
- Erwin, Mabel and kinchen- Clothing for Modern, Mac Milan publishing, New York.
- Fabrics science by Joseph Puzzuto
- Modern textiles by Dorothy Siegert Lyle
- Understanding fabric from fiber to finished cloth by Dbbie and Giollo
- Understanding textiles by Phyllis G. Tortora and Billie J Collier
- Corbman,P.B., Textiles-Fibre to Fabric, Gregg Division/McGraw Hill Book Co.,US, 1985.
- Joseph M.L.,Essentials of Textiles (5th Edition), Holt, Rinehart and Winston Inc.,Florida, 1988.
- Complete Guide to Sewing-Readers Digest, The reader's digest association, 1976
- Complete Book of Sewing, Alison Smith Dorling Kindersley, 1999
- Singer Sewing Book, Gladys Cunningham, The Singer Company

B.Sc. Home Science Semester –II (DSC)
BHS2T04
Interior Design

Total Marks	150
Theory	**Marks**
SEE	80
CIE	20
Practical	**Marks**
SEE	25
CIE	25

Objective :

1) To develop good taste through the study of basic elements and principles of design
2) To acquire knowledge about aesthetic sense to become good art consumer
3) To acquire knowledge of using colors to create different effects in space, with the use of various color schemes.
4) To develop skill /techniques of using color in different media
5) To gain knowledge of flowers / floral decoration and arrangement

UNIT - I

1. Elements of Art – i) Line ii) Form iii) Colour iii) Texture vi) Space v) Light vi) Pattern vii) Idea
2. Principles of Design in Interior
   i. Harmony,
   ii. Balance,
   iii. Rhythm,
   iv. Proportion
   v. Emphasis

UNIT - II

1. Design in current life style - Concept of Design, Objectives of design –i) Beauty ii) Expressiveness iii) Functionalism
2. Importance of good taste
3. Aesthetic sense and its importance
4. Types of design: i) Structural ii) Decorative iii) Naturalistic iv) Stylized v) Geometric vi) Abstract vii) Modern viii) Traditional

UNIT – III

1. Importance of colour in Interior Decoration
2. Characteristics or dimensions of colour (a. Hue, b. Value, c. Intensity)
3. Classification of colour - a. Primary, b. Secondary, c. Intermediate, d. Tertiary, e. Quaternary

4 Colour Schemes:

i) Related colour scheme
ii) B. Contrast colour scheme

Unit - IV

1. Definition, Importance and Objectives
2. Material Required

3. Types of flower arrangement
   Traditional
   Oriental / Japanese
   Modern
   Floating
   Miniature
   Dry
4. Application of Elements of Art in flower Arrangement
5. Application of Principles of Art in Flower Arrangement.
6. Do's & Don'ts in flower arrangement

PRACTICALS

1. Classification of colors (Primary, Secondary and Intermediate)
2. Colour Wheel
3. Warm & Cool colours
4. Value Scale
5. Colour Schemes (Monochromatic, Analogous, Complementary, Triad and Neutral)
6. Types of flower decoration/arrangements (i) Single stick ii) Small Bunch iii) Miniature iv) Modern)
7. Accessories in home decoration (Creative Art)

CIE = 25

Practicals	**SEE Total Marks – 25**
Colour Wheel/ Warm & Cool colours/ Value Scale	05
Colour Scheme	10
Flower arrangement	05
Record Book	05

B.Sc. Home Science Semester –II (VSC)
BVS2P03
Food Preservation and Bakery Science

Total Marks	100
Practical	**Marks**
SEE	50
CIE	50

OBJECTIVES:

- To acquire knowledge of food preservation and preservation techniques.
- To know the importance and basic principles of food preservation.
- To understand the importance of baking.

Preservation

- Introduction of food preservation and bakery

1. Preparation of Squash/Syrup
2. Preparation of Pickle
3. Preparation of Jam and Jelly
4. Preparation of Chutneys
5. Preparation of Sauce
6. Preparation of Tutti frutti
7. Preparation of Murrabbas

Bakery

1. Preparation of Cakes
2. Preparation of Nankhatai and Biscuits

Total Marks	**100**
SEE	**50**
Cooking	20
Presentation	15
Record	15
CIE	**50**

CIE

- Scrap Book: Related to methods of food preservation.
- To organize exhibition of food products.

Any one of the following:

- Visit to preservation units.
- Visit to bakery units and bakery outlets.

REFERENCES:

- B. Srilakshmi, Food Science, third edition, new age international (P) Ltd, New Delhi (2006).

- N Shakuntala Manay and M Shakuntala Manay, Foods Facts and Principles, New Age International (P) Ltd, New Delhi (1995).
- Rahman M S (2007) Handbook of Food Preservation 2nd ed CRC Press .
- Srivastava R P and Kumar S (2002) Fruits and Vegetables Preservations : Principles and Practices, 3rd Edition . International Book Distributing Co. Lucknow.
- Dubey,S.C.Basic Baking IV Edtion, The Society of Indian Bakers, New Delhi.

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao. Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan, Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin%20of%20Astronomy.pdf

B.Sc. Home Science Semester –II (IKS)
BIK2T02
Indian Knowledge System
History of Home Science-II

Total Marks	100
Theory	Marks
SEE	80
CIE	20

Objectives:

1. To enhance the knowledge of food and nutrition.
2. To acquire knowledge regarding child care in ancient India
3. To familiarize with the traditional sarees of different states of India
4. To comprehend the knowledge aboutvastushastra.
5. To understand the evolution of knowledge system in home science extension and traditional folk media

COURSE CONTENT: THEORY

UNIT I

- Concept of health.
- Guidelines for good health
- Relationship between nutrition and health.
- Introduction and definition of yoga.
- Yogasana - meaning, principal and their health benefit.
- Introduction to Pranayama and Dhyana and their health benefits.
- Concepts of Aahara (Diet) according yogic text.

UNIT II

Child care in Ancient India (Perspectives of developmental psychology)

- Care of the newborns and children
- Rites of passage and rituals
- Common childhood disorders
- Treatment of childhood disorders

UNIT III

Traditional Sarees of Different states of India:

- Bandhani :-History, Colour, Designs and Threads used in it
- Patola :- History, Colour, Designs and Threads used in it
- Chanderi :- History, Colour, Designs and Threads used in it
- Paithani :- History, Colour, Designs and Threads used in it
- Dacca :- History, Colour, Designs and Threads used in it
- Brocades :- History, Colour, Designs and Threads used in it
- Kashmiri Shawls :- History, Colour, Designs and Threads used in it

UNIT IV RESOURCE MANAGEMENT

1. History of Vastushastra
2. Importance of Vastushastra
3. Placement of Rooms according to vastushaastra
4. Placement of Doors according to vastushaastra
5. Location of Water bodies according to vastushaastra

UNIT V

- Evolution of knowledge system in home science extension.
- Evolution of system approaches to agricultural innovations.
- Use of natural resources
- Different folk media to transmit knowledge, culture, traditions, custom, social values, norms.
- Traditional folk media: Drama, bhajan, kirtan, bharud, davandi.

References:

- Maimum Nisha, Health Food & Nutrition, Kalpaz Publication.
- B. Srilakshmi, Nutrition Science, sixth edition, new age international (P) Ltd, New Delhi (2018).
- Joshi. A. S, "Nutrition & Dietetics", third edition, Tata McGraw hill education Pvt. Ltd., New Delhi (2010).
- Sen Colleen Taylor Food Culture in India Greenwood Press,2005
- Swami Mangalteertham : Synthetic approach to Diet & Nutrition, Deogarh Nutan Publication, Deogarh, 2005 4. Swami Gambh
- Dr R Nagarathna and Dr H R Nagendra: Yoga and Health, Swami Vivekananda Yoga Prakashana, 2002.
- Kapil Kapoor, "Indian Knowledge Systems: Nature, Philosophy and Character" in Indian Knowledge Systems, Kapil Kapoor & Avadhesh Kumar Singh (eds), DK Printworld, New Delhi, 2002
- https://www.exoticindiaart.com/book/details/child-care-in-ancient-india-from-perspectives-of-developmental-psychology-and-paediatrics-nac410/
- Usha Shrikant - Ethinic Embroidery of India, SamaiaEnterprises , Mumbai.
- Vastrashastra:Prof.VimalAdhauMaharashtra VidhyapeethGranthNirmitMandalasathi, Vidhya Books Aurangabad.
- William Watson - Textile Design and colour, Longman Green and Co. London.
- Agan T.C. – The House Oxford and I.B.H. publishing Co.
- Deshpande R.S. – Modern Indian Homes in India, United Book Corporation, Poona 2nd Edition
- Goldstein H./Goldstein V. – Art in Every day Life Macmillan Co. , New York, 4th Edition
- Pak – Tin & Helan Yeap – Feng Shui – Health Harmony B. Jain Publishers Pvt. Ltd. New Delhi , 1998
- Edition Shrivastav - Remedial Vastushastra, Manoj Publication, Delhi, 2001
- Dahama, O.P. and Bhatnagar O.P. Education and communication for Development, Oxford & IBH Publishing Co., New Delhi, 1977.
- Supe, S.V., An introduction to Extension Education, Oxford Publishing Company, New Delhi and Kolkata.

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Scheme and Syllabus

Bachelor of Science (Information Technology)

Submitted by

Board of Studies,

Bachelor of Science (Information Technology)

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)

(Information Technology- Major)

Four Year (Eight Semester Degree Course)

Teaching and Examination Scheme

B.Sc. Sem-I (Information Technology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Programming in C	BIT1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Programming in C	BIT1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	IT Support Technologies	BIT1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	IT Support Technologies	BIT1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Office Automation	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Information Technology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Object Oriented Programming using C++	BIT2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Object Oriented Programming using C++	BIT2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Operating System and Linux	BIT2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Operating System and Linux	BIT2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Computer Animation	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

B.Sc. Sem-III (Information Technology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Data Structure	BIT3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Data Structure	BIT3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Java Programming	BIT3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Java Programming	BIT3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Information Technology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Advanced Java Programming	BIT4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advanced Java Programming	BIT4P07			2	1	-	-	-	-	25	25	25
3	DSC	Software Engineering	BIT4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Software Engineering	BIT4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Information Technology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min.
1	DSC	.NET Framework using C#	BIT5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	.NET Framework using C#	BIT5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Data Base Management System	BIT5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Data Base Management System	BIT5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Data Warehousing	BIT5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Data Warehousing	BIT5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BIT5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BIT5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Information Technology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Python Programming	BIT6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Python Programming	BIT6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Data Communication and Network	BIT6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Data Communication and Network	BIT6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Unix Shell Programming	BIT6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Unix Shell Programming	BIT6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BIT6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BIT6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Information Technology - Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	R-Programming	BIT7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	R-Programming	BIT7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Cloud Computing	BIT7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Cloud Computing	BIT7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Data Analytics	BIT7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Data Analytics	BIT7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Software Architecture & Design	BIT7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Software Architecture & Design	BIT7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3	BIT7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BIT7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BIT7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BIT7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Information Technology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Artificial Intelligence	BIT8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Artificial Intelligence	BIT8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Internet of Things (IoT)	BIT8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Internet of Things (IoT)	BIT8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Information Architecture	BIT8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Information Architecture	BIT8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	3D Object Modelling	BIT8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	3D Object Modelling	BIT8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BIT8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BIT8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Information Technology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	R-Programming	BIT7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	R-Programming	BIT7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Cloud Computing	BIT7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Cloud Computing	BIT7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Data Analytics	BIT7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Data Analytics	BIT7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BIT7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BIT7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BIT7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BIT7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Information Technology - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Artificial Intelligence	BIT8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Artificial Intelligence	BIT8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Internet of Things (IoT)	BIT8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Internet of Things (IoT)	BIT8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Information Architecture	BIT8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Information Architecture	BIT8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BIT8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BIT8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2 +1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Information Technology)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Office Automation	Computer Science	**BVS1P01**
II	**VSC**	Computer Animation	Computer Science	**BVS2P03**
III	**VSC**	Web design using HTML and DHTML	Computer Science	**BVS3P05**
V	**VSC**	Web Development using Java	Computer Science	**BVS5P07**
VI	**VSC**	Shell Programming	Computer Science	**BVS6P08**

Basket for ELECTIVE (DSE) Category Courses (Information Technology)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Web Technology	BIT5T12
		B. VB.NET	
VI	Elective 2	A. PHP	BIT6T16
		B. ASP.NET	
VII (Honors)	Elective 3	A. SQL and PL-SQL	BIT7T21
		B. Data Mining	
VIII (Honors)	Elective 4	A. Business Analytics	BIT8T27
		B. Machine Learning	
VII (Research)	Elective 3	A. Deep Learning	BIT7T20R
		B. Block Chain Technology	
VIII (Research)	Elective 4	A. Neural Networks	BIT7T25R
		B. Parallel Computing	

'R' in the subject code indicates 'Research'.

Bachelor of Science (Honors/Research)
(Information Technology- Major)
Four Year (Eight Semester Degree Course)

The objectives of the Program

1. The primary objective of this program is to provide a foundation of computing principles for effectively using information systems and enterprise softwares.

2. It helps students analyze the requirements for system programming and exposes students for information systems

3. This programme provides students with options to specialize in various software system.

4. To produce outstanding Computer Scientists who can apply the theoretical knowledge into practice in the real world and develop standalone live projects themselves

5. To provide opportunity for the study of modern methods of information processing and its applications.

6. To develop among students the programming techniques and the problem solving skills through programming

7. To prepare students who wish to go on to further studies in computer science and related subjects.

8. To acquaint students to Work effectively with a range of current, standard, Office Productivity software applications.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. Discipline knowledge: Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity
2. Problem Solving: Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.
3. Design and Development of Solutions: Ability to design and development of algorithmic solutions to real world problems.
4. Programming a computer: Exhibiting strong skills required to program a computer for various issues and problems of day-to-day scientific applications.
5. Application Systems Knowledge: Possessing a minimum knowledge to practice existing computer application software.
6. Communication: Must have a reasonably good communication knowledge both in oral and writing.
7. Ethics on Profession, Environment and Society: Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer-based solutions for problems.
8. Lifelong Learning: Should become an independent learner. So, learn to learn ability.
9. Motivation to take up Higher Studies: Inspiration to continue educations towards advanced studies on Computer Science.

B.Sc. Sem-I (Information Technology - Major)
SC-DSC (Paper I)
BIT1T01
PROGRAMMING IN 'C'

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1.To formulate simple algorithms for arithmetic and logical problems.
2.To translate the algorithms to programs (in C language).
3.To test and execute the programs and correct syntax and logical errors.
4.To implement conditional branching, iteration and recursion.
5. To implement operations on arrays, strings, structures, unions , functions and file handling.

Course Outcomes :

After completing this course satisfactorily, a student will be able to:
1. Write simple algorithms for arithmetic and logical problems.
2. Write the C code for a given problem
3. Perform input and output operations using programs in C
4. Write programs that perform operations on arrays, strings , structures, unions , functions and file handling.

UNIT I

Programming Structure: Sequence, Selection, Iteration and Modular. Problem Solving techniques: Development Tools: Algorithm, Flowcharts and Pseudo code (Definition and its characteristics) Developing Algorithm and Drawing flowcharts

UNIT II

C Character set, Tokens, Identifier, Keywords, Variables, Data types, Qualifiers. Operators and Expressions: Arithmetic, Relational, Logical, Bit-Wise, Increment, Decrement, Conditional and Special operators. typedef, Type Conversion, Constants, Declaring Symbolic Constants, Character Strings, Enumerated Data Types, Operator Precedence and Associativity. Library functions: Maths, string handling Functions. Control Structure: Compound Statement, Selection Statement: if, if-else, Nested if, switch. Iteration statement: for, while, do...while, Nested loops, Jump statements: break, continue, goto (Special emphasis on problem solving)

UNIT III

Arrays: Need, Types: Single and Two Dimensional Array.
Strings: Strings Manipulation, Arrays of Strings, Evaluation order
Function: Function Components, Return Data type, Parameter Passing, Return by Reference, Default Arguments, Recursive Functions, Arrays with Functions, Storage Classes. (Special emphasis on problem Solving)

UNIT IV

Structure: Declaration, Definition, Accessing structure members, Initialization, Nesting of Structures.
Union: Unions, Differences between Structure and Union
Pointer: Introduction, Address Operator (&), Pointer variables, void pointers, Pointer Arithmetic, Pointers to Pointers.

File handling: Hierarchy of File Stream Classes, Opening & closing a file, Testing for errors, File Modes, File pointers and their manipulations, Sequential Access, Random Access, Command Line arguments.

Books

1. The Art of programming through flowcharts & algorithm by Anil B. Chaudhari Firewall Media, Laxmi publication, New Publication.
2. Programming in C by E. Balagurusamy TMH Publications.
3. C Programming – KernighenRitche
4. Programming with C – Y. Kanetkar.
5. C Programming – Holzner, PHI Publication.
6. Programming in C – Ravichandran.

B.Sc. Sem-I (Information Technology - Major)
SC- DSC (Paper II)
BIT1T02
IT SUPPORT TECHNOLOGIES

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1.To understand the different types of IT support technologies.
2.To understand the different types of network topologies.
3.To understand the concepts of cryptography.

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Course Outcomes :

After completing this course satisfactorily, a student will be able to:
1.Confidently operate computers to carry out computational tasks
2.Understand working of Hardware and Software and the importance of network topologies
3.Understand challenges of cloud computing in terms of application security.

Unit I

Introduction to the different types of IT Support Technologies.Infrastructure, Hardware Support, Security. Need for IT Support, traditional IT Support demands vs modern IT Support demands. Evolving support technologies.

Unit II

Introduction to LANs, WANs, MANs, Internet.Types of cables, switches, routers, repeaters. LAN topologies: Bus topology, Ring topology, Token passing rings. Cloud service and Deployment models, Server virtualization.

Unit III

Security concerns in modern IT, Challenges of cloud computing in terms of application security, server security, and network security. Security in computer networks: principles of cryptography, symmetric key, public key, digital signatures, firewalls.

Unit IV

Security in different layers: secure E-mail, SSL,IP security. Firewall planning and design, developing a security policy, firewall configuration strategies. Recent trends and challenges in the field of IT Support Technologies.

Books

1.Deal Richard, Cisco ASA configuration (1 ed.), Tata McGraw-Hill Education, 2009. ISBN 978-0070677241.
2.William Stallings, Data and Computer Communications (9 ed.), Pearson Education, 2010. ISBN 978-0131392052.
3.Raj Kumar Buyya,JamesBroberg and Andrezei M. Goscinski, Cloud Computing: Principles and paradigms (1 ed.), MIT Press, 2011. ISBN 978-0470887998.
4.B. A. Forouzan, Data communication and Networking (5 ed.), McGraw Hill, 2007. ISBN 978-1259064753.
5.A. S. Tanenbaum, Computer Networks (5 ed.), Prentice Hall, 2010. ISBN 978-0133485936.

B.Sc. Sem-I (Information Technology)

OFFICE AUTOMATION (BVS1P01)

Credits : 2 **Duration : 60 Hours**

Course Objectives:

1.To understand functionality of Operating Systems and its applications.
2.To understand the working with the user interface.
3.To understand Word Processing, their usage, details of word processing screen, Opening, saving and printing a document
4.To understand Worksheet creation, inserting and editing data in cells..

Course Outcomes :

After completing this course satisfactorily, a student will be able to:
1. understand functionality of Operating Systems and its applications.
2. Working with the user interface.
3. prepare documents, letters and do necessary formatting of the document.
4. Worksheet creation, inserting and editing data in cells.
5. Opening/saving a presentation and printing of slides and handouts.

UNIT I

Introduction to windows Operating System Advantages of windows operating system, using different windows applications simultaneously, operating with windows, GUI, use of help features, starting an application, essential accessories, creating shortcuts, windows explorer, control panel, my computer, my documents, recycle bin, finding folders and files, changing system settings, system tools, use of run command, setting peripherals, drivers, editing graphics in windows.

UNIT II

Introduction, basics, starting Word, creating document, parts of Word window, mouse and keyboard operations, designing a document; Formatting- selection, cut, copy, paste; Toolbars, operating on text; Printing, saving, opening, closing of document; Creating a template; Tables, borders, pictures, text box operations; Mail Merge.

UNIT III

Introduction to MS EXCEL, navigating, Excel toolbars and operations, Formatting; copying data between worksheets; entering formula, chart creation; data forms, data sort; Functions in ExcelROUND( ), SQRT ( ), MAX( ), MIN( ), AVERAGE( ), COUNT( ), SUMIF( ), SUMIF( ), ABS( ), ROMAN( ), UPPER( ), LOWER( ), CELL( ), TODAY( ), NOW( ).

UNIT IV

Introduction to MS POWER POINT Working with Power Point Window, Standard Tool Bar, Formatting tool bar, Drawing tool Bar, Moving the Frame, Inserting Clip Art, Picture, Slide, Text Styling, Send to back, Entering data to graph, Organization Chart, Table,Design template, Master Slide, Animation Setting, Saving and Presentation , auto Content Wizard.

Books

1.MS Office XP for Everyone By Sanjay Saxena (Vikas Publi, Noida)
2.MS-Office 2000(for Windows) By Steve Sagman
3.A First Course in Computers – Sanjay Saxena

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto- cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr P.U. Meshram, Allied Publishers, New Delhi.
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

B.Sc. Sem -II (Information Technology - Major)
SC- DSC (Paper I)
BIT2T03
OBJECT ORIENTED PROGRAMMING USING 'C++'

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1. To provide basic characteristics of OOP through C++.
2. To impart skills on various kinds of overloading and inheritance.
3. To introduce pointers and file handling in C++ together with exception handling mechanism.

Course Outcomes:

After completion of this course, students will be able to:

1. Realize the need and features of OOP and idealize how C++ differs from C.
2. Infer knowledge on various types of overloading.
3. Choose suitable inheritance while proposing solution for the given problem.
4. Handle pointers and effective memory management.
5. Illustrate application of pointers in virtual functions.

UNIT I

Object Oriented Methodology: Elements of Object Oriented programming, Objects, Classes, OOPs features. **Classes & Objects:** Specifying a Class, Creating Objects, Accessing Class members, Defining member function, Outside Member Functions as inline, Accessing Member Functions within the class, Static data member, Access specifiers: private, protected and public Members.

UNIT II

Constructors & Destructors: Introduction, Parameterized Constructors, Constructor Overloading, Constructors with Default Arguments, Copy Constructor, Destructor, Order of Construction and Destruction, Static data members with Constructor and Destructors.
Operator Overloading: Definition, Overloadable Operators, Unary Operator Overloading, Unary & Binary overloading, Rules for Operators Overloading.

UNIT III

Dynamic Objects: Pointers to Objects, Creating and Deleting Dynamic Objects: New and Delete operators, Array of Objects, Array of Pointers to Objects, Pointers to Object Members, this Pointer**.**
Inheritance: Defining, Abstract classes, Single, Multilevel, Multiple, Hierarchical, Hybrid Inheritance, Constructor and Destructor in Derived Classes.

UNIT IV

Virtual Functions: Need for Virtual Functions, definition, Pure Virtual Functions, Abstract Classes, Rules for Virtual Functions.
Exception Handling: Exception Handling Model, List of Exceptions, Handling Uncaught Exceptions, Fault Tolerant Design Techniques, Memory Allocation Failure Exception, Rules for Handling Exception Successfully.

Books

1. Mastering C++ by K R Venugopal Tata McGraw-Hill, New Delhi.
2. The C++ Programming Language –Bjarne Stroustrup
3. Programming with C++ - Ravichandran
4. Programming with C++ - Robert Lafore
5. Object Oriented Programming with C++ by E. Balagurusamy, McGraw Hill

B.Sc. Sem -II (Information Technology - Major)
SC- DSC (Paper II)
BIT2T04

OPERATING SYSTEMS AND LINUX

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1. To introduce the Operating system concepts and designs to provide the skills required to implement the OS services.
2. To describe the trade-offs between contradictory objectives in large scale OS system design.
3. To develop the knowledge for application of the various OS design issues and services.
4. To understand structure of Linux OS and commands.

Course Outcome: After completion of this course, students will be able to:
1. Describe the various OS functionalities, structures and layers.
2. Usage of system calls related to OS management and interpreting different stages of various process states.
3. Design CPU scheduling algorithms to meet and validate the scheduling criteria.
4. Apply and explore the communication between inter process and synchronization techniques.
5. Implement memory placement strategies, replacement algorithms related to main memory and virtual memory techniques.
6. Differentiate the file systems; file allocation, access techniques along with virtualization concepts and designing of OS with protection and security enabled capabilities.
7. Working on Linux OS.

UNIT I

Structure of Operating System, Operating System functions, Characteristics of Modern OS. Process Management: Process states, Creation, Termination, Operations on Process, Concurrent process, Processes Threads, Multithreading, Micro Kernels CPU Scheduling: Schedulers, Scheduling Methodology, CPU Scheduling Algorithm: FCFS, SJF, RR, Priority Scheduling.

UNIT II

Performance comparison : Deterministic Modeling , Queuing analysis, Simulators. Deadlock and Starvation: Resource Allocation Graph, Conditions for Dead Lock, Dead Lock Prevention, Dead Lock Detection, Recovery from Deadlock.

UNIT III

Memory Management: Logical Vs. Physical Address Space, Swapping, Memory Management Requirement, Dynamic Loading and Dynamic Linking, Memory Allocation Method: Single Partition allocation, Multiple Partitions, Compaction, paging, segmentation, File Management: File Management system, File Accessing Methods, File Directories, File Allocation Methods

UNIT IV

Anatomy of Linux OS, Directory Structure, /usr Directory, File Types: User datafiles, System data files, Executable files. Naming files and directories. Shell: Creating User Account, Shell Program, bash shell, Changing shell prompt. Commands: Basic Syntax for a command,

Exploring the Home Directory, ls, mkdir, rmdir, stat, cat, rm, mv, cp, Managing users accounts, Changing Password, Creating group accounts.

Books:

1.Operating Systems by P. Balakrishna Prasad [Scitech Publication]
2.Operating System Concept :Silbershaz (Addision Education)
3.Operating System :A.S.Godbole (TMH)
4.Modern Operating Systems :Tenenenbaum (Pearson Education)
5.SAMS Teach Yourself Linux by Craig and Coletta Witherspoon [Techmedia]

B.Sc. Sem-II (Information Technology)
BVS2P03
COMPUTER ANIMATION

Credits : 2 **Duration : 60 Hours**

Course Objectives:

1. To Understand the concept of 2D and 3D Animation.
2. To Execute creative concepts and ideas through a variety and combination of techniques including hand drawn, computer generated, 2D and 3D storyboards and animatics.
3. To Understand how animation works.
4. To Understand the basic concepts of multimedia technology which will help them to get started easily in multimedia.

Course Outcome: After completion of this course, students will be able to:
1. Get knowledge about various terms like, images, text, fonts, file formats. Understanding these things is very necessary.
2. produce traditional style animation as well as puppet animation and the knowledge of the principles of animation to be built upon in subsequent courses leading up to the Portfolio course.
3. apply skills learned in this class in other areas including motion graphics, stop motion and basic traditional animation

Unit I
Animation, Introduction to 2D and 3D Animation. Advantages of animation, Different tools of 2D Animation.
GIMP Features and Capabilities, Toolbox, Image Window, Dialog and Docking, Working with images,
Pencil2D , Overview of Pencil2D, Traditional Animation Workflows, How to rotate image, Scrolling background in Camera layer

Unit II
Opentoonz , Production Workflow, Interface Overview, Managing Projects,Setting Up a Scene, Scanning Paper Drawings, Cleaning-up Scanned Drawings, Drawing Animation Levels, Editing Animation Levels, Managing Palettes and Styles, Painting Animation Levels, Working in Xsheet/Timeline, Creating Movements, Editing Using Spreadsheet and Curves, Creating Cutout Animation, Create animations using Plastic tool, Applying Effects, Using the Particles Effect, Previewing and Rendering

Unit III
Blender, History and Installation, Interface : Blender Interface, Adding New Objects, Moving Things Around, Modeling : Mesh, Edit Mode, Sculpt Mode, Retopology
Lighting and Procedural Textures : Setting Up a Basic Scene, The Scene Camera, Procedural Materials and Textures., UV Mapping : Creating a UV Map, Texture Painting, Projection Painting, Normal Maps and Bump Maps
Curves and NURBS : Metaballs, Curves, Spins, Nurbs,

Unit IV

Basic Rigging and Animation : Keyframing with the Timeline, The Dopesheet ., Parenting, Graph Editor, Pivot Point: The Center of Rotation, Basic Tracking: Eyes That Follow, Rigging with Bones, Rigging a Simple Character, Advanced Rigging ..: Forward Kinematics vs. Inverse Kinetics, Blender 2.5 Rigs, Walk Cycles., Shape Keys, Lip Syncing.
Making Movies : Disabling, Color Management, Rendering Formats, Alpha, Lighting Adjustments, The Video Sequence Editor, Crash Management and Rendering Speed, Introduction to Game Engine.

Books :

https://docs.gimp.org/odftest/en.pdf
https://opentoonz.readthedocs.io/en/latest/using_the_toonz_farm.html
https://www.pencil2d.org/doc/tutorials
Beginning Blender Open Source 3D Modelling, Animation, and Game Design, Lance Flavell, Apress.
https://www.academia.edu/7984869/Beginning_Blender_Open_Source_3D_Modeling_Animation_and_Game_Design_Companion_eBook_Available_Full_Color_Inside_BOOKS_FOR_PROFESSIONALS_BY_PROFESSIONALS_Beginning_Blender_Open_Source_3D_Modeling_Animation_and_Game_Design

Reference Book :

Learning Blender A Hands-On Guide to Creating 3D Animated Characters, Oliver Villar
Blender Basics Classroom Tutorial Book 4th Edition, James Chronister.
https://www.cdschools.org/cms/lib04/pa09000075/centricity/domain/81/blenderbasics_4thedition2011.pdf
Blender 3D Basics Beginner's Guide: A quick and easy-to-use guide to create 3D modeling and animation using Blender 2.7, Gordon Fisher

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus
Bachelor of Science (Mathematics)

Submitted by
Board of Studies,
Bachelor of Science (Mathematics)

FYUGP-Scheme I-VIII Semester
Bachelor of Science (Honors/Research)
(Mathematics - Major)
Four Year (Eight Semester Degree Course)
Teaching and Examination Scheme

B.Sc. Sem-I (Mathematics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Algebra and Trigonometry	BMT1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Algebra and Trigonometry	BMT1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Differential Calculus	BMT1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Differential Calculus	BMT1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Sage Math software system	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Mathematics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Integral Calculus and Ordinary DEq	BMT2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Integral Calculus and Ordinary DEq	BMT2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Vector Analysis	BMT2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Vector Analysis	BMT2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Maxima software system	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

B.Sc. Sem-III (Mathematics- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Partial Differential Equations	BMT3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Partial Differential Equations	BMT3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Analytical Solid Geometry	BMT3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Analytical Solid Geometry	BMT3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)	BMT1T01	2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)	BMT1P01	-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)	BMT1T02	2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)	BMT1P02	-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Mathematics- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Mathematical Methods	BMT4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Mathematical Methods	BMT4P07			2	1	-	-	-	-	25	25	25
3	DSC	Sequences and Series	BMT4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Sequences and Series	BMT4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)	BMT2T03	2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)	BMT2P03			2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)	BMT2T04	2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)	BMT2P04			2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Mathematics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min.
1	DSC	Analysis	BMT5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Analysis	BMT5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Abstract Algebra	BMT5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Abstract Algebra	BMT5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Mechanics	BMT5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Mechanics	BMT5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BMT5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BMT5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)	BMT3T05	2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)	BMT3P05	-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)	BMT3T06	2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)	BMT3P06	-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Mathematics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Complex Analysis	BMT6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Complex Analysis	BMT6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Linear Algebra	BMT6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Linear Algebra	BMT6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Graph Theory	BMT6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Graph Theory	BMT6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BMT6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BMT6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)	BMT4T07	2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)	BMT4P07	-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Mathematics - Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Algebra-1	BMT7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Algebra-1	BMT7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Real Analysis-1	BMT7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Real Analysis-1	BMT7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Topology	BMT7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Topology	BMT7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Ordinary Differential Equations	BMT7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Ordinary Differential Equations	BMT7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3	BMT7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BMT7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BM7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BM7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Mathematics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Algebra-2	BMT8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Algebra-2	BMT8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Real Analysis -2	BMT8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Real Analysis -2	BMT8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Differential Geometry	BMT8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Differential Geometry	BMT8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Integral Equations	BMT8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Integral Equations	BMT8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BMT8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BMT8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Mathematics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Algebra-1	BMT7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Algebra-1	BMT7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Real Analysis-1	BMT7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Real Analysis-1	BMT7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Topology	BMT7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Topology	BMT7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BMT7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BMT7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BMT7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BMT7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Mathematics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Algebra-2	BMT8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Algebra-2	BMT8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Real Analysis-2	BMTT8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Real Analysis-2	BMTT8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Differential Geometry	BMT8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Differential Geometry	BMT8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BMT8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BMT8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2 +1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Mathematics)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Sage Math software system	Mathematics	**BVS1P01**
II	**VSC**	Maxima software system	Mathematics	**BVS2P03**
III	**VSC**	Mathematical foundation for data science	Mathematics	**BVS3P05**
V	**VSC**	Scilab	Mathematics	**BVS5P07**
VI	**VSC**	Statistics with R	Mathematics	**BVS6P08**

Basket for ELECTIVE (DSE) Category Courses (Mathematics)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	Linear Programming Problems	BMT5T12-A
		Statistics	BMT5T12-B
VI	Elective 2	Mathematical Modeling	BMT6T16-A
		Special Theory of Relativity	BMT6T16-B
VII (Honors)	Elective 3	Advanced Numerical Methods	BMT7T21-A
		Fluid Dynamics	BMT7T21-B
VIII (Honors)	Elective 4	General Theory of Relativity	BMT8T27-A
		Operations Research	BMT8T27-B
VII (Research)	Elective 3	Ordinary Differential Equations	BMT7T20R-A
		Advanced Numerical Method	BMT7T20R-B
VIII (Research)	Elective 4	Integral Equations	BMT7T25R-A
		General Theory of Relativity	BMT7T25R-B

'R' in the subject code indicates 'Research'.

RASHTRASANT TUKDOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

As per National Education Policy 2020

B.Sc. Four Years (Honors/Research)

Curriculum Framework for Eight Semester Degree Course with Mathematics Major

B.Sc. Part I (Semester I and II)

With effect from
the Academic Year 2023-24
B.Sc. Part I (Semester I and II)

PROGRAM: B. Sc. Mathematics

Program Outcome:

PO1. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2. Problem Solving: Solve problems from the disciplines of concern using the knowledge, skills and attitudes acquired from mathematics/ sciences/social sciences/humanities.

PO3. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by
connecting people, ideas, books, media and technology.

PO4. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in wide variety of settings.

PO5. Ethics: Understand multiple value systems including your own, the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and sustainability: Understand the impact of technology and business practices in societal and environmental contexts, and sustainable development.

PO7. Self-directed and life-long learning: Demonstrate the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

PO8. Design/Development of Solutions: Design solutions for complex science problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO9. Computational Thinking: Understand data-based reasoning through translation of data into abstract concepts using computing technology-based tools.

PO10. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO11. Global Perspective: Understand the economic, social and ecological connections that link the world's nations and people.

PO12. Aesthetic Engagement: Demonstrate and master the ability to engage with the arts and draw meaning and value from artistic expression that integrates the intuitive dimensions of participation in the arts with broader social, cultural and theoretical frameworks.

Program Specific Outcome:

PSO1: **Rational Thinking**: Students be able to formulate and develop Mathematical arguments in a logical manner to unravel the gist hidden in the problem at hand.

PSO2: **Problem solving ability**: Student should be able to think in a critical manner to process the data, and develop Mathematical problem-solving ability.

PSO3: **Revisiting the question**: Students should be able to recall basic facts, important milestones, discoveries in Mathematics and inculcate habit of rational thinking by which the problem at hand can be revisited, time and again, that helps in solving it.

PSO4: **Analytical ability**: In the growing field of research, it is necessary for students to learn to use some packages like Matlab, Scilab, Mathematica, Maxima, etc, so that analytical tools be available to investigate the functions, problems through graphs, programming, etc.

PSO5: **Numerical Ability**: Using packages, students can make programs to solve some problems of which exact solutions are not available, using tools of Numerical analysis.

PSO6: **Simulation Ability**: The problems that cannot be solved directly, can at times be solved through techniques of simulation by honors/research students.

PSO7: **Research**: Students thus motivated would prepare themselves for research studies in Mathematics and related fields.

PSO8: **Application**: Student will be able to apply their skills and knowledge in Mathematics to various fields of studies including, science, engineering, commerce and management etc.

B.Sc. Semester I (MATHEMATICS)

Sem I Paper - I **DSC (Core) Code: BMT1T01** **For Minor: BMT1T01**	Course Title: **Algebra and Trigonometry** **Course Outcomes:** CO1: **Foundational Knowledge**: Students will be able to update their basics of Set Theory, Matrices, Theory of equations and Complex variables and its applied aspects. CO2: **Elementary Skills**: Students will be able to understand the importance of hyperbolic functions and their relationships with trigonometric functions. CO3: **Basic Analytic skills**: The main outcome of the course is to equip students with necessary basic analytic skills for problem solving. CO4: **Application**: By applying the principles of basic tools through the course curriculum, students can solve a variety of practical problems in science and engineering.	**Credit 2** **No. of hours 30**
	Syllabus for B.Sc. Semester – I Paper - I **BMT1T01: Algebra and Trigonometry**	**No. of hours**
	Unit I – <u>Algebra</u>: Set theory, equivalence relations, equivalence classes. Theory of Numbers: Divisibility, division algorithm, Euclidean algorithm, congruence, linear congruence.	**8**
	Unit II - <u>Matrices</u>: Hermitian and skew- Hermitian matrices, idempotent, nilpotent, involuntary, orthogonal and unitary matrices. Rank of a matrix, Equivalent matrices, Row canonical form, Normal form, System of homogeneous and non-homogeneous equations, Characteristic equation and roots, Application of Cayley-Hamilton Theorem.	**7**
	Unit III – <u>Theory of Equations</u>: Relation between the roots and the coefficients of general polynomial equation in one variable, Descartes' rule of signs, Calculation of f(x + h) by Horner's process, Transformation of equations, Reciprocal equations. Solution of cubic Equation (Cardon's Method) and Biquadratic equations (Ferrari's Method)	**7**
	Unit IV - <u>Trigonometry</u>: De Moivre's Theorem and its application, The n^{th} roots of unity, series expansions of circular, inverse circular and Hyperbolic functions, Separation of f(z) into real and imaginary parts. Logarithm of a complex variable, Properties of logarithmic function.	**8**
	<u>Reference Books:</u> 1) Elementary Number Theory: David M. Burton (Seventh Edition), New Delhi. **2)** Matrix and Linear Algebra: K. B. Datta, Prentice Hall of India Pvt. Ltd., New Delhi- 2000. **3)** Higher Algebra: H.S. Hall and S.R. Knight, S. Chand & Co. Ltd., New Delhi, 2008.	

	4) Theory and problems of Complex variables by Murray R. Spiegel, Schaum's outline series, McGraw-Hill Book Company, New York (1981) **5)** A Textbook of Matrices: Shanti Narayan, P.K. Mittal, S. Chand & Company, 2010 **6)** Theory and problems of Matrices: Frank Ayres, JR., Schaum's outline series, McGraw-Hill Book Company, New York. (1974) **7)** Schaum's Outline of trigonometry: Robert Moyer, Frank Ayres, 2012 Suggested digital platform: NPTEL/SWAYAM/MOOCs	
	PRACTICAL: BMT1P01: Algebra and Trigonometry	
Sem I **Paper - I** **DSC (Core) Code: BMT1P01** **For Minor: BMT1P01**	**Course Outcomes:** CO1: Students will be able to learn implications of equivalence relations in determining equivalence classes. CO2: Students will understand properties of divisibility through problem solving. CO3: Students will be able to perform different operations on the given congruence. CO4: Solution of linear congruence will be studied by students. CO5: Students will be able to perform matrix operations to determine invertible matrices, row canonical and normal form of the matrices. CO6: Students will be able to apply matrix operations to solve system of linear equations. CO7: Students will be able to find roots of a cubic and biquadratic equation. CO8: Students will be able to apply De Moivre's theorem to find n^{th} roots of a complex number find.	**Credit 1** **No. of hours** 30
	Syllabus for Practical BMT1P01: Algebra and Trigonometry Note: **Minimum 12** topics from listed practical problems must be conducted, at least 3 from every unit.	
	<u>List of topics for practical problems:</u> (1) Comparing relations and functions. (2) Exploring implication of equivalence relations in determining equivalence classes. (3) Properties of divisibility through problem solving. (4) Application of different operations on the given congruence. (5) Solution of linear congruence (6) Matrix algebra: (i) $AB \neq BA$ in general (ii) $A \neq 0, B \neq 0$ but $AB = 0$ (iii) $(AB)' = B'A', (AB)^{-1} = B^{-1}A^{-1}$	

(7) Different methods of finding Inverse of a matrix.

(8) Row canonical form, normal form and rank of a matrix.

(9) Solution of system of linear equations $AX = 0$ and $AX = B$, $B \neq 0$ using row operations.

(10) Linearly independent and dependent vectors in terms of a row.

(11) Application of Cayley-Hamilton theorem

(12) Solving Eigen value problems: Eigen values and eigen vectors of square matrices.

(13) Calculation of $f(x + h)$ by Horner's method

(14) Roots of a polynomial equation: Arithmetic, Geometric, Harmonic progression.

(15) Reciprocal equation, their types, and their solutions.

(16) Application of Cardano's method to find roots of a cubic equation.

(17) Application of De Moivre's theorem to find nth roots of a complex number.

(18) Trigonometric functions, hyperbolic functions and their relations.

(19) Separation of real and imaginary parts of trigonometric and hyperbolic functions.

(20) Logarithm of a real valued and complex valued functions.

Reference Books:

1. Elementary Number Theory: David M. Burton (Seventh Edition), New Delhi.
2. Matrix and Linear Algebra: K. B. Datta, Prentice Hall of India Pvt. Ltd., New Delhi- 2000.
3. Higher Algebra: H.S. Hall and S.R. Knight, S. Chand & Co. Ltd., New Delhi, 2008.
4. Theory and problems of Complex variables by Murray R. Spiegel, Schaum's outline series, McGraw-Hill Book Company, New York (1981)
5. A Textbook of Matrices: Shanti Narayan, P.K. Mittal, S. Chand & Company, 2010
6. Theory and problems of Matrices: Frank Ayres, JR., Schaum's outline series, McGraw-Hill Book Company, New York. (1974)
7. Schaum's Outline of trigonometry: Robert Moyer, Frank Ayres, 2012

Suitable computer programs can be used: SageMath/Maxima/SciLab/etc

Sem I **Paper - II** **DSC (Core) Code: BMT1T02** **For Minor: BMT1T02**	Course Title: **Differential Calculus** **Course Outcomes:** CO1: **Foundational Knowledge**: Students will be able to update their basic knowledge of Maxima and Minima of functions of single variables and their application. CO2: **Elementary Skills**: Students will undergo problem solving training by learning Indeterminate forms and L' Hospital's Rule and their applicability. CO3: **New Concepts learning**: Students will be able to learn new concept of functions of two variables, Taylor series, and maxima and minima of such functions. CO4: **Analytic Skills**: The problem-solving skills will bring forth the importance of Jacobian in understanding the existence of inverse transformation and other aspects of independence of pair of functions. CO5: **Application**: By applying the principles of basic tools through the course curriculum, students can solve a variety of practical problems in science and engineering.	**Credit 2** **No. of hours 30**
	Syllabus for BSc Semester – I Paper -II **BMT1T02: Differential Calculus**	**No. of hours**
	Unit I – <u>Functions of Single Variable – Part 1:</u> Intermediate value theorem, Rolle's Theorem, Mean value theorems and their geometrical interpretations, Applications of mean value theorems. Maxima and Minima; cases of one variable involving second or higher degree polynomials	**8**
	Unit II – <u>Functions of Single Variable – Part 2:</u> Successive differentiation and n^{th} differential coefficient of functions, Leibnitz's theorem, Maclaurin's and Taylor's theorems, Indeterminate forms and L' Hospital's Rule	**7**
	Unit III -. <u>Functions of Two Variables – Part 1:</u> Limit and continuity of functions of two variables, Partial derivatives, Homogeneous functions, Total differentials, Composite functions, Asymptotes.	**7**
	Unit IV - <u>Functions of Two Variables – Part 2:</u> Jacobians and its properties, Taylor's series of function of two variables, Maxima and Minima of function of two variables, Lagrange's method of multiplier.	**8**
	<u>Reference Books:</u> 1. Differential Calculus: Shanti Narayan and Dr P. K. Mittal, S. Chand & Co. Ltd, New Delhi (2014). 2. Introduction to Real Analysis: R.G. Bartle & D.R. Sherbert, , John Wiley & Sons, 1999 3. Calculus: T.M. Apostal, Vol. I, John Wiley & Sons Inc., 1974	

	4. A Basic Course in Real Analysis: Ajit Kumar and S. Kumaresan, CRC Press, 2019 5. Differential Calculus: S. Balachandra Rao & C. K. Shantha, New Age Publication 1992 6. Calculus: H. Anton, I. Birens and S. Davis, John Wiley and Sons, Inc. 2007 **7.** Calculus: G. B. Thomas and R.L. Finney, Pearson Education, 2010 Suggested digital platform: NPTEL/SWAYAM/MOOCs	

Sem I Paper - II **DSC (Core) Code: BMT1P02** **For Minor: BMT1P02**	**PRACTICAL: BMT1P02: Differential Calculus**	
	Course Outcomes: CO1: Students will be able to make out the maximum or minimum nature of the functions by applying different conditions on the functions. CO2: Working on Geometric interpretation of Mean value theorems through graphs of a function will make students grasp the subject admirably. CO3: Students will learn application of Leibnitz, Maclaurin's and Taylor's theorems. CO4: Students will be able to apply L' Hospital's Rule to solve the problems CO5: Solving problems when functions involved are homogeneous CO6: Students will able to solve Jacobians and learn properties due to Jacobian. CO7: Analyzing Maxima and Minima of functions of two variables	**Credit 1** **No. of hours** 30
	Syllabus for Practical BMT1P02: Differential Calculus Note: **Minimum 12** topics from listed practical problems must be conducted, at least 3 from every unit.	
	List of topics for practical problems: (1) Application of Rolle's theorem (2) Geometric interpretation of Mean value theorems through graph of a function (3) Application of Mean Value Theorems (4) Comparing results due to Rolles' theorem and Lagrange's mean value theorem on a given function with different conditions. (5) Application of Intermediate value theorem, and analyze it through its graph (6) Determination of n^{th} differential coefficient of functions (7) Application of Leibnitz's theorem (8) Application of Maclaurin's theorem and Taylor's theorems (9) Comparing different Indeterminate forms, and their conversions if possible (10) Solution of limiting problems using L' Hospital's Rule (11) Performing iterative limits on functions of two variables (12) Solving partial derivatives for functions of two variables (13) Solving problems when functions involved are homogeneous	

	(14) Solving total differentials of scalar functions (15) Finding asymptotes of a function and analyze it through its graph. (16) Solving Jacobians of functions f & g (17) Analyzing independent nature of functions f & g through Jacobians (18) Verification of $J J' = 1$ for a given function and analyze existence of inverse transformation (19) Analyzing Maxima and Minima of function of two variables (20) Application of Lagrange's method of multiplier **Reference Books:** 1. Differential Calculus: Shanti Narayan and Dr P. K. Mittal, S. Chand & Co. Ltd, New Delhi (2014). 2. Introduction to Real Analysis: R.G. Bartle & D.R. Sherbert, , John Wiley & Sons, 1999 3. Calculus: T.M. Apostal, Vol. I, John Wiley & Sons Inc., 1974 4. A Basic Course in Real Analysis: Ajit Kumar and S. Kumaresan, CRC Press, 2019 5. Differential Calculus: S. Balachandra Rao & C. K. Shantha, New Age Publication 1992 6. Calculus: H. Anton, I. Birens and S. Davis, John Wiley and Sons, Inc. 2007 7. Calculus: G. B. Thomas and R.L. Finney, Pearson Education, 2010 **Suitable computer programs can be used:** SageMath/Maxima/SciLab/etc	

Vocational Skill Enhancement Course (VSC)

SEMESTER - I

VSC – 01 : Sage Math Software System

Sage is free, open-source Mathematics software that supports research and teaching in algebra, geometry, number theory, cryptography, numerical computation, and related areas.

(**Download from http://www.sagemath.org/**)

SYLLABUS

	PRACTICAL: Sage Math Software System	
Sem- I **VSC - 01** **Code:** **BVS1P01**	Course Title: **SAGE MATH SOFTWARE SYSTEM** Course Outcomes: **Students will be able** 1) to explore topics in Calculus, Applied Linear Algebra and Numerical Method along with several applications 2) to learn an alternative software as against the commercial products Magma, Maple, Mathematica and MATLAB 3) to learn the most recent algorithms and tools for many domains of mathematics 4) to use as wonderful scientific and graphical calculator.	**Credit 2** **No. of hours** 30
	Syllabus for BSc Semester – I: VSC - 01 **Code BVS1P01: SAGE MATH SOFTWARE SYSTEM**	**No. of hours**
	TOPICS: 1. Introductory Tutorial 2. Evaluating Sage Commands 3. Functions in Sage 4. Annotating with Sage 5. Basic Symbolics and Plotting 6. Basic 2D Plotting 7. Basic 3D Plotting 8. Calculus 1- Differentiation 9. Calculus 2- Integration 10. Advanced 2D Plotting 11. Graphing Functions and Plotting Curves 12. Plotting Data	**30**
	Reference books / materials: **1.** Computational Mathematics with Sage Math, By Paul Zimmermann, Alexandre Casamayou, Nathann Cohen, Guillaume Connan, Thierry Dumont, Laurent Fousse, François Maltey, Matthias Meulien, Marc Mezzarobba, Clément Pernet, Nicolas M. Thiéry, Erik Bray, John Cremona, Marcelo Forets, Alexandru Ghitza, Hugh Thomas. **2.** https://doc.sagemath.org/html/en/prep/index.html **3.** https://www.ictmumbai.edu.in/Mathematics/SageMath Lecures_AjitKumar_ICT Mumbai.pdf **4.** http://lamastex.org/preprints/compSageMathZimmerman120517.pdf **5.** ajitmathsoft.wordpress.com/sage math	

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere-Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (8 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto- cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (8 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr P.U. Meshram, Allied Publishers, New Delhi.
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution of Civil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

Sem- II **Paper - I** **DSC (Core) Code: BMT2T03** **For Minor: BMT2T03**	Course Title: **Integral Calculus and Ordinary Differential Equations** **Course Outcomes:** CO1: **Foundational knowledge**: Students to update their knowledge of improper integrals, Beta and Gamma functions and their applicability. CO2: **Basic skills**: Students will be able to understand the importance of varied methods of solving differential equations of first and second order. CO3: **Analytical skills**: The main objective of the course is to equip students with necessary analytic skills due to integrability and solutions of differential equations. CO4: **Application**: By applying the principles of basic tools through the course curriculum, students can solve a variety of practical problems in science and engineering.	**Credit 2** **No. of hours 30**
	Syllabus for BSc Semester – II Paper - I **BMT2T03: Integral Calculus and Ordinary Differential Equations**	**No. of hours**
	Unit I - <u>Reduction Formulae and Beta, Gamma Functions:</u> Reduction formulae for basic trigonometric functions, Integration of irrational functions, Beta and Gamma functions, their properties, Relation between Beta and Gamma functions, Evaluation of integrals using Beta and Gamma functions.	**8**
	Unit II – <u>Multiple Integrals:</u> Double integration, Application of double integrals, Change the order of integration, Change of variable, Triple integration.	**7**
	Unit III – <u>First Order Differential Equations:</u> Exact differential equations, Integrating factors, Linear and Bernoulli's differential equations, First order higher degree differential equations solvable for x, y and p, Clairaut's form, Orthogonal trajectories.	**7**
	Unit IV - <u>Second Order Linear Differential Equations:</u> The general solution of the homogeneous equations, Operator methods for finding particular solutions, Euler's Equidimensional Equations, Use of a known solution to find another, The method of variation of parameters.	**8**
	<u>Reference Books:</u> 1) Integral Calculus: Shanti Narayan and P. K. Mittal, S. Chand & Co. Ltd, New Delhi (2005). 2) Differential Equations with Applications and Historical Notes: G. F. Simmons, McGraw-Hill Inc, New Delhi (Second Edition) 1991. 3) Calculus: T.M. Apostal, Vol. I, John Wiley & Sons Inc., 1974 4) Calculus: H. Anton, I. Birens and S. Davis, John Wiley and Sons, Inc. 2007 5) Calculus: G.B. Thomas and R.L. Finney, Pearson Education, 2010. Suggested digital platform: NPTEL/SWAYAM/MOOCs	

Sem- II **Paper - I**	**PRACTICAL: BMT2P03:** **Integral Calculus and Ordinary Differential Equations**	
DSC (Core) Code: BMT2P03 **For Minor: BMT2P03**	**Course Outcomes**: CO1: Students will be able to solve problems using reduction formulae, Beta and Gamma functions. CO2: Application of double integration in solving problems on area of a region. CO3: Students will able to solve problems by changing the order of integration CO4: Students will learn application of triple integration CO5: Students will be able to apply integrating factor in solving non-exact differential equations CO6: Students will be able to solve Euler's Equidimensional Eqs CO7: Students will able to use concept of Wronskian in solving problems by method of variation of parameters	**Credit 1** **No. of hours** 30
	Syllabus for Practical BMT2P03: Integral Calculus and Ordinary Differential Equations Note: **Minimum 12** topics from listed practical problems must be conducted, at least 3 from every unit.	
	List of topics for practical problems: **Abbreviations: Eq- Equation, DEq – Differential Equations** (1) Application of Reduction formulae for basic trigonometric functions (2) Solving problems of integration of irrational functions (3) Properties of Beta and Gamma functions (4) Relationship between Beta and Gamma functions (5) Solution of integrals using Beta and Gamma functions. (6) Solution of problems involving double integration (7) Application of double integration in solving problems on area of a region (8) Solving problems by changing the order of integration (9) Solution of double integral using polar coordinates (10) Learning triple integration through examples (11) Solving exact DEqs (12) Comparing exact and non-exact DEqs, and need of integrating factor in solving non-exact DEqs	

	(13) Solution of Bernoulli's DEqs (14) Solutions of First order higher degree DEqs (15) Finding orthogonal trajectory of the given family, and then sketch both the families together to decipher the orthogonality (16) Application of Wronskian in understanding the independent/dependent nature of functions (17) Solutions of homogeneous DEqs (18) Solutions of Euler's Equidimensional Eqs (19) Determination of a solution from a known solution (20) Application of method of variation of parameters **Reference Books:** (1) Integral Calculus: Shanti Narayan and P. K. Mittal, S. Chand & Co. Ltd, New Delhi (2005). (2) Differential Equations with Applications and Historical Notes: G. F. Simmons, McGraw-Hill Inc, New Delhi (Second Edition) 1991. (3) Calculus: T.M. Apostal, Vol. I, John Wiley & Sons Inc., 1974 (4) Calculus: H. Anton, I. Birens and S. Davis, John Wiley and Sons, Inc. 2007 (5) Calculus: G.B. Thomas and R.L. Finney, Pearson Education, 2010. **Suitable computer programs can be used:** SageMath/Maxima/SciLab/etc	

Sem- II **Paper - II** **DSC (Core) Code: BMT2T04** **For Minor: BMT2T04**	Course Title: **Vector Analysis** **Course Outcomes:** CO1: **Foundational knowledge:** To impart foundational knowledge of vector algebra and vector differentiation. CO2: **Basic skills**: To inculcate in students foundational base of gradient of a scalar function, divergence and curl. CO3: **Concept learning**: New concept of vector integration shall be introduced and problems of work done by force shall be solved. CO4: **Application of Vector Theorems**: To solve variety of practical problems in science and engineering by applying Greens theorem, divergence theorem, Stokes' theorem. CO5: **Application**: The course curriculum is so prepared that it has wide application in physics, and in other Science and Engineering subjects.	**Credit 2** **No. of hours** 30
	Syllabus for BSc Semester – II Paper -II **BMT2T04: Vector Analysis**	**No. of hours**
	Unit I – <u>Vector Differentiation:</u> Vector triple products, product of four vectors, ordinary derivatives of vectors, space curves, continuity and differentiability, differentiation formulae, partial derivatives of vectors, differentials of vectors.	**8**
	Unit II - <u>Gradient, Divergence and Curl:</u> The vector differential operator del, Gradient, directional derivatives, Divergence, solenoidal vector, Curl, irrotational vector field.	**7**
	Unit III - <u>Vector Integration:</u> Ordinary integrals of vectors, Line Integral, Work done by force, exact differential and scalar potential, Surface integral, Volume integral.	**7**
	Unit IV – <u>Vector Theorems:</u> Green's Theorems in the plane (statement only), Gauss divergence Theorem (statement only), Stokes' Theorem (statement only) and their applications.	**8**
	<u>Reference Books:</u> 1. Theory and Problems of Vector Analysis: Murray R Spiegel, Schaum's Outline Series, McGraw-Hill Book Company, New York. (1974) 2. Introduction to Vector Analysis: N. Saran and S. N. Nigam, Pothishala Pvt. Ltd. Allahabad. 3. Vector Analysis: Shanti Narayan and P. K. Mittal, S. Chand & Co. Ltd, New Delhi (2005). Suggested digital platform: NPTEL/SWAYAM/MOOCs	

	PRACTICAL: BMT2P04: **Vector Analysis**	
Sem- II **Paper - II** **DSC (Core) Code: BMT2P04** **For Minor: BMT2P04**	**Course Outcomes:** CO1: Students will be able to update themselves with foundational knowledge of vector algebra and vector differentiation by solving examples. CO2: The basic skills required in science will be ingrained in students through foundational base of gradient of a scalar function, divergence and curl by solving examples. CO3: New concept of vector integration shall be learnt by students and problems of work done by force shall be solved by them. CO4: Students will be able to solve variety of practical problems in science and engineering by applying Greens theorem, divergence theorem, Stokes' theorem. CO5: The course curriculum is so prepared that it has wide application in physics, and in other Science and Engineering subjects, and this will help students immensely in their future.	**Credit 1** **No. of hours** 30
	Syllabus for BSc Semester – II Paper -II **Practical BMT2P04: Vector Analysis** Note: **Minimum 12** topics from listed practical problems must be conducted, at least 3 from every unit.	
	List of topics for practical problems: (1) Application of product of four vectors (2) Determination of ordinary derivatives of the functions (3) Finding partial derivatives of the functions (4) Determination of differentials of vector functions (5) Solving examples involving gradient of the scalar function, and plotting its graph (6) Application of gradient of function in obtaining directional derivatives (7) Application of divergence in determination of solenoidal vector (8) Learning concept of curl of vector function (9) Application of curl in irrotational/rotational field (10) Performing gradient operation in calculating angle between the surfaces (11) Solving ordinary integrals of vectors (12) Solving line integrals along various paths (13) Application of work done by force along different paths, and to verify if it is independent of the paths (14) Application of surface integrals (15) Application of volume integrals (16) Solving problems by Green's theorem in the plane	

	(17) Application of Green's theorem in the plane (18) Determination of area by Greens's theorem in the plane (19) Application of Gauss theorem (20) Application of Stokes' theorem **Reference Books:** 1. Theory and Problems of Vector Analysis: Murray R Spiegel, Schaum's Outline Series, McGraw-Hill Book Company, New York. (1974) 2. Introduction to Vector Analysis: N. Saran and S. N. Nigam, Pothishala Pvt. Ltd. Allahabad. 3. Vector Analysis: Shanti Narayan and P. K. Mittal, S. Chand & Co. Ltd, New Delhi (2005). **Suitable computer programs can be used:** SageMath/Maxima/SciLab/etc	

BSc Semester – II

Vocational Skill Enhancement Course (VSC)

SEMESTER - II

VSC -02 : Maxima Software System

Maxima is a free, open source computer algebra system, which is primarily used for symbolic computation, including differentiation, integration, Taylor series, Laplace transforms, ordinary differential equations, systems of linear equations, polynomials, sets, lists, vectors, matrices and tensors.

	Maxima Software System	
Sem- II **VSC - 02** **Code:** **BVS2P03**	**PRACTICAL:** **Course Outcomes**: **Students will be able** 1. to develop skills to deliver practical knowledge in its application 2. to explore topics in Calculus, ordinary differential equations, systems of linear equations, polynomials, sets, lists, vectors, matrices 3. to provide algorithms and tools for many domains of mathematics 4. to use as wonderful scientific and graphical calculator	**Credit** **2** **No. of hours** 30
	Syllabus for BSc Semester – II: VSC - 02 **Code BVS2P03: MAXIMA SOFTWARE SYSTEM**	**No. of hours**
	TOPICS: 1. Introduction to Maxima 2. Mathematical functions in Maxima 3. Plotting: 2D and 3D graphical output. 4. Polynomials: Standard forms for polynomials, and Maxima functions operating on them 5. Limits: Limits of expressions 6. Differentiation: Differential calculus 7. Integration: Integral calculus 8. Equations: Defining and solving equations 9. Differential Equations: Defining and solving differential equations 10. Numerical: Numerical integration 11. Matrices: Matrix operations 12. Number Theory: Number theory problems	**30**

	Reference Books: 1. Computational Mathematics Using Maxima Software - Paper 3 - A Manual for SY BSc Mathematics , Dr. Kalyanrao Takale, Dr. Amjad Shaikh, Dr. Veena Kshirsagar, Dr. Shrikisan Gaikwad, Prof. S. R. Patil. 2. Computational Mathematics Using Maxima Software , Dr. K Takale, Dr. S Gailwad, Dr. A Shaikh, Dr. V Kshirsagar, Dr. V Jadhav, Prof. S Patil. 3. Mathematics for Engineers and Science Labs Using Maxima, 1st Edition, by Seifedine Kadry, Pauly Awad. 4. Algebra And Calculus Using Maxima Software, Dr. K. C. Takale, Dr. A. S. Shaikh, Dr. V. S. Jadhav, Dr. S. B. Gaikwad, Prof. S. R. Patil, Nirali Prakashan.	

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

Bachelor of Science (Microbiology)

Submitted by

Board of Studies,
Bachelor of Science (Microbiology)

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)

(Microbiology - Major)

Four Year (Eight Semester Degree Course)

Teaching and Examination Scheme

B.Sc. Sem-I (Microbiology - Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				Th	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Fundamentals of Microbiology	BMI1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Fundamentals of Microbiology	BMI1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Basic Techniques in Microbiology	BMI1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Basic Techniques in Microbiology	BMI1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Calibration, validation and handling of laboratory equipment	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II(Microbiology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Microbial Diversity	BMI2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Microbial Diversity	BMI2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Chemistry of Biomolecules	BMI2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Chemistry of Biomolecules	BMI2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Preparation and standardization of Lab reagents	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

B.Sc. Sem-III (Microbiology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Metabolism	BMI3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Metabolism	BMI3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Environmental Microbiology	BMI3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Environmental Microbiology	BMI3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Microbiology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Food Microbiology	BMI4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Food Microbiology	BMI4P07			2	1	-	-	-	-	25	25	25
3	DSC	Dairy Microbiology	BMI4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Dairy Microbiology	BMI4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Compulsory English	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Microbiology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min.
1	DSC	Medical Microbiology- Host Parasite Relationship	BMI5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Medical Microbiology- Host Parasite Relationship	BMI5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Molecular Biology	BMI5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Molecular Biology	BMI5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Immunology	BMI5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Immunology	BMI5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BMI1T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BMI1P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Microbiology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Industrial Microbiology	BMI6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Industrial Microbiology	BMI6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Medical Microbiology- Microbial Diseases	BMI6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Medical Microbiology- Microbial Diseases	BMI6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Recombinant DNA Technology and Applications	BMI6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Recombinant DNA Technology and Applications	BMI6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BMI6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BMI6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Microbiology- Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Enzymology –I	BMI7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Enzymology –I	BMI7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Virology-I	BMI7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Virology-I	BMI7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Bioinstrumentation II	BMI7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Bioinstrumentation II	BMI7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Microbial Metabolites	BMI7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Microbial Metabolites	BMI7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3	BMI7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BMI7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BMI7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BMI7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Microbiology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Enzymology-II	BMI8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Enzymology-II	BMI8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Virology -II	BMI8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Virology -II	BMI8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Bioinstrumentation – II	BMI8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Bioinstrumentation – II	BMI8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Biomolecules and their Interactions	BMI8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Biomolecules and their Interactions	BMI8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BMI8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BMI8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Microbiology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Enzymology –I	BMI7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Enzymology –I	BMI7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Virology-I	BMI7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Virology-I	BMI7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Bioinstrumentation – I	BMI7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Bioinstrumentation – I	BMI7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BMI7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BMI7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BMI7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BMI7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Microbiology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Enzymology-II	BMI8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Enzymology-II	BMI8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Virology -II	BMI8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Virology -II	BMI8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Bioinstrumentation –II	BMI8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Bioinstrumentation –II	BMI8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BMI8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BMI8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2 +1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Microbiology)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Calibration, validation and handling of laboratory equipment	Microbiology	**BVS1P01**
II	**VSC**	Preparation and standardization of Lab reagents	Microbiology	**BVS2P03**
III	**VSC**	Diagnostic Microbiology	Microbiology	**BVS3P05**
V	**VSC**	Water analysis	Microbiology	**BVS5P07**
VI	**VSC**	Biofertilizers & Biopesticides	Microbiology	**BVS6P08**

Basket for <u>ELECTIVE</u> (DSE) Category Courses (Microbiology- Major)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Bioprocess Technology	BMI5T12
		B. Haematology and Clinical Biochemistry	
VI	Elective 2	A. Applied Agricultural Microbiology	BMI6T16
		B. Biostatistics	
VII (Honors)	Elective 3	A. Drug, Vaccine and Disease Management	BMI7T21
		B. Bioinformatics	
VIII (Honors)	Elective 4	A. Pharmaceutical Microbiology	BMI8T27
		B. Bioethics, Biosafety and IPR	
VII (Research)	Elective 3	A. Drug, Vaccine and Disease Management	BMI7T20R
		B. Bioinformatics	
VIII (Research)	Elective 4	A. Pharmaceutical Microbiology	BMI8T25R
		B. Bioethics, Biosafety and IPR	

R' in the subject code indicates 'Research'.

Introduction:

Microbiology is a branch of science that deals with study of microorganism i.e. bacteria, protozoa, algae, fungi, viruses. It studies their interaction with their environments as well as how these organisms are harnessed in human endeavour and their impact on society. The microbiological study has wide range of scope ranging from basic sciences to applied sciences. .Microbiological study is mainly focused on health care, agricultural, food, dairy, environmental and industrial use.

Microbiology is at the heart of the healthcare industry, whether they're developing diagnostic kits, vaccines, biologics, pharmaceuticals, or medical gear. Microbiology fields such as molecular biology, cell biology, recombinant technology, and immunotherapeutics benefited from the medical sector's evolution. For those interested in a career in Medical Microbiology, there are numerous career prospects in health care/ pharma industry in various departments such as- production, R&D, QC, sales & marketing, content writing/ technical writing etc. & entrepreneurship. Also can be employed in diagnostic centers, in hospitals as laboratory staff or paramedical, hospital management as bio safety & hygiene management staff. In Medical academics also contribution can given.

In Agrculture low crop yield, crop quality deterioration, weeds, loss of soil fertility, abiotic stress, and biotic stress are the issues to be addressed . Microorganisms are also helpful in enhancing the crop productivity. Our students are entrepreneur in this field. The biofertilizers, biopesticides are produced in bulk and are commercialized by few of our students. Incidentally biofertilizers are ecofriendly. In this field students can get employment in govt. sector, private sector in production, QC, R&D, Academics & a vast scope for entrepreneurship.

Food microbiology overcomes challenges in food production, processing, and preservation. The production of value-added food products are the greatest examples. In food & beverage industry microbiologists play an important role in production , QC, R& D, supply chain management. Many fermented products are produced where microbiologist have a key role. Dairy industry also demands microbiologists as it produces packed milk to development of fermented products. Functional foods like probiotic foods & single cell proteins are the examples. Food Safety is a new area for employment. For entrepreneurship large opportunities are available. Packed Mineral water is another sector. Food industry provides large scope for microbiologist. Our students have occupied jobs at different food industries. Microbiology always helps in introducing technology which aims to enhance the production, processing, packaging and preservation of food also.

Environmental microbiology aims to restore the balance between nature, ecology and human interest. Bioremediation and biological intervention is only possible by the way of utilization of techniques of microbiology. All these issues are now being addressed by using biotech processes. Microbes like bacteria, fungi algae and plants are being used in the process of bioremediation.

Beside job opportunities in the sector of agriculture, pharmaceutical and food industries our students are working as research fellow at various National Institutes. Many students are working as Assistant Professor in colleges, Laboratory Technicians at Government and private pathological laboratories**.**

Objetive to be achieved

- To enrich Knowledge and train them in field of Microbiology
- To aware students about applied Microbiology as well as in research field
- To inculcate sense of scientific responsibilities and social and environment awareness
- To get successful career in the Microbiology field

Course Structure:

- As per scheme given in table
- For the purpose of computation of workload, the following mechanism may be adopted as per UGC guidelines:
  - i) 1 Credit = 1 Theory period of one-hour duration per week
  - ii) 1 Credit = 1 Tutorial period of one-hour duration per week
  - **iii)** 1 Credit = 1 Practical period of two-hour duration per week

B. Sc. Semester-I
Discipline Specific Core Course (DSC-1)-MICROBIOLOGY - Paper-I
(BMI1T01) (FUNDAMENTALS OF MICROBIOLOGY)

DSC-1 THEORY	**Hours: 2+2=04 Hours /Week**	**Marks: 80+20=100**	**Credit: 2+1=03**
	Unit-I		
History of Microbiology	1. Discovery of Microbes, 2. Theory of biogenesis & abiogenesis 3. Contributions of- Antonie van Leeuwenhoek, Louis Pasteur , Robert Koch, Joseph Lister, Winogradsky, Beijerinck, John Tyndall, Thomas M. Rivers 4.Branches of Microbiology- Definition and scope of a) Systemic Microbiology- Bacteriology, Mycology, Phycology, Virology, b) Biotechnology, c) Geo microbiology, d)Exobiology, e) Medical microbiology, f) Environmental MicrobiologY g) Industrial Microbiology h) Food Microbiology.		**7 Hrs**
	Unit-II		
Bacterial cell structure	1. Differences between prokaryotes and eukaryotes 2. Description of sizes, shapes and arrangements of bacteria 3. **Typical Bacterial cell structure**- a) Structure of cell wall (Gram positive & Gram negative bacteria) b) Cell membrane:- Fluid mosaic model, mesosomes 4. Ribosomes, Nucleoid, Plasmids, cytoplasmic inclusions 5. Capsules, slime layer, pilli, flagella 6. Endospore structure- formation, germination. 7. Exospores, Myxospores, Eukaryotic spores 8. Significance of dormancy		**7 Hrs**
	Unit III		
Microbial Nutrition	1. Nutritional types of bacteria 2. Basic nutritional requirements. 3. Types of culture media- Selective, Differential, Enriched, Synthetic and non synthetic (Definition, ingredients, principle and applications). 4. Media for isolation of fungi- Definition, ingredients, principle and applications 5. Enrichment Culture		**8 Hrs**

Unit IV		
Microbial growth	1. Bacterial reproduction. 2. Axenic cultures. 3. Growth curve 4. Mathematical expression of growth. 5. Continuous culture – Chemostat and turbidostat 6. Synchronous growth 7. Diauxic culture 8. Factors influencing microbial growth.	**8 Hrs**

Reference Books:

1. Prescott, Hurley. Klein-Microbiology, 7th edition, International edition, McGraw Hill.
2. Kathleen Park Talaro& Arthur Talaro - Foundations in Microbiology International edition 2002,| McGraw Hill.
3. Michael T. Madigan & J. M. Martin, Brock, Biology of Microorganisms 12th Ed. International edition 2006, Pearson Prentice Hall
4. A.J. Salle, Fundamental Principles of Bacteriology.
5. Stanier. Ingraham et al ,General Microbiology 4th & 5th Ed. 1987, Macmillan Education Ltd
6. Microbiology TMH 5th Edition by Michael J. Pelczar Jr., E.C.S. Chan ,Noel R. Krieg
7. Microbiology An Introduction. 6th Edition. Tortora, Funke and Case. Adisson Wesley Longman Inc. 1998.
8. Kanungo R. (2017). Ananthanarayan and Paniker's Textbook of Microbiology. 10th edition. Universities Press, Hyderabad, India
9. Powar C. B. and Daginawala H. I. (2005). General microbiology Volume I. Himalaya Publishing House Private Limited, Pune, India.
10. Powar C. B. and Daginawala H. I. (2005). General microbiology Volume II. Himalaya Publishing House, Private Limited, Pune, India
11. Reddy S. M., Girisham S. and Narendra Babu G. (2017). Applied Microbiology (Agriculture, Environmental, Food and Industrial Microbiology). Scientific Publishers, Jodhpur, Rajasthan, India

List of Experiments:
Perform at least 5 practical (Excluding 1, 2 & 3).

1. General guidelines for safety in microbiology laboratory, possible laboratory hazards, safety precautions and disposal of laboratory waste and ethics in microbiology.
2. General concept of basic equipments & apparatus.
3. Preparation of media & stains.
4. Study of permanent slides of Streptococci, Diplococci, Capsule forming bacteria, Micrococcus sp. *Clostridium tetani*, *Bacillus anthracis*, *Vibrio cholera*, *Mycobacterium tuberculosis, Treponema palladium,* Cell organelles
5. Demonstration of microbes from environment, skin & teeth – Study colony characteristics (Major).
6. Staining—Simple staining.
7. Differential staining - Gram staining,(Major).
8. Bacterial motility by hanging drop method (Major).
9. Anaerobic cultivation of bacteria.
10. Effect of pH or temperature on growth of bacteria. (Major)
11. Measurement of microbial cell size by Micrometry. (Major)

Scheme of practical examination-

1. One long expt.----------..10 Marks
2. One short expt.----------..05 Marks
4. Viva-voce----------05 Marks
5. Record----------05 Marks

Total Marks= 25

Course outcomes

After this course the students will be able to

Sr. No.	Course outcome
1.	Students will understand the contributions of different scientists in the fields of Microbial science..
2.	Students will have knowledge about the established and emerging fields of science with respect to Microbiology.
3.	Students will have knowledge about basic structure & nutritional requirement of bacteria
4.	Develop practical skills to handle microorganism aseptically
5.	Understand the use of apparatus and their use without fear.
6.	Correlate their Microbiology theory concepts with practical outcomes.

B. Sc. Semester-I Discipline Specific Core Course (DSC-2)-MICROBIOLOGY - Paper- II (BMI1T02) (BASIC TECHNIQUES IN MICROBIOLOGY)			
DSC-2 THEORY	**Hours: 2+2=04 Hours /Week**	**Marks: 80+20=100**	**Credit: 2+1=03**
Unit-I			
Microscopy	**Principle, applications and ray diagram:** 1. Simple, compound microscope—Bright field Microscopy, 2. Dark field Microscopy, 3. Electron microscopy (TEM, SEM), 4. Phase-contrast microscopy, 5. Fluorescent microscopy.		**7 Hrs**
Unit-II			
Staining Techniques.	1. Stains & dyes, chromophore, auxochrome, chromogenes, types of stains 2. Theories of staining 3. Staining techniques : Simple, negative staining, differential staining- Gram staining, acid-fast staining 4. Staining of specific structures: flagella , spores, capsule		**7 Hrs**
Unit III			
Microbial Techniques	1. Isolation of pure culture by various methods. 2. Determination of nutritional requirement by auxonographic technique, replica plating technique & multi-point inoculator technique. 3. Measurement of growth 4. Preservation of microorganisms, National & international collection centers		**8 Hrs**
Unit IV			
Microbial control	1. Terms & definitions used in microbial control- Sterilization, inhibition, Microbiostatic, microbicidal, disinfectant, sanitizer, viricide, sporicide, antimetabolite antibiotic, germicide, Preservative etc. 2. Concept of microbial death 3. Properties of ideal antimicrobial agent. 4. Physical control methods—types, mode of action & applications only-a) High & low temperature b) filtration c) radiation d) osmotic pressure. 5. Chemical agents—Different types, mode of action & applications only- a) Phenols b) Alcohols c)Halogenes d) Heavy metals e) Quaternary ammonium compounds f) surface active agents g) phenol-coefficient 6. Mechanism of cell injury 7. Chemotherapeutic agent—sulphonamides only- mode of action & application, Antibiotics, examples according to mode of action, source		**8 Hrs**

Reference books -

1. Introduction to Microbial Techniques by Gunasekaran
2. Microbiology: Fundamentals and Applications by Ronald M. Atlas, New York: Macmillan Publication
3. Powar C. B. and Daginawala H. I. (2005). General microbiology Volume I. Himalaya Publishing House Private Limited, Pune, India.
4. Powar C. B. and Daginawala H. I. (2005). General microbiology Volume II. Himalaya Publishing House, Private Limited, Pune, India
5. Debnath M., Prasad G. B. and Bisen P. S. (2012). Microbes: Concepts and Applications. Germany: Wiley.
6. McDonnell G. E. (2020). Antisepsis, Disinfection, and Sterilization: Types, Action, and Resistance. United States: Wiley.
7. Pelczar M. J. Jr., Chan E.C.S. and Krieg N. R. (2010). Microbiology: An Application based Approach. McGraw-Hill Education (India) Private Limited, New Delhi, India.
8. Pierce B. E. and Leboffe M. J. (2019). Microbiology: Laboratory Theory and Application: Essentials. United States: Morton Publishing
9. Tortora G. J., Funke B. R. and Case C. L. (2016). Microbiology: An Introduction. Twelfth edition. Pearson, London.
10. Sharma K. (2007). Manual of Microbiology (Second Edition). ANE Books, New Delhi, India.

List of Experiments:
Perform at least 5 practical (Excluding 1)

1. General guidelines for safety in microbiology laboratory, possible laboratory hazards, safety precautions and disposal of laboratory waste and ethics in microbiology.
2. Isolation of pure culture by streak & spread plate method,
3. Isolation of pure culture by serial dilution and pour plate method. (Major).
4. Effect of Oligodyanamic action of heavy metal on microbial growth. (Major).
5. Effect of UV radiation on bacteria. (Major).
6. Effect of salt & sugar concentration on bacterial growth. (Major).
7. Bacterial endospore staining.
8. Capsule Staining.
9. Staining of Metachromatic granules.
10. Flagella Staining.

Scheme of practical examination as per Paper 1 practical.

COURSE OUTCOMES

After this course the students will be able to

Sr. No.	Course outcome
1.	Students will be able to understand the needs and basics of techniques used in observing microbes.
2.	Students will be aware of applications of basic techniques.
3.	Students will learn sterilization and disinfection principles and procedures
.4	Students will learn cultivation & aseptically handling of microorganism.

Calibration, Validation & Handling of Laboratory Equipments
Course Code: (BVS1P01)

VSC	Hours: 04 Hours /Week	Marks: SEE= 50 CIE= 50	Credit: 02

60 Hrs

LIST OF EXPERIMENTS
(Perform at least 10 practical)

1. Calibration, validation and handling of Ph meter
2. Calibration, validation and handling of Incubator
3. Calibration, validation and handling of Oven
4. Calibration, validation and handling of Laminar Air Flow
5. Calibration, validation and handling of Autoclave
6. Calibration, validation and handling of Electric Balance
7. Calibration, validation and handling of Thermometer
8. Calibration, validation and handling of Pressure Gauge
9. Handling and general maintenances of Microscope
10. Washing and cleaning of Laboratory glass ware for Microbiological work
11. Handling of centrifuge machine
12. Calibration of colorimeter
13. Calibration constant temperature water bath

Scheme of Practical Examination:

1. Two long expt.----------. 15 Marks each
2. Viva-voce---------- 10 Marks
3. Record---------- 10Marks

Total Marks = 50

Reference Books:

1. Praful B. Godkar and Darshan P Godkar, 2011, Textbook of Medical Laboratory Technology 2nd edition, Bhalani publishing house, Mumbai
2. Fischbach, 2005. Manual of lab and diagnostic tests, Lippincott Williams Wilkins, New York
3. J Ochei & Kolhatkar, 2002. Medical laboratory science theory and practice, Tata McGraw- Hill,
4. New Delhi.
5. Indian Pharmacopoeia Commission (IPC)
6. U.S. Pharmacopoeia (USP)

Course outcomes

After this course the students will be able to

Sr. No.	Course outcome
1.	Student will learn the basic knowledge of calibration, validation handling of laboratory instruments
2.	The knowledge is very useful for opting job in industries.

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr

P.U. Meshram, Allied Publishers, New Delhi.

8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group

Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

B. Sc. Semester-II Discipline Specific Core Course (DSC-)-MICROBIOLOGY - Paper-III (BMI1T03) (MICROBIAL DIVERSITY)			
DSC - 3 THEORY	**Hours: 2+2=04 Hours /Week**	**Marks: 80+20 = 100**	**Credit: 2+1=03**
Unit-I			
Prokaryotic microbes	1. General characters of a) Proteobacteria, b) Mycoplasma, c) Rickettsia and d) Chlamydia 2. Cyanobacteria: Characteristics of anabena and applications of cyanobacteria 3. Actinomycetes: Characteristics of Streptomyces and their applications 4. Archae bacteria: Types of archae bacteria (Brief description), Methanogenic bacteria and their importance		**7 Hrs**
Unit-II			
Eukaryotic microbes	1. Fungi and yeast: General characters, Asexual and sexual mode of reproduction, 2. Algae:-General characters and industrially important algal cells 3. Protozoans: General characters and life cycle Of *Entamoeba histolytica*		**7 Hrs**
Unit III			
Acellular microbes: Viruses.	1. Discovery of viruses, General structure, symmetry and classification 2. Cultivation, chick embryo & tissue culture method 3. Detection of viral growth 4. T4-Bacteriophages- lytic cycle, 5. Lambda phage- Lysogenic cycle.		**8 Hrs**
Unit IV			
Microbial interaction	1. Positive and negative interaction: Commensalism, synergism, syntropism, mutualism, parasitism, predation, antagonism, competition 2. Life cycle of Bdellovibrio 3. Protist-Plant interaction: Root nodule bacteria 4. Protist-Animal interaction: Rumen bacteria, insect midgut bacteria, luminescent bacteria		**8 Hrs**

Reference Books:

1. Prescott, Hurley. Klein-Microbiology, 7th edition, International edition, McGraw Hill.
2. Stanier.Ingrahametal, General Microbiology 4th & 5th Ed.1987, Macmillan Education Ltd
3. Microbiology An Introduction. 6th Edition. Tortora, Funke and Case. Adisson Wesley Longman Inc. 1998.
4. Powar C. B. and Daginawala H. I. (2005). General microbiology Volume I. Himalaya Publishing House Private Limited, Pune, India.
5. Powar C. B. and Daginawala H. I. (2005). General microbiology Volume II. Himalaya Publishing House, Private Limited, Pune, India
6. Madigan M.T, Martinko J M, Dunlap P V and Clark. D P. 2008. Brock Biology of Microorganisms. 12th Ed. Pearson/ Prentice Hall
7. Arora B. and Arora D. R. (2020). Practical Microbiology. CBS Publishers and Distributors, New Delhi, India.
8. Tortora G. J., Funke B. R. and Case C. L. (2016). Microbiology: an Introduction. Twelfth edition. Pearson, London.

List of Experiments:
Perform at least 5 practical

1. Study of permanent slides of special bacteria--- Fungi (*Aspergillus, Penicillium* and *Mucor*) Protozoa (*Plasmodium vivax*, *Trypanosoma* and *amoeba*) & Algae (*Spirullina, Anabena* and *Euglena*), *Mycoplasma, Rickettsia* and *Chlamydia.*
2. Slide culture techniques for the cultivation and study of mould. (Major)
3. Isolation of Anabaena and study its morphology
4. Isolation of Protozoa from water.
5. Isolation of Bacteriophage. (Major)
6. Isolation of Rhizobium from root nodules. (Major)
7. Enumeration of phytoplankton by haemocytometer.
8. Study of bacterial motility by hanging drop method. (Major)

Scheme of practical examination as per Paper 1 practical.

COURSE OUTCOMES

After completing this course students will be able to

Sr. No.	Course outcome
1.	Acquire basics and importance of Microbiology
2.	Learn about basic characteristics features of microorganisms
3.	Describe the classification of Bactria
4.	Gain insights into the important characters, classification & life cycle of viruses.

B. Sc. Semester-II

Discipline Specific Core Course (DSC-4)-MICROBIOLOGY - Paper-IV

(BMI1T04)

(CHEMISTRY OF BIOMOLECULES)

DSC - 4 THEORY	**Hours: 2+2=04 Hours /Week**	**Marks: 80 + 20 = 100**	**Credit: 2+1=03**
	Unit-I		
Carbohydrates and Lipids	1. Classification of carbohydrates, 2. Structure of glucose, fructose, maltose, lactose, sucrose, raffinose, starch, hyaluronic acid, glycogen, cellulose, osazone formation 3. Classification of lipids, structure of triglyceride, compound lipids, derived lipids		**7 Hrs**
	Unit-II		
Amino acids and proteins	1. Classification of amino acids, 2. Titration curve, acidic, basic and neutral amino acids, 3. Peptide bond theory, 4. Organizational levels of proteins, 5. Concept of oligomeric protein		**7 Hrs**
	Unit III		
Enzymology	1. Definitions and nature of enzymes, classification, nomenclature, 2. Primary concept of enzyme kinetics, MM equation, modifications of MM equations, 3. Activation energy, transition state, ES complex, enzyme activity, katal, specific activity ,turnover number 4. Allosteric sites, allosteric modulaters, 5. Functional diversity such as holoenzyme, apoenzyme, coenzyme, cofactor, prosthetic group, isoenzymes, 6. Membrane bound enzymes, multienzyme complex, zymogens		**8 Hrs**
	Unit IV		
Nucleic acid and Vitamins	1. Structure of purines, pyrimidines, nucleosides, nucleotides, 2. Structure of DNA, RNA, and various forms of DNA 3. Types of vitamins, Classification on the basis of solubility, functions of vitamins, 4. Hypervitaminosis – Definition, causes, symptoms, treatment of Vit. A and D 5. Hypovitaminosis – Definition, causes, symptoms, treatment of Vit. B12, A and D		**8 Hrs**

Reference Books:

1. Lehninger. Principles of Biochemistry. 4th Edition. D. Nelson and M. Cox. W.H. Freeman and Company. New York2005
2. Microbiology an Introduction. 6th Edition. Tortora, Funke and Case. Adisson Wesley Longman Inc. 1998.
3. Prescott, Hurley. Klein-Microbiology, 5th & 6thedition, International edition 2002 & 2006, McGraw Hill.
4. Garrett, R. H. and Grisham, C. M. (2004) Biochemistry. 3rd Ed. Brooks/Cole Publishing
   Company, California.
5. Conn Eric, Stumpf Paul K., Bruuening George, Doi Roy H., (1987) Outlines of Biochemistry 5th Ed , John Wiley and Sons, New Delhi.
6. Miller A. D. and Tanner J. (2013). Essentials of Chemical Biology: Structure and Dynamics of Biological Macromolecules. Germany: Wiley.
7. Powar C. B. and Daginawala H. I. (2005). General microbiology Volume I. Himalaya Publishing House Private Limited, Pune, India.

List of Experiments
Perform at least 5 practical

1. Preparation of normal and molar solutions.
2. Preparation of buffer solutions (any 4)
3. Qualitative detection of carbohydrates.
4. Qualitative detection of Protein or amino acids.
5. Qualitative detection of Lipids
6. Determination of pKa value of amino acid. (Major)
7. Quantitative estimation of DNA by DPA method. (Major)
8. Quantitative estimation of RNA by Orcinol method. (Major)
9. Quantitative estimation of protein by Folin Lowry method (Major)
10. Extraction and detection beta carotene
11. Detection of amylase/lipase/gelatinase. (Major)

Scheme of practical examination as per Paper 1 practical.

COURSE OUTCOMES

After completing this course students will be able to

Sr. No.	Course outcome
1.	Students will learn about different types of biomolecules and their functions.
2.	To categorize on the types of enzymes and their mechanism.
3.	Students will learn about the various diseases due to deficiency of vitamins.

Preparation & Standardization of Laboratory Reagents
Course Code: (BVS2P03)

VSC	Hours: 04 Hours /Week	Marks: SEE= 50 CIE= 50	Credit: 02

60 Hrs

LIST OF EXPERIMENTS
(Perform at least 10 practical)

1. Preparation of standard Molar solution of Glucose
2. Preparation of standard Molar solution of Glycine
3. Preparation of standard Molar solution of NaoH and its standardization
4. Preparation of standard Molar solution of HCL and its standardization
5. Preparation of working standard molar solution from stock standard molar solution
6. Preparation of physiological saline solution
7. Preparation of standard buffer solution. Exa. Phosphate buffer and carbonate buffer
8. Preparation of standard normal solution of Bicarbonate and its standardization
9. Preparation of standard normal solution of acetic acid and its standardization
10. Preparation of Leishman stain
11. Preparation of crystal violet solution
12. Preparation of Lugol's iodine
13. Preparation of malachite green solution for spore staining

Scheme of Practical Examination:

4. Two long expt.----------. 15 Marks each
5. Viva-voce---------- 10 Marks
6. Record---------- 10Marks

Total Marks = 50

Reference Books:

1. Plummer, David T. Introduction to Practical Biochemistry, Tata McGraw-Hill Publishing New Delhi
2. Praful B. Godkar and Darshan P Godkar, 2011, Textbook of Medical Laboratory Technology 2nd edition, Bhalani publishing house, Mumbai
3. **Thimmaiah S.K.**, **Standard Methods of** Biochemical **Analysis,** Kalyani Pub.
4. Victor W. Rodwell, David Bender, **Harper**'s Illustrated **Biochemistry** Thirty-First Edition
5. Indian Pharmacopoeia Commission (IPC)

Course outcomes

After this course the students will be able to

Sr. No.	Course outcome
1.	Student will learn the basic knowledge of solution and reagents preparation.
2.	The knowledge is very useful for opting job in industries.

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

Bachelor of Science (Physics)

Submitted by

Board of Studies,

Bachelor of Science (Physics)

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research) (Physics - Major)

Four Year (Eight Semester Degree Course) Teaching and Examination Scheme

B.Sc. Sem-I (Physics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Measurement, Mechanics, and Properties of Matter	BPH1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Measurement, Mechanics, and Properties of Matter	BPH1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Kinetic Theory of Gases and Thermodynamics	BPH1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Kinetic Theory of Gases and Thermodynamics	BPH1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Electronic and Electrical Components	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Physics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Acoustic and Ultrasonics	BPH2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Acoustic and Ultrasonics	BPH2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Oscillations and Blackbody Radiation	BPH2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Oscillations and Blackbody Radiation	BPH2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Instrumental Errors in Measurement	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

B.Sc. Sem-III (Physics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Solid State Physics	BPH3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Solid State Physics	BPH3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Optics	BPH3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Optics	BPH3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)	BPH1T01	2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)	BPH1P01	-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)	BPH1T02	2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)	BPH1P02	-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (Physics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Lasers and Optical Fibres	BPH4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Lasers and Optical Fibres	BPH4P07			2	1	-	-	-	-	25	25	25
3	DSC	Mathematical Physics	BPH4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Mathematical Physics	BPH4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)	BPH2T03	2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)	BPH2P03			2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)	BPH2T04	2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)	BPH2P04			2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Compulsory English	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Physics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min.
1	DSC	Electrostatics and Electric Currents	BPH5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Electrostatics and Electric Currents	BPH5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Magnetostatics and Magnetism	BPH5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Magnetostatics and Magnetism	BPH5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Electronic Devices and Circuits	BPH5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Electronic Devices and Circuits	BPH5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BPH5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BPH5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)	BPH3T05	2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)	BPH3P05	-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)	BPH3T06	2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)	BPH3P06	-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (Physics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Quantum Mechanics-I	BPH6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Quantum Mechanics-I	BPH6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Classical Mechanics	BPH6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Classical Mechanics	BPH6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Atomic and Molecular Physics	BPH6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Atomic and Molecular Physics	BPH6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BPH6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BPH6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)	BPH4T07	2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)	BPH4P07	-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Physics - Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Numerical Methods and Complex Analysis	BPH7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Numerical Methods and Complex Analysis	BPH7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Statistical Physics	BPH7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Statistical Physics	BPH7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Electrodynamics	BPH7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Electrodynamics	BPH7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Advanced Mathematical Physics	BPH7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Advanced Mathematical Physics	BPH7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3	BPH7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BPH7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BPH7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BPH7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Physics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Quantum Mechanics -II	BPH8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Quantum Mechanics -II	BPH8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Spectroscopy	BPH8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Spectroscopy	BPH8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Nuclear and Particle Physics	BPH8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Nuclear and Particle Physics	BPH8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Advanced Electrodynamics	BPH8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Advanced Electrodynamics	BPH8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BPH8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BPH8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Physics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Numerical Methods and Complex Analysis	BPH7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Numerical Methods and Complex Analysis	BPH7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Statistical Physics	BPH7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Statistical Physics	BPH7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Electrodynamics	BPH7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Electrodynamics	BPH7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BPH7T21R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BPH7P21R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BPH7T22R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BPH7P22R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Physics - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Quantum Mechanics -II	BPH8T23R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Quantum Mechanics -II	BPH8P23R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Spectroscopy	BPH8T24R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Spectroscopy	BPH8P24R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Nuclear and Particle Physics	BPH8T25R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Nuclear and Particle Physics	BPH8P25R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BPH8T27R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BPH8P27R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2 +1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Physics)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Electronic and Electrical Components	Physics	**BVS1P01**
II	**VSC**	Instrumental Errors in Measurement	Physics	**BVS2P03**
III	**VSC**	Regulated Power Supply	Physics	**BVS3P05**
V	**VSC**	Optical Instruments	Physics	**BVS5P07**
VI	**VSC**	Installation of Rooftop Solar Systems	Physics	**BVS6P08**

Basket for <u>ELECTIVE</u> (DSE) Category Courses (Physics)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	Digital Electronics and Microprocessor	BPH5T12A
		Optoelectronics and Devices	BPH5T12B
VI	Elective 2	Analogue and Communication Electronics	BPH6T16A
		Astrophysics and Special Theory of Relativity	BPH6T16B
VII (Honors)	Elective 3	Experimental Techniques in Physics	BPH7T21A
		Sources of Energy and Energy Storage Devices	BPH7T21B
VIII (Honors)	Elective 4	Biophysics and Biodevices	BPH8T27A
		Nanomaterials and Properties	BPH8T27B
VII (Research)	Elective 3	Experimental Techniques in Physics	BPH7T21RA
		Sources of Energy and Energy Storage Devices	BPH7T21RB
VIII (Research)	Elective 4	Biophysics and Biodevices	BPH8T27RA
		Nanomaterials and Properties	BPH8T27RB

'R' in the subject code indicates 'Research'.

B. Sc. Semester-I Discipline Specific Core Course (DSC-1)-PHYSICS - Paper-I (BPH1T01) (Measurements, Mechanics, and Properties of Matter)			
DSC-1 THEORY	**Hours: 2+2=04 Hours /Week**	**Marks: 80+20=100**	**Credit: 2+1=03**
Unit-I			
Measurements	Definition of Physics; levels and need of measurement; CGS and SI units, fundamental and derived physical quantities, and their units. Length, mass, and time measurements. Definition of Seven Fundamental Units and their applications in industries and society. Least count, accuracy, and precision of measuring instruments (Viz. Meter scale, Vernier Callipers, Screw Gauge, Travelling microscope, spectrometer, voltmeter, ammeter, etc.). Errors in measurement, Significant figure. Dimensions of Physical quantities, dimensional analysis, and its applications.		**7 Hrs**
Unit-II			
Newtonian Mechanics	Force and Inertia, Newton's First Law of motion; Momentum, Newton's Second Law of motion; Impulse; Newton's Third Law of motion. Law of conservation of linear momentum and its applications, Collisions. Static and Kinetic friction, laws of friction, rolling friction. Dynamics of uniform circular motion: Centripetal and centrifugal forces and their applications		**7 Hrs**
Unit III			
Motion	Frame of reference, motion in a straight line: position-time graph, speed, and velocity. Uniform and non-uniform motion, average speed and instantaneous velocity, uniformly accelerated motion, velocity-time, position-time graphs, relations for uniformly accelerated motion. Relative Velocity, Motion in a plane, Projectile Motion, Uniform Circular Motion.		**8 Hrs**
Unit IV			
Properties of Matter	Elastic behaviour, Stress-strain relationship, Hooke's Law, Young's modulus, bulk modulus, modulus of rigidity. Pressure due to a fluid column; Pascal's law and its applications. Viscosity, Stokes' law, terminal velocity, streamline and turbulent flow, Reynolds number. Bernoulli's principle and its applications. Surface energy and surface tension, angle of contact, application of surface tension – drops, bubbles, and capillary rise.		**8 Hrs**

Reference Books:

1. Mechanics: D.S. Mathur, S. Chand, and Company.
2. The Physics of Sound Third Edition Richard E. Berg, David, David G. Stork, Pearson Publication, 2012.
3. Introduction to Classical Mechanics, 2nd ed. - Atam P. Arya by Prentice Hall Publishing
4. Continuum Mechanics and Elements of Elasticity Structural Mechanics - Victor E. Saouma.
5. Feynman Lectures on Physics (Volumes 1,2,3)- Feynman, Leighton and Sands.
6. Theory of elasticity, McGraw-Hill Education (India) Private Limited, 2010
7. Handbook of Measurement Error Models, Edited By Grace Y. Yi, Aurore Delaigle, Paul Gustafson, 2021, published by Chapman & Hall

List of Experiments:

1. Torsional Oscillations: To determine modulus of rigidity η of a material of wire by torsional pendulum
2. Torsional Oscillations: To determine modulus of rigidity η of a material of wire by Maxwell's needle
3. Spectrometer: To find least count of a spectrometer.
4. Spectrometer: To determine angle of prism.
5. To determine 'Y' (Young's Modulus) of a wire material by method of vibrations-Flat spiral Spring
6. To find the Young's Modulus of a material by method of bending of beam
7. To determine Coefficient of Viscosity (η) of a given liquid by Poiseuille's Method
8. Determination of Surface Tension of mercury / Angle of contact of liquids
9. To determine equivalent focal length of a lens system by magnification method.
10. Spectrometer: To determine refractive index μ of the material of prism
11. To determine the moment of inertia of a fly-wheel.
12. To find the surface tension by capillary rise method
13. To determine the surface tension of a liquid by Jaeger's method.

Course outcomes

After this course the students will be able to

Sr. No.	Course outcome
1.	Develop interest in measurement with conceptual knowledge of physics.
2.	Develop practical skills in accurate measurements with minimal errors.
3.	Understand and practice these skills while performing physics practical.
4.	Understand the use of apparatus and their use without fear.
5.	Correlate their physics theory concepts with practical outcomes.
6.	Understand the concepts of errors and their estimation.

B. Sc. Semester-I Discipline Specific Core Course (DSC-2)-PHYSICS - Paper- II (BPH1T02) (Kinetic theory of gases and Thermodynamics)			
DSC-2 THEORY	**Hours: 2+2=04 Hours /Week**	**Marks: 80+20=100**	**Credit: 2+1=03**
Unit-I			
Kinetic Theory of Gases	Assumptions of kinetic theory of gases, Molecular collision, Mean free path and collision cross section, Expression for mean free path (Clausius Expression) Degrees of freedom, Law of equipartition of energy, Derivation of Maxwell's law of distribution of velocities and its experimental verification. Momentum and viscosity of gas, Transport of energy and thermal conductivity, Transport of mass and diffusion, their relationship,		**7 Hrs**
Unit-II			
Real Gases and Thermodynamics	Van der wall's real gas, Equation of state, Critical constants, Van der wall's constants, Critical coefficient, limitations. Thermodynamic variables, Thermal equilibrium and temperature, Zeroth law of thermodynamics, Thermodynamic processes (isothermal, adiabatic, isochoric, isobaric), Indicator diagram, Work done during isothermal and adiabatic processes, Specific heats at constant pressure and volume, First law of thermodynamics,		**7 Hrs**
Unit III			
Heat Engine and Entropy	Thermodynamic processes (Reversible and Irreversible), Heat engine, Carnot's ideal heat engine, Carnot's cycle and it's efficiency, Second law of thermodynamics, Carnot's theorem. Concept of entropy, Change in entropy in reversible cycle, Principle of increase of entropy of the universe in reversible and irreversible process. Second law of thermodynamics in terms of entropy, Thermodynamic scales of temperature, Absolute zero on thermodynamic scale, Third law of thermodynamics, T-S diagram.		**8 Hrs**
Unit IV			
Maxwell's Relations	Maxwell's thermodynamic relations [$\delta (T, S)/ \delta (x, y) = \delta (P, V)/ \delta (x, y)$] and it's applications, Clausius-Clapeyron latent heat equation, Joule-Thomson effect, Porous plug experiment, Joule-Thomson coefficient. Inversion temperature, Boyls law.		**8 Hrs**

Reference books -

1. Heat, Thermodynamics and Statistical Physics, by- Singhal, Agrawal.
2. Heat and Thermodynamics, by- Brijlal, Subramanyam.
3. A Text Book of Heat, by- J. B. Rajam.
4. Heat, thermodynamics and statistical physics, by- Brijlal, Subramayam and Hemne.
5. Heat and thermodynamics, by- C. L. Arora.
6. Principles of Thermodynamics by Jean-Philippe Ansermet, Sylvain D. Brechet, Cambridge University Press; 1st edition (2019)
7. Introduction to Electrodynamics by David J. Griffiths (Author)Cambridge University Press; 4th edition (2017)

List of Experiments:

1. To determine the pressure coefficient of air by constant volume air thermometer.
2. To verify the Stefan's law of radiation by using an incandescent lamp.
3. Thermal conductivity of a metal rod using Forbes method.
4. Thermal conductivity of a bad conductor by Lee's disc method.
5. To determine the critical temperature and critical pressure of a gas.
6. To determine the coefficient of thermal conductivity of glass in the form of a tube.
7. To determine specific heat of a given liquid by method of cooling.
8. Mechanical equivalent of heat by Calendar- Barne's constant flow method.
9. To determine the mechanical equivalent of heat (J) with the help of Joule's calorimeter.
10. To determine temperature coefficient of resistance of platinum using platinum resistance thermometer
11. Study of heating efficiency of electrical kettle with varying voltages.
12. To determine the ratio of specific heats of a gas (γ) by Clement and Desormes method.
13. To study the Boyle's law and to verify it experimentally.
14. To study Charle's law and to verify it experimentally.
15. To verify the Stefan's law of radiation by using an incandescent lamp.

COURSE OUTCOMES

After this course the students will be able to

Sr. No.	Course outcome
1.	Understand the assumptions of kinetic theory of gases, ideal and real gases.
2.	Understand the nature of calorimetry by specific heat of solids and gases.
3.	Analyses different transport phenomena in gases
4.	Describe basic concepts of Thermodynamics.
5.	Analyses the laws of thermodynamics in different cases and entropy.
6.	Restate definition of system, surrounding, closed and open system, extensive and intensive variables and properties.
7.	Design various types of basic heat engines.
8.	Apply Maxwells thermodynamic relations.
9.	Understanding the low temperature physics

B. Sc. Semester-1 Vocational Skill Course (VSC - 1) - PHYSICS Course Code (BVS1P01) (Electronic and Electrical Components)			
VSC-1 Practical	**04 Hours /Week**	**Marks: 100**	**Credit: 02**
Components	**Name of Experiments** (Any 10 experiments to be performed)		
Resistors	1. **To study the coding of given Carbon Resistance and compare it with its practical value measured by a Multimeter. Find its tolerance range and calculate the error involved.**		
Extension Activity: Laws of series and parallel combination of resistances and finding the possible errors involved in both the combinations using tolerance information			
Capacitors	2. **To study the coding of given Capacitor (Ceramic/ Electrolytic/ Miller etc.) and compare it with its practical value measured by a Multimeter. Find its tolerance range and calculate the error involved.**		
Extension Activity: Laws of series and parallel combination of Capacitors and finding possible errors involved in both the combinations using tolerance information.			
Transformers	3. **To study the efficiency, turn's ratio, and power calculations of Transformers (Step-up/ Step-down / power etc.) and comparison between theoretical and practical values with errors involved in the measurements.**		
Extension Activity: Find the induction of Primary and Secondary windings of the transformer. Also find the mutual inductance between them			
Semiconductor Diodes	4. **To study the characteristic properties of a Diode, Zener Diode and LED and compare the respective cut-in, breakdown and knee voltages. Gather information about the limiting values of these components.**		
Extension Activity: Using a small power supply design a working device such as a half wave/ full wave rectifier or a regulated power supply using a Zener diode or a working LED/s of different colours.			
Power Controlling Devices	5. **To study the Circuit Breakers (MCBs and RCCBs) with their current limits. Study of Wires (Aluminium, Copper, Still, etc.) with their gauges and to find their current carrying capacities.**		
Extension Activity: Loading effect on fuses and MCBs. Study of current carrying capacities of given wires with temperature measurement.			
Analogue and Digital Meters	6. **To study the voltmeter, ammeter, galvanometer and other analogue devices and comparison of their loading effect with the digital Multimeter and/or Digital Storage Oscillator.**		
Extension Activity: Open a non-working ammeter, voltmeter, and a galvanometer. Find the differences among them. Justify why a digital voltmeter is preferred over these analogue devices?			

Induction Motors	7. **To study the Principle, Construction and Working of DC and AC Induction Motors and Measurement of their RPM with electrical parameters.**
Extension Activity: Study of a BLDC Motor and comparison of its efficiency with other type of motors.	
Light emitting devices	8. **Study of different types of Bulbs (Viz. Incandescent, CFL, Plasma tubes and LEDs). Analysis and comparison of their efficiencies using a Luxmeter.**
Extension Activity: Use of a Solar Photo Cell for measurement of light intensity of these devices. Use of filters for calibration with wavelength range of these devices.	
Semiconductor Transistors	9. **To study the Principle, Construction and Working of different types of Transistors (UJT, BJT, FET, MOSFET etc.)**
Extension Activity: Identification of the lids of the given component (anyone from the list), its biasing and use as a fully operable device.	
Energy Storages Devices	10. **Study of Supercapacitors and Rechargeable Batteries. Their Charging and Discharging through a load and finding their energy densities.**
Extension Activity: Use sophisticated instruments for the measurement of charge-discharge cycle of any one of these devices.	
Active Components	11. **To study the Principle, Construction and Working of different types of Transistors (UJT, BJT, FET, MOSFET etc.)**
Extension Activity: Identification of the lids of the given component (anyone from the list), its biasing and use as a fully operable device.	
Introduction to Measuring Devices	12. **Study and Use of ExpEyes-17 / SeeLab 3.0 for performing various experiments in Physics**
Extension Activity: Characteristics of most of the electronic components using either ExpEyes-17 / SeeLab 3.0 or equivalent equipment.	

References:

1. Electronic Devices and Circuits by Allen Mottershead, Prentice Hall India Learning Private Limited.
2. Integrated Electronics Analog Digital Circuits, Jacob Millman and D. Halkias, McGraw Hill.
3. Electronic Devices and Circuit Theory, by Boylestad / Nashelsky; Pearson Education India; 11th edition (1 January 2015)
4. Basic Electronics by B. L. Theraja, S. Chand & Company Limited, New Delhi
5. Electrical Circuit Theory M Scheme Sem Iii Electrical & Electronics Polytechnique By A Balakrishnan (Author), T Vasantha (Author); NV Publications Pollachi

Course outcomes

After the completion of this course students will be able to

Sr. No.	Course Outcome
7.	Get acquainted hands-on practice for electronic components and their uses in electronic circuits
8.	Get acquainted hands-on practice for electrical components and their uses in electrical circuits
9.	Apply the practical knowledge in conducting various practical during graduation.
10.	Apply the practical knowledge in repairing household electronic and electrical gadgets.

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto- cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr P.U. Meshram, Allied Publishers, New Delhi.
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

B. Sc. Semester-II Discipline Specific Core Course (DSC-)-PHYSICS - Paper-III (BPH2T03) (Acoustic and Ultrasonics)			
DSC - 3 THEORY	**Hours: 2+2=04 Hours /Week**	**Marks: 80+20 = 100**	**Credit: 2+1=03**
Unit-I			
Musical Sound and Noise	Musical Sound, characteristics of musical sound (Loudness, Quality, and Pitch) sound intensity level, bel and decibel, Consonance and Dissonance, Harmony and melody, Musical interval, Musical Scales (diatonic scale), temperament, Musical instruments (sitar, flute, harmonium), Weber-Fechner law, Limits of human audibility, Noise, Noise thermometer, Noise standards, Noise Hazards, and control.		**7 Hrs**
Unit-II			
Acoustics	Absorption coefficient, Reverberation and reverberation period, Live and Dead room, Sabine's formula, Factors affecting the acoustics of the building, Sound absorbers, Requirements for good acoustics. Transducers and their characteristics, Active and Passive Transducers, Microphone (Moving coil electrodynamic microphone, Crystal microphone, Condenser microphone), Loudspeaker (Moving coil loudspeaker), Hearing aids, Earphone, headphone, Recording and reproduction of sound.		**7 Hrs**
Unit III			
Ultrasonic Waves	Introduction, Properties of Ultrasonic waves (velocity, specific acoustic impedance, intensity & pressure), detection of ultrasonic waves, production of USW, Mechanical method (Galton whistle), electrostatic method, piezoelectric effect, piezoelectric generator, Magnetostriction oscillators, measurement of Frequency and velocity of ultrasonic waves (Acoustical Grating), Sing around technique		**8 Hrs**
Unit IV			
Application of Ultrasonic Waves	Measurement of depth of sea, SONAR system, Non-destructive testing, Pulse Echo testing, Soldering Cavitation), Ultrasonic welding, cleaning, flowmeters, Medical applications: ultrasonography, Types of scan, applications of B scan (Qualitative), Ultrasonic Microscopy, Blind stick		**8 Hrs**

Reference Books:

1. Modern Acoustics by A.B. Gupta Books and Allied (P) Ltd. 2016
2. Oscillation, Waves and Sound by- Sharma and Saxena.
3. Waves and Oscillation by- N. Subrahmaniam and Brijlal, Vikas Publishing House Pvt. Ltd., Second Revised Edition, 2010
4. Science and Technology of Ultrasonics, Bldev Raj, V, Rajendran, P, Palanichamy, Narosa Pub. House, 2004
5. A Text Book of Oscillations, Waves and Acoustic by Dr. M. Ghosh, Dr. D. Bhattacharya, S. Chand Publication
6. 7. The Physics of Waves and Oscillation by- N. K. Bajaj, Tata McGraw-Hill, publishing co. ltd. 1984
7. Textbook of Sound by V.R. Khanna and R.S.Bedi, 1st edition, Kedharnaath Publish &. Co, Meerut (1998)
8. Oscillations and Waves by Satya Prakash Pragathi Prakashan, Meerut, Second Edition,2003

9. Mechanics: D.S. Mathur, S. Chand, and Company.
10. The Physics of Sound Third Edition Richard E. Berg, David, David G. Stork, Pearson Publication, 2012

Physics Practical / Laboratory

List of the experiments-

1. To determine the frequency of unknown tuning fork by Helmholtz resonator
2. To determine the velocity of sound by resonance method.
3. To determine unknown frequency and to verify the law of inverse variation of frequency and volume of air by Helmholtz resonator.
4. To determine the velocity of sound wave in air (gas) with Kundt's tube.
5. To determine the velocity of ultrasonic wave using ultrasonic interferometer.
6. To study the characteristics of micro phone.
7. Study of loudspeaker (woofer, squawker, tweeter) as a transducer.
8. Study of Piezoelectric transducer.
9. To study the Noise level in the different places with the help of sound level meter.
10. To study the characteristics of an NTC/PTC thermistor as transducer.
11. To study the thermocouple as transducer.
12. To determine velocity of ultrasonic waves using by acoustical grating method.

COURSE OUTCOMES

After completing this course students will be able to

Sr. No.	Course outcome
1.	Understand the different aspects and attributes of a musical sounds. Also response of ear to sound and audible limits of human ear
2.	Learn about various musical scales and musical instruments
3.	Learn about acoustics of a hall and requirement of a good acoustic of a hall
4.	Learn about different microphones their design and action and also about loudspeaker.
5.	Learn about the characteristics and production method as well as detection of USW.
6.	Learn about different applications of USW like SONAR, soldering, cleaning and medical applications like sonography etc.

B. Sc. Semester-II Discipline Specific Core Course (DSC-4)-PHYSICS - Paper-IV (BPH2T04) (Oscillations and Black body radiation)			
DSC - 4 THEORY	**Hours: 2+2=04 Hours /Week**	**Marks: 80 + 20 = 100**	**Credit: 2+1=03**
Unit-I			
Free Oscillation	Introduction to linear and angular S.H.M., , Differential equation of S.H.M. and its solution, Mass attached to spiral spring, Torsional pendulum, Composition of two perpendicular linear S.H.M.s for 1:1 and 1:2 (analytical method), Lissajous's figure. Applications of Lissajous figures.		**7 Hrs**
Unit-II			
Damped and Forced Oscillation	Differential equation of damped harmonic oscillator and its solution, logarithmic decrement, Energy equation of damped oscillations, Power dissipation and quality factor. Forced oscillation, Differential equation of forced oscillation and its solution, Resonance, Sharpness of resonance, Power Absorption, Power dissipation, Quality factor and bandwidth,		**7 Hrs**
Unit III			
Waves in Media	Introductions, transverse and longitudinal waves, General equation of progressive wave, Speed of transverse wave on a stretched string, differential equation of a wave motion in a fluid, Wave equation for a transverse wave in a string, harmonics and overtones, phase velocity and group velocity and their relation. Doppler effect.		**8 Hrs**
Unit IV			
Black Body Radiation	Properties of Thermal Radiation, Blackbody radiation, spectral distribution, Weins Displacement law, Wiens distribution Law, Sahas Ionization Formula, Rayleigh Jeans Law, Ultra-Violet catastrophe concept of energy density and pressure of radiation. Derivation of Planck's law, deduction of Wien's distribution law, Rayleigh-Jeans law, Stefan-Boltzmann law and Wien's displacement law from Planck's law.		**8 Hrs**

Reference Books:

1. Mechanics: D.S. Mathur, S. Chand, and Company.
2. The Physics of Waves and Oscillation by- N. K. Bajaj, Tata McGraw-Hill, publishing co. ltd. 1984
3. Modern Acoustics by A.B. Gupta Books and Allied (P) Ltd. 2016
4. Oscillation, Waves and Sound by- Sharma and Saxena.
5. Waves and Oscillation by- N. Subrahmaniam and Brijlal, Vikas Publishing House Pvt. Ltd., Second Revised Edition, 2010
6. A Text Book of Oscillations, Waves and Acoustic by Dr. M. Ghosh, Dr. D. Bhattacharya, S. Chand Publication
7. Textbook of Sound by V.R. Khanna and R.S.Bedi, 1st edition, Kedharnaath Publish &. Co, Meerut (1998)
8. Oscillations and Waves by Satya Prakash Pragathi Prakashan, Meerut, Second Edition,2003

List of Experiments

1. Study the speed of waves on stretched string.
2. Determination of velocity of sound using volume resonator.

3. To Stefan's constant by incandescent bulb
4. To study the Lissajous's figure using CRO.
5. To determine the frequency of tuning fork using sonometer.
6. To study the logarithmic decrement, coefficient of damping, relaxation time and quality factor of a damped simple pendulum.
7. To study the logarithmic decrement using compound pendulum.
8. To find Planck's constant using photocell.
9. To study the oscillation of bifilar suspension
10. To study the oscillations of oscillations of compound pendulum
11. To study the oscillations of rubber band and draw its potential energy curve.
12. To study the oscillations of spring and find spring constant and verify laws of spring.

COURSE OUTCOMES

After completing this course students will be able to

Sr. No.	Course outcome
1.	Understand the simple harmonic motion, and properties of different oscillatory motion of an object
2.	Understand the damped and forced oscillation
3.	Understand mechanical waves in a medium and wave equation of the transverse waves on string and longitudinal waves in a fluid.
4.	Understand black body radiation and development of quantised nature of blackbody radiation.
5.	Understand the temperature of heavenly bodies

B. Sc. Semester-II
Vocational Skill Course (VSC) - PHYSICS Course Code (BVS2P03)
(Instrumental Errors in Measurement)

VSC-3 Practical	04 Hours /Week	Marks: 100	Credit: 02

Instruments	Name of Experiments (Any 10 experiments to be performed)
Vernier Calliper	1. **To study the probable and percentage error of the measuring instrument vernier calliper.**
Extension Activity: Find least count of the vernier calliper. Find significant figures, probable error and percentage error after taking observations and calculations.	
Screw Gauge	2. **To study the probable and percentage error of the measuring instrument screw gauge.**
Extension Activity: Find least count of the screw gauge. Find significant figures, probable error and percentage error after taking observations and calculations.	
Travelling Microscope	3. **To study the probable and percentage error of the measuring instrument travelling microscope.**
Extension Activity: Find least count of the travelling microscope. Find significant figures, probable error and percentage error after taking observations and calculations.	
Sextant	4. **To study the probable and percentage error of the measuring instrument sextant.**
Extension Activity: Find least count of the screw gauge attached with sextant instrument. Find significant figures, probable error and percentage error after taking observations and calculations.	
Spectrometer	5. **To study the probable and percentage error of the measuring instrument Spectrometer.**
Extension Activity: Find least count of the Spectrometer and identify its different parts. Find significant figures, probable error and percentage error after taking observations and calculations.	
Compound Pendulum	6. **To study the probable and percentage error of the gravity related apparatus compound pendulum**
Extension Activity: Find significant figures, probable error and percentage error after taking observations and calculations. Drawing of graph.	
Meter Bridge	7. **To study the probable and percentage error of the measuring electrical equipment meter bridge.**
Extension Activity: Making electrical circuit connection, find significant figures, probable error and percentage error after taking observations and calculations.	
Light emitting devices	8. **To study the probable and percentage error of the measuring electrical equipment potentiometer.**
Extension Activity: Making electrical circuit connection, find significant figures, probable error and percentage error after taking observations and calculations.	

Rheostat, Milliammeter, Voltmeter, and Galvanometer	9. **To study the probable and percentage error of the measuring electrical equipment Rheostat, Milliammeter, Voltmeter, and Galvanometer**
Extension Activity: Making electrical circuit connection, find significant figures, probable error and percentage error after taking observations and calculations.	
Analogue and Digital Multimeter	10. **To study the probable and percentage error of the measuring electrical equipment analogue and digital multimeter**
Extension Activity: Making electrical circuit connection, find significant figures, probable error and percentage error after taking observations and calculations.	
Magnetometer	11. **To study the probable and percentage error of the magnetic equipment like magnetometer in the determination of horizontal component of earth's magnetic field.**
Extension Activity: Making electrical circuit connection, find significant figures, probable error and percentage error after taking observations and calculations.	
Copper Calorimeter	12. **To study the probable and percentage error of the copper calorimeter for measuring heat of physical changes and heat capacity.**
Extension Activity: Making electrical circuit connection, find significant figures, probable error and percentage error after taking observations and calculations.	

References:

1. An Advanced course in practical physics by C. Chattopadhyay and P. C. Rakshit.
2. Practical Physics by S. L. Gupta and V. Kumar
3. B. Sc. Practical Physics by C. L. Arora
4. Measurement uncertainties: Physical parameters and calibration of instruments by S. V. Gupta
5. B. Sc. Practical Physics by Harnam Singh and P.S. Hemne

Course outcomes

After the completion of this course students will be able to

Sr. No.	Course Outcome
1.	Understand the function of different instruments.
2.	Choose and apply proper instrument for the measurement.
3.	Handle the instrument carefully and apply the practical knowledge in his further study.
4.	Find the different man made and instrumental errors in doing different practical.

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus
Bachelor of Science (Statistics)

Submitted by
Board of Studies
Bachelor of Science (Statistics)

FYUGP-Scheme I-VIII Semester
Bachelor of Science (Honors/Research)
(STATISTICS - Major)
Four Year (Eight Semester Degree Course)
Teaching and Examination Scheme

B.Sc. Sem-I (STATISTICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Probability Theory	BST1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Probability Theory	BST1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Descriptive Statistics	BST1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Descriptive Statistics	BST1P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	R For Beginners	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (STATISTICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Probability distributions	BST2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Probability distributions	BST2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Economic Statistics	BST2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Economic Statistics	BST2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Excel for beginners	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

B.Sc. Sem-III (STATISTICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Statistical Methods	BST3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Statistical Methods	BST3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Applied Statistics	BST3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Applied Statistics	BST3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem-IV (STATISTICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Statistical Inference	BST4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Statistical Inference	BST4P07			2	1	-	-	-	-	25	25	25
3	DSC	SQC&LPP	BST4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	SQC&LPP	BST4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Compulsory English	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (STATISTICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min.
1	DSC	Nonparametric Methods & Survival Analysis	BST5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Nonparametric Methods & Survival Analysis	BST5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Sampling survey Techniques and Indian Official Statistics	BST5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Sampling survey Techniques and Indian Official Statistics	BST5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Industrial Process and Quality Control	BST5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Industrial Process and Quality Control	BST5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 1	BST5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 1	BST5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem-VI (STATISTICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Operations Research	BST6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Operations Research	BST6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Experimental designs	BST6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Experimental designs	BST6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Estimation Theory	BST6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Estimation Theory	BST6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 2	BST6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 2	BST6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (STATISTICS - Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Linear &non linear Modelling I	BST7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Linear &non linear Modelling I	BST7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Computational Statistics I	BST7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Computational Statistics I	BST7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Industrial Statistics	BST7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Industrial Statistics	BST7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Testing Of Hypothesis	BST7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Testing Of Hypothesis	BST7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 3	BST7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 3	BST7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BST7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BST7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (STATISTICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Linear &non linear Modelling II	BST8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Linear &non linear Modelling II	BST8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Computational Statistics II	BST8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Computational Statistics II	BST8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Mathematical Programming	BST8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Mathematical Programming	BST8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Sampling Theory	BST8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Sampling Theory	BST8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Elective 4	BST8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Elective 4	BST8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (STATISTICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Linear &non linear Modelling I	BST7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Linear &non linear Modelling I	BST7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Computational Statistics I	BST7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Computational Statistics I	BST7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Mathematical Programming	BST7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Mathematical Programming	BST7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 3	BST7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 3	BST7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BST7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BST7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (STATISTICS - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Linear &non linear Modelling II	BST8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Linear &non linear Modelling II	BST8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Computational Statistics II	BST8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Computational Statistics II	BST8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Sampling Theory	BST8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Sampling Theory	BST8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Elective 4	BST8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Elective 4	BST8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2 +1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, AbilSTy Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, CommunSTy Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Statistics)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	R For Beginners2	Statistics	**BVS1P01**
II	**VSC**	Excel for beginners	Statistics	**BVS2P03**
III	**VSC**		Statistics	**BVS3P05**
V	**VSC**		Statistics	**BVS5P07**
VI	**VSC**		Statistics	**BVS6P08**

Basket for ELECTIVE (DSE) Category Courses (STATISTICS)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Statistical Computing Using C/C++ programming B. Survival analysis	BST5T12
VI	Elective 2	A Data Mining B. Stochastic Models in Finance	BST6T16
VII (Honors)	Elective 3	A. Demography B. Actuarial Statistics	BST7T21
VIII (Honors)	Elective 4	A. Time series Analysis B. Bioassay	BST8T27
VII (Research)	Elective 3	A. Demography B. Actuarial Statistics	BST7T20R
VIII (Research)	Elective 4	A. Time series Analysis B. Bioassay	BST7T25R

'R' in the subject code indicates 'Research'.

Rashtrasant Tukdoji Maharaj Nagpur University,Nagpur

Faculty of Science & Technology

Programme: B. Sc. (Statistics)

STATISTICS - MAJOR

B Sc SEM I & SEM II Syllabus

Sr Number	Semester	Course Code	Course Category	Name of course	Credits
1	I	BST1T01	DSCI	Probability Theory	2
2	I	BST1T02	DSCII	Descriptive Statistics	2
3	II	BST1T03	DSCIII	Probability Distributions	2
4	II	BST1T04	DSCIV	Economic Statistics	2

STATISTICS - MAJOR

POs

At the time of graduation, Students will be able to

PO1.Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
PO2.Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.
PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.
PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PSOs:

Upon completion of the program, students would be able to

1. recall basic facts about statistics and should be able to display knowledge of conventions such as notations,terminology.
2. get adequate exposure to global and local concerns that explore them many aspects ofmathematical sciences.
3. Be equipped with statistical modeling ability, problem solving skills, creative talent and power of communication necessary for various kinds of employment.
4. apply their skills and knowledge that is translate information presented verbally into statistical form, select and use appropriate statistical formulae or techniques in order toprocess the information and draw the relevant conclusion.
5. develop a positive attitude towards statistics as an interesting and valuable subject of study.
6. acquire basic knowledge of diagrammatic & graphical representation of Data with and without software.

STATISTICS
SEMESTER I

SUBJECT: STATISTICS
B.Sc.– I SEMESTER – I
Paper I
CODE - BST1T01

DSC I - PROBABILITY THEORY (2 CREDITS – 30 Hrs)

OBJECTIVES

A majority of topics in Statistics depend upon a strong foundation of Probability theory It also serves as base for applied probability theory. Another basic concept is that of a random variable , its distribution and associated properties. This course includes topics like Conditional probability, Baye's theorem,p.m.f., p.d.f., moments,etc.

OUTCOMES:

Students acquire knowledge about : independence of random variables, applications of Bayes' theorem, expectation of a random variable, etc.

Unit-I (7 Hrs)

(A) Important concepts in Probability: Definition of Probability,Classical and relative frequency approach to Probability. Richard Von Mises, Cramer and Kolmogorov's approaches to Probability, merits and demerits ofthese approaches. Only general ideas to be given.

(B) Random Experiment: Trial, sample point and sample space, definition of an event, operation of events, mutually exclusive and exhaustive events. Discrete sample space, properties of Probability based on axiomaticapproach.

Unit-II (7 Hrs)

(A) Conditional Probability: Independence of events, pairwise and mutual independence,theoremson independence.

(B) Bayes' theorem: Theorem and its applications. Chebyshev's inequality and applications with problems.

Unit-III (8 Hrs)

(A) Random variables: Definition of discrete random variables, ,idea of continuous random variable,

Probability mass function, Probability density function,

(B) Probability density function: Illustrations of random variables and its properties,expectation of a randomvariable and its properties.

Unit-IV (8 Hrs)

A) Moments: Measures of location, dispersion, skewness and kurtosis

(B) Probability generating function (if it exists): Moment generating function, their properties and uses

PRACTICALS ON PAPER I (I Credit)(15 Hrs)	
Sr Number	**Title of the practical**
1	Evaluation of Probabilities usingaddition theorems
2	Evaluation of Probabilities using multiplication theorems
3	Evaluation of Probabilities using concepts of counting technique
4	Problems on independence ofevents, pairwise independence ,Mutual independence
5	Problems on probabilities usingBayes' theorem.
6	Exercises on mathematical expectations
7	Finding measures of centraltendency,

REFERENCES:

1. Bhat B.R, Srivenkataramana T And RaoMadhava K.S. (1997): **STATISTICS: A BEGINNER'S TEXT,VOL II,NEW AGE INTERNATIONAL (P)LTD.**
2. Edward P.J, Ford J.S And Lin(1974): PROBABILITY FOR STATISTICALDECISION MAKING,PRENTICE HALL
3. **Goon A. M,Gupta M. K, Das Gupta,B (1999):** Fundamentals OfStatistics, Vol Ii, World Press, Calcutta**.**
4. Mood A.M,Graybill F.A And Boes D.C (1974): INTRODUCTION TO THEORY OF STATISTICS, Mcgraw HILL.
5. Freund J. E: Mathematical Statistics (Prentice Hall India)
6. P. L. Meyer: Introductory Probability and Statistical Applications, (Oxford and IBH)
7. SudhaPurohit, GoreS.D., Deshmukh S. R: 'Statistics Using R' (Narosa)
8. Walpole Ronald E.: INTRODUCTION TO STATISTICS, Macmillan,
9. KVS Sarma, Statistics Made Simple: Do it yourself on PC (PHI)

SUBJECT: STATISTICS

B.Sc. – I SEMESTER – I Paper II

CODE - BST1T02

DESCRIPTIVE STATISTICS (2 CREDITS – 30 Hrs)

OBJECTIVES:

Students acquire knowledge about analysis of quantitative data, concepts c e n t r a l t e n d e n c y , dispersion,etc.

OUTCOMES:

Students learn various measures of dispersion, correlation coefficient, measures ofcentral tendency and theirapplications

Unit-I (7 Hrs)

(A) Analysis of Quantitative data: Uni-variate data - Concepts of central tendency and location, Measures of central tendency: Mean, Median and Mode, Geometric Mean and Harmonic mean (Definitions, merits and demerits, properties, theoretical problems), weighted averages

Unit-II (7 Hrs)

(B) Concepts of dispersion, Measures of dispersion: Range, Mean Deviation, Quartile deviation andstandard deviation (Definitions, merits and demerits and properties), Measures of and relative dispersion: coefficient of dispersion and coefficient of variation, Moments: Rawand Central moments, expression for central moments in terms of raw moments, Sheppard's corrections for moments for grouped data (without derivation

Unit-III (8 Hrs)

(C) Partition values: Quartiles, Deciles, Percentiles (definition, formulae and procedure for finding these values graphically), Concepts of skewness and kurtosis and their measures including those based on quantiles),Box plot, q-q plot and their use in describing data.

Unit-IV (8 Hrs)

(D) Bivariate Data: Scatter diagram, Product moment correlation coefficient and its properties. Coefficient of determination (ANOVA APPROACH). Concepts of error in regression (NORMALITY OF ERRORS).

Principle of least squares. Fitting of linear regression and related results. Rank correlation—Spearman's andKendall's measures.

PRACTICALS ON PAPER II (I Credit) (15 Hrs)	
Sr Number	**Title of the practical**
1	Calculation of various Measures of central tendency and Dispersion
2	Calculation of various Measures of Dispersion
3	Calculation of Quartiles and drawing box plots (Manually).
4	Calculation of Quartiles and drawing box plots (Manually).
5	Calculation of Measures of dispersion, skewness and kurtosis
6	Problems on calculation of coefficient of correlation
7	Problems on calculation of coefficient of rank correlation
8	Problems on fitting of lines of regression.

REFERENCES:

1 **Bhat B.R,Srivenkataramana T And RaoMadhava K.S(1997): STATISTICS: A BEGINNER'S TEXT,VOLI,NEW AGE INTERNATIONAL (P) LTD.**

2. Goon A. M,Gupta M. K, Das Gupta,B (1999): FUNDAMENTALS OF STATISTICS, VOL I, WORLD PRESS, CALCUTTA.

3. CroxtonF.E,Cowden D.J And Kelin S(1973): APPLIED GENERAL STATISTICS, PRENTICE HALL OF INDIA

4. Agrawal B. L.: BASIC STATISTICS (New Age International Publishers)

5. Sudha Purohit, GoreS.D., Deshmukh S. R.: Statistics Using R (Narosa)

6 Christian S. Albright, Wayne L. Winston, Zappe Christopher J. : Decision Making using Microsoft Excel(CENGAGE Learning) MS Excel

Vocational Skills Courses (VSC)

	Semester I (VSC) **For Statistics major**
	Name of the Paper – R for Beginners
	Paper code - BVS1P01 2 Credits (4 hrs practical per week)
	List of Practical's
1	**INTRODUCTION TO R**
1.1	Introduction
1.2	R as a statistical software and language
1.3	R as a calculator
1.4	R preliminaries
1.5	Methods of data input
1.6	Data accessing or indexing
1.7	Some useful built-in functions
1.8	Graphics with R
1.9	Getting help
1.10	Saving, storing and retrieving work
2	**DESCRITPIVE STATISTICS**
2.1	Introduction
2.2	Diagrammatic representation of data
2.3	Graphical representation of data
2.4	Measures of central tendency
2.5	Measures of dispersion
2.6	Measures of skewness and kurtosis
2.7	Selection of representative samples
2.8	Drawing Histogram using R
3	**CORRELATION AND REGRESSION ANALYSIS**
3.1	Introduction
3.2	Correlation
3.3	Inference procedures for correlation coefficient
3.4	Linear Regression
3.5	Validation of linear regression model

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr **P.U. Meshram, Allied Publishers, New Delhi.**
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

STATISTICS

SEMESTER II

SUBJECT: STATISTICS
B.Sc– I SEMESTER–II Paper III

DSC 3 **CODE– BST2T03**

PROBABILITY DISTRIBUTIONS (2 CREDITS – 30 Hrs)

Unit-I (7 Hrs)

(A) Discrete distributions: Discrete Uniform distribution (Finding Mean, Variance),Bernoulli, Binomial, Poisson Finding (Mgf and pgf, Mean, Variance, mode, skewness and kurtosis, recurrence relation for central moments and for probabilities, additive property),

Unit-II (7 Hrs)

Geometric distribution (Finding Mgf and Mean, Variance, Lack of memory property, problems), Negative Binomial Distribution (Finding Mgf and Mean, Variance, problems), and Hypergeometric, (Finding Mean, Variance, problems)

Unit-III (8 Hrs)

Continuous Univariate Probability distributions: Continuous Uniform (Finding Mgf and Mean,Variance), Normal distribution.Properties of normal distribution,Finding Mgf and Mean, mode,

median, Variance, recurrence relation for central moments, skewness and kurtosis, additive property, standardNormal variable, Area property of Normal distribution and Problems based on that.

Unit-IV (8 Hrs)

(A) Continuous Univariate distributions: Exponential (Finding Mgf and Mean, Variance, Lack of memory property), Gamma with one parameter and gamma with two parameters (Finding Mgf and Mean, Variance, Additive property), Beta distributions of both types (Finding r^{th} moment, Mean and variance).

PRACTICALS ON PAPER III (I Credit) (15 Hrs)	
Sr Number	**Title of the practical**
1	Fitting of Binomial distribution (Manually)
2	Fitting of Poisson distribution (Manually)
3	Fitting of Normal distribution
4	Problems on Area Property of Normal distribution
5	Simple problems on Geometric distribution
6	Simple problems on Hypergeometric distribution
7	Simple problems on Negative Binomial distribution

REFERENCES:

1. Bhat B.R, Srivenkataramana T And RaoMadhava K.S. (1997): STATISTICS: A BEGINNER'S TEXT,VOLII,NEW AGE INTERNATIONAL (P) LTD.

2. Edward P.J, Ford J.S And Lin(1974): PROBABILITY FOR STATISTICAL DECISIONMAKING,PRENTICE HALL.

3. Goon A. M,Gupta M. K, Das Gupta,B (1999): FUNDAMENTALS OF STATISTICS, VOL I, WORLDPRESS, CALCUTTA.

4. Mood A.M,Graybill F.A And Boes D.C (1974): INTRODUCTION TO THE THEORY OF STATISTICS,McGRAW HILL.

5. Freund J. E: Mathematical Statistics (Prentice Hall India)

6. SudhaPurohit, GoreS.D., Deshmukh S. R: 'Statistics Using R' (Narosa)
7. Meyer P.L.: INTRODUCTORY PROBABILITY AND STATISTICAL APPLICATIONS (Oxford and IBHPublishing Company)

8. Christian S. Albright, Wayne L. Winston, Zappe Christopher J. : Decision Making using Microsoft Excel (CENGAGE Learning)

9. KVS Sarma, Statistics Made Simple: Do it yourself on PC (PHI)

SUBJECT:

STATISTICS B.Sc.– I

SEMESTER–II Paper IV

DSC 4 CODE– BST2T04

ECONOMIC STATISTICS (2 CREDITS –30 Hrs)

OBJECTIVES:

1. To give the students' knowledge of Index numbers, cost of living index, national income
2. To let the students, know about laws of Demand and Supply and how the market keeps changing in accordance with time

OUTCOMES:

1. Students have gained knowledge about the market statistics, inflation and deflation,consumers priceindex, wholesale price index, etc
2. How to compute National income and understand the purchasing power of money
3. Market demand and price relation, supply and its relation to price, elasticities of priceand effect of timeseries on market

Unit-I (7 Hrs)

(A) Index number: Its definition, applications of index numbers, price relatives and quantityor volume relatives, link and chain relatives, problems involved in computation of index numbers, use of averages, simple and weighted aggregative and simple and weighted average methods, Laspeyre's, Paasche's, Marshall Edgeworth's, Walsch's, Kelly's Drobish Bowley's and Fisher's quantity and price index numbers, Time and Factor reversal tests of index numbers.

Unit-II (7 Hrs)

(B) Base shifting, Splicing of index number series, Consumer Price Index: steps in its construction, methods and uses, Index of Industrial Production: method of construction and itsuses, Wholesale price index number: method of construction and its uses, concept of purchasing power of money, inflation and deflation, Methods of computation of national income.

Unit-III (8 Hrs)

(C) Demand Analysis: Demand and Supply function, Static laws of demand and supply, priceelasticity of demand, price elasticity of supply, Income and cross elasticity of demand. Engel' law and Engel's curves, analysis of income and allied size distribution – Pareto distribution, fitting of Pareto's law, Lorenz curve andGini's coefficient.

Unit-IV (8 Hrs)

(D) Time Series Analysis: Economic time series, its different components, illustrations, additive and multiplicative models, methods of determination of trend, analysis of seasonal fluctuations, methods of construction of seasonal indices. Estimation of elasticity from time series data: Leontief's method, Pigou's method

PRACTICALS ON PAPER IV (I Credit) (15 Hrs)	
Sr Number	**Title of the practical**
1	Construction of price and quantity Index numbers by simple aggregativemethod.
2	Construction of price and quantity Index numbers by weighted aggregative method. Using Laspeyre's, Paasche's, Mashall Edgeworth's, Walsch's, Drobish-Bowley's, Fisher's method and Kelly's fixed weight method.
3	Construction of price indices using simple and weighted average of price relatives using arithmetic mean and geometric mean.
4	Construction of chain base indices.
5	Problems on base shifting of index numbers.
6	Construction of cost-of-living index numbers by (i) aggregateexpenditure method (ii)family budget method.
7	Determination of trend in a time series using moving average method.
8	Determination of trend in a time series using least square method.
9	Construction of seasonal indices using ratio to moving average method.
10	Construction of seasonal indices using ratio to trend method.
11	Construction of seasonal indices using link relative method.
12	Fitting of demand curve / function and Estimation of price elasticity ofdemand from time series data.
13	Fitting of Pareto curve to income data.
14	Fitting of Lorenz curve of concentration.

REFERENCES

1 Croxton F.E and Cowden D.J. (1969): Applied General Statistics, Prentice Hall of India.

2 Goon A.M., Gupta M.K., Das Gupta. B. (1986): Fundamentals of Statistics, Vol.II, World Press, Calcutta

3 Gupta and Mukhopadhyay P.P.: Applied Statistics, Central Book Agency

4 Hooda R P: 'Statistics for Business and Economics'; MACMILAN Business books, third edition

5 Nagar A. L. and Das R. K. : Basic Statistics; Oxford University Press

6 Asthana and Shrivastav: Applied Statistics of India ,Chaitanya Publishing House

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Vocational Skill Courses (VSC) for Sem II

For Statistics major

	Semester II (VSC)
	Name of the Paper - EXCEL for Beginners
	Paper code – BVS2P03 2 Credits (4 hrs practical per week)
	List of Practicals
1	Data Entry, Editing & saving
2	Establishing and copying formulae ,Built in functions – Copy and paste. Find and Replace
3	Sorting - A tool that allows you to arrange data in ascending or descending order. Study of statistical function .
4	Introduction to spreadsheet, reading data, manipulating
5	Basic spreadsheets operations & functions – IF, nested IF, VLOOK UP, H LOOK UP,Functions that allow you to search for specific data in a table and return corresponding values.
6	Pivot Tables- An interactive table that allows you to summarize and analyze large amounts of data.
7	Conditional Formatting - A feature that allows you to control the type of data that can be entered into a cell.
8	Data Validation - A feature that allows you to control the type of data that can be entered into a cell.
9	Filtering - A technique that allows you to display only specific rows of data based on certain criteria.
10	Trend Analysis A technique that allows you to identify patterns and trends in data over time.
11	Charts and Graphs Plotting different type of diagrams (Bar ,subdivided Bar ,multiple bar etc) Visual representations of data that allow you to identify trends and patterns.
12	Plotting Scatter diagram
13	Problems on Calculation of coefficient of Correlation
14	Problems on Calculation of coefficient of rank Correlation
15	Problems on fitting of lines of regression
16	Fitting of Binomial distribution
17	Fitting of Poisson l distribution
18	Fitting of Normal distribution

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

Bachelor of Science (Zoology)

Submitted by

Board of Studies,

Bachelor of Science (Zoology)

FYUGP-Scheme I-VIII Semester

Bachelor of Science (Honors/Research)

(Zoology- Major)

Four Year (Eight Semester Degree Course)

Teaching and Examination Scheme

B.Sc. Sem.-I (Zoology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Life and Diversity of Animals-Nonchordates (Protozoa to Annelida)	BZO1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Life and Diversity of Animals-Nonchordates (Protozoa to Annelida)	BZO1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Environmental Biology	BZO1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Environmental Biology	BZO1T02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Vermicomposting	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

B.Sc. Sem-II (Zoology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Life and Diversity of Animals-Nonchordates (Arthropoda to Hemichordata)	BZO2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Life and Diversity of Animals-Nonchordates (Arthropoda to Hemichordata)	BZO2P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Cell Biology	BZO2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Cell Biology	BZO2P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Culture of Indian major Carps	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

B.Sc. Sem.-III (Zoology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Life and Diversity of Animals- Chordates (Protochordata to Amphibia)	BZO3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Life and Diversity of Animals- Chordates (Protochordata to Amphibia)	BZO3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Genetics	BZO3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Genetics	BZO3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

B.Sc. Sem.-IV (Zoology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Life and Diversity of Animals- Chordates (Reptilia to Mammalia)	BZO4T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Life and Diversity of Animals- Chordates (Reptilia to Mammalia)	BZO4P07			2	1	-	-	-	-	25	25	25
3	DSC	Developmental Biology	BZO4T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Developmental Biology	BZO4P08			2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)				2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**200**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem.-V (Zoology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min.
1	DSC	General Mammalian Physiology I	BZO5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	General Mammalian Physiology I	BZO5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Applied Zoology	BZO5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Applied Zoology	BZO5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Evolutionary Biology	BZO5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Evolutionary Biology	BZO5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	• Systematic Entomology • Systematic Ichthyology • Male Mammalian Reproductive Physiology • Endocrinology	BZO5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	• Systematic Entomology • Systematic Ichthyology • Male Mammalian Reproductive Physiology • Endocrinology	BZO5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket		-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service		-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**225**	**225**	**-**

B.Sc. Sem.-VI (Zoology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	General Mammalian Physiology II	BZO6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	General Mammalian Physiology II	BZO6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Parasitology	BZO6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Parasitology	BZO6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Molecular Biology	BZO6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Molecular Biology	BZO6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	• Insect morphology and Physiology • Fish Physiology/ • Female Mammalian Reproductive Physiology • Biochemistry	BZO6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	• Insect morphology and Physiology • Fish Physiology/ • Female Mammalian Reproductive Physiology • Biochemistry	BZO6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem.-VII (Honors) (Zoology- Major)

S N	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Systematic Zoology	BZO7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Systematic Zoology	BZO7P17	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Biotechnology	BZO7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Biotechnology	BZO7P18	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Biostatics and Bioinformatics	BZO7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Biostatics and Bioinformatics	BZO7P19	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Microtechniques	BZO7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Microtechniques	BZO7P20	-	-	2	1	-	-	-	-	-	50	25
9	DSE	• Insect pests • Applied Fisheries • Reproductive Endocrinology and Toxicology • Nerve Physiology	BZO7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	• Insect pests • Applied Fisheries • Reproductive Endocrinology and Toxicology • Nerve Physiology	BZO7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BZO7T22	2	-	-	2	3	80	20	40	-	-	-
12	RM	Research Methodology	BZO7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem.-VIII (Honors) (Zoology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Biotechniques	BZO8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Biotechniques	BZO8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Ethology	BZO8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Ethology	BZO8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Molecular Biology	BZO8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Molecular Biology	BZO8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Immunology	BZO8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Immunology	BZO8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	• Industrial Entomology • Fishery technology and fish pathology • Avian Biology • Hydrobiology	BZO8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	• Industrial Entomology • Fishery technology and fish pathology • Avian Biology • Hydrobiology	BZO8P27	-	-	2	1	-	-	-	-	25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem.-VII (Research) (Zoology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Systematic Zoology	BZO7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Systematic Zoology	BZO7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Techniques in Life Sciences	BZO7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Techniques in Life Sciences	BZO7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Biostatics and Bioinformatics	BZO7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Biostatics and Bioinformatics	BZO7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	• Insect pests • Applied Fisheries • Reproductive Endocrinology and Toxicology • Nerve Physiology	BZO7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	• Insect pests • Applied Fisheries • Reproductive Endocrinology and Toxicology • Nerve Physiology	BZO7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BZO7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BZO7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem.-VIII (Research) (Zoology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Biotechniques	BZO8T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Biotechniques	BZO8P22R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Ethology	BZO8T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Ethology	BZO8P23R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Molecular Biology And Immunology	BZO8T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Molecular Biology And Immunology	BZO8P24R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	• Industrial Entomology • Fishery technology and fish pathology • Avian Biology • Hydrobiology	BZO8T25R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	• Industrial Entomology • Fishery technology and fish pathology • Avian Biology • Hydrobiology	BZO8P25R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2 +1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Zoology)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Vermicomposting	Zoology	**BVS1P01**
II	**VSC`**	Culture of Indian major Carps	Zoology	**BVS2P03**
III	**VSC**	Aquarium preparation and maintenance	Zoology	**BVS3P05**
V	**VSC**	Silkworm culture	Zoology	**BVS5P07**
VI	**VSC**	Prawn culture	Zoology	**BVS6P08**

Basket for <u>ELECTIVE</u> (DSE) Category Courses (B.Sc. Zoology)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Systematic Entomology	BZO5T12
		B. Systematic Ichthyology	
		C. Male Mammalian Reproductive Physiology	
		D. Endocrinology	
VI	Elective 2	A. Insect Morphology and Physiology	BZO6T16
		B. Fish Physiology	
		C. Female Mammalian Reproductive Physiology	
		D. Biochemistry	
VII (Honors)	Elective 3	A. Insect pests	BZO7T21
		B. Applied Fisheries	
		C. Reproductive Endocrinology and Toxicology	
		D. Nerve Physiology	
VIII (Honors)	Elective 4	A. Industrial Entomology	BZO8T27
		B. Fishery technology and fish pathology	
		C. Avian Biology	
		D. Hydrobiology	
VII (Research)	Elective 3	A. Insect pests	BZO7T20R
		B. Applied Fisheries	
		C. Reproductive Endocrinology and Toxicology	
		D. Nerve Physiology	
VIII (Research)	Elective 4	A. Industrial Entomology	BZO7T25R
		B. Fishery technology and fish pathology	
		C. Avian Biology	
		D. Hydrobiology	

'R' in the subject code indicates 'Research'.

FYUGP ZOOLOGY

Programme Specific Outcomes (PSOs) of Four Year Undergraduate Programme for Zoology:

- Students will be able to describe, identified, classified and differentiate the animals of different taxonomic ranks. They could differentiate morphological, anatomical, and histological features of different organs and organ-systems of different animal groups. They could understand and analyze the different evolutionary trends among different animal groups.
- Students could describe different component of environment and ecosystems an could understand and explain the significance of consequences of deterioration of ecosystem and biodiversity. They could estimate and evaluate the different physic-chemical parameters of waters like DO, dissolved CO_2, pH, hardness etc. to deduce its status.
- Students could able to describe, sketch and differentiate different cell organelles of animal cell and could examine normal and abnormal cellular physiology. Students could demonstrate cells organelles and acellular components in tissues as well as able to estimate protein, lipid and carbohydrates in tissues.
- They could able to describe, interpret inheritance pattern in animals . They could differentiate varied mechanisms controlling inheritance in animals.
- They could describe, analyze the different aspect of Applied Zoology. They could understand the practices of apiculture, sericulture, fisheries etc. and acquainted themselves with economic benefit of these practices as well as explain it to others.
- Students understand, analyze, interpret the innate and learned behaviour of different animal groups.
- Students will be able to perform different experiments which could help them to prove their hypotheses. They could able t o analyze the data with help of different statistical tools. Students will develop capabilities which help them to design and investigate the scientific research work. They could able to draft a scientific write up and could argue, defend his findings based on standard practices of research in Life Science

B.Sc. Sem. I . DSC: BZO1T01

Life and Diversity of Animals - Nonchordates (Protozoa to Annelida)

Theory- 2 Credits + Practical - 1 Credit

Course Outcomes (COs):

- Students will able to understand about early phyla viz., Protozoa, Porifera, Coelenterata, Platyhelminthes, Aschelminthes and Annelida.
- Students could able to identify, classify and analyze different animals belonging to phylum Protozoa to Annelida on the basis of levels or grades of organization, symmetry, coelom etc. upto class.
- Students will learn, analyze, describe a representative animal belonging to phylum Protozoa to Annelida
- Students could elucidate and explain uniqueness of phylum Protozoa to Annelida and they could able to demonstrate peculiar tissues, organs of animals belonging to these phyla.

Unit:I **7 Hrs.**

1.1 **Kingdom Protista, Phylum - Protozoa:** General characters of Protozoa.
1.2 **Paramecium:** Structure, locomotion and reproduction.
1.3 **Plasmodium:** Structure and life cycle.
1.4 **Parasitic Protozoans of Man :** *Entamoeba, Trypanosoma, Giardia and Leishmania* - Mode of infection, Damage and control.

Unit: II **7 Hrs.**

2.1 **Kingdom- Animalia:** Major phyla of Animalia, general characters and classification upto classes of Phylum Porifera.

2.2: **Sycon**: Structure, reproduction and development, Canal system in sponges.

2.3 C**oelenterata** : General characters and classification up to classes.

2.4 ***Obelia*** : Structure and life cycle, corals and coral reef formation.

Unit III **8 Hrs.**

3.1Platyhelminthes: General characters and classification up to class.

3.2*Taenia solium*: Structure and life cycle, parasitic adaptations in ***Taenia solium.***

3.3Aschelminthes: General characters and classification up to classes.

3.4*Ascaris* : External morphology, reproductive system and life cycle.

Unit – IV **8 Hrs.**

4.1 **Annelida**: General characters and classification up to classes.

4.2 **Leech**: Morphology, digestive and urinogenital system.

4.3**Annelidan larvae**: Trochophore larva and its significance.

4.4 Economic importance of Annelids: Harmful Annelids, Beneficial Annelids, Therapeutic value of Annelids.

Practical : BZO1P01

1. Study of museum specimens (Classification of animals up to orders)

I. Protozoa (Slides) : *Paramoecium ,Euglena, Plasmodium vivax*

II. Porifera: *Sycon, Leucosolenia, Hyalonema, Euplectella, Spongilla*

III. Coelenterata : *Obelia, Aurelia, Tubipora, Fungia, Adamsia*

IV. Platyhelminthes : *Planaria, Fasciola, Taenia*

V. Aschelminthes : *Ascaris, Drancunculus, Ancylostoma, Wuchereria*

VI. Annelida : *Aphrodite, Nereis, Chaetopteurs, Tubifix, Hirudinaria*

2. Study of permanent slides

Enatmoeba, Giardia, Sponge gemmules, Sponge spicules,V.S. *Sycon*, T.S. *Sycon,*

Obelia medusa, Miracidium, Redia and Cercaria larvae of *Fasciola*,T.S. male and

female *Ascaris,* Scolex of *Taenia,* Mature and gravid proglottids of *Taenia solium,*

T. S. of Leech through crop pockets, Trochophore larva

3. Anatomical observation (Demonstration only through You tube video and other ICT tools, models, and charts)

Digestive, nervous and reproductive system of Earthworm

4. Mounting

Spicules and gemmules of Sponge, *Obelia* colony, *Nereis* parapodia, Jaws of Leech,

Nephridia of Leech.

Practical Examination Scheme
Distribution of Marks – **Total Marks: 25**

i. Identification and Comment on Spots (4 Museum specimens + 2 slides)	06
ii. Anatomical observation or Examination of pond water to identify invertebrates.	08
iii. Permanent stained preparation	04
iv. Submission of certified practical record	03
v. Submission of Slides	02
vi.Viva voce	02

List of Recommended Books:

1. Barnes R.D.(1980) **– Invertebrate Zoology. Halt-Saunders international,** 4th Edition, Philadelphia, USA, pp. 1089.

2. Borradaile L.A.and Potts F.A. (1935). **The Invertebrata; a manual for the use of students, 2nd Edition.** McMilan Publisher, New York, USA, pp. 746.

3. Nigam H. C. (2013). **Biology of Nonchordates.** Shoban Lal Nagin Chand, India, pp. 871.

4. Kotpal, Agrawal and Khetrapal (2012). **Modern Text Book of Zoology – Invertebrates.** Rastogi Publication, Meerut, India, pp.

5. Puranik P.G.and Thakur R.S. **– Invertebrate Zoology**

6. Majupuria T.C. **– Invertebrate Zoology**

7. Dhami and Dhami **– Invertebrate Zoology**

8. Parker and Hashwell, **Textbook of Zoology Vol. I (Invertebrates)** A.Z.T.B.S. Publishers and Distributors, New Delhi

9. Dr. S.S. Lal **Practical Zoology Invertebrates 9th edition,** Rastogi Publication Meerut

10. EJW Barrington– **Invertebrate Structure and Function** ELBS III Edition8

11. R.L. Kotpal **– Phylum Protozoa to Echinodermata (series),** Rastogi and Publication, Meerut

12. Parker J. and Haswell W. – **Text Book of Zoology**, ELBS Edition

13. Vidyarthi – **Text Book of Zoology**, Agrasia Publishers, Agra

14. Jordan E.L. and Verma P.S. – **Chordate Zoology**, S. Chand and Co., New Delhi

15. Ayer E. – **Manual of Zoology**

16. M.D. Bhatia – **The Indian Zoological Memories – Leech**

17. Beni Prasad – **The Indian Zoological Memories – Pila**

18. P. K. Gupta – **Vermicomposting for Sustainable Agriculture**, Agrobios India Ltd

19. A manual of Practical Zoology Invertebrates – P. S. Verma

DSC: BZO1T02

Environmental Biology

Theory- 2 Credits + Practical - 1 Credit

Course Outcomes (COs):

- Students will able to describe and explain atmosphere,hydrosphere, lithosphere and energy resources.
- Students could describe, elucidate different types and components of ecosystems. They could identify, describe and explain different biotic components and could explain and analyze their role in ecosystem.
- Students will describe, explain and aware about the significance and need of biodiversity conservation. They also understand, describe and explain legislations passed to conserve the biodiversity and acquainted themselves to nearby National Parks and Wildlife Sanctuaries.
- They will elucidate and differentiate causes of different types and hazards of pollution.
- Students will estimate the different physico-chemical parameters of water to analyze.

Unit–I *7 Hrs.*

1.1 Atmosphere: Major zones, importance, composition of air.

1.2 Hydrosphere: Global distribution of water, Physico-chemical characteristics of water.

1.3 Lithosphere: formation of soil, Causes of soil erosion.

1.4 Renewable and non-renewable energy sources.

Unit–II *7 Hrs.*

2.1 Ecosystem-Definition and Types- Forest, Grassland, Desert, Pond.

2.2 Food chain, food web.

2.3 Ecological pyramids- Definitions, pyramids in pond, forest and parasitic food chain.

2.4 Energy flow in an ecosystem, Single channel, Y –shape and Universal model.

Unit–III *8 Hrs.*

3.1 Biodiversity and its conservation, Biological Diversity Act, 2002.

3.2 Causes of reduction of biodiversity.

3.3 Salient features of Wildlife Protection Act, 1972, Zoological Survey of India: formation and role in animal conservation.

3.4 Hot spots of biodiversity in India,Introductory study of national parks and sanctuaries – Tadoba, Nagzira, Kanha.

Unit–IV *8 Hrs.*

4.1 Air Pollution: Sources, effect and control measures of air pollution, Acid rain, green house effect, ozone depletion and global warming.

4.2 Water Pollution: Sources, effect and control measures of water pollution, effect of mercury.

4.3 Noise pollution: Sources effect and control measures of noise pollution.

4.4 Biomagnification and Bioaccumulation.

Practical: BZO1P02

1. **Major Experiment**:
   i. Estimation of dissolved oxygen (DO) of water.
   ii. Estimation of soil organic carbon by Walkley and Black (Rapid Titration) method.
   iii. Estimation of total hardness of water.
2. **Minor experiment**

   i. To demonstrate the functioning of Simple and Compound Microscope (Minor)

   ii. Estimation of pH of water sample.

   ii. Estimation of noise frequency by using dB meter.

   iii. Quantitative analysis of plankton by Sedwick Rafter method.

   iv. Estimation of free CO_2 of water .

3. **Preparation of permanent stained preparation of zooplanktons**

4. Collection of photographs and identification of producers, primary consumers, secondary consumers, tertiary consumers, decomposers.

5. Preparation of permanent stained preparation of zooplanktons.

6. Study and collection of different types of zooplanktons.

7. Study tour at nearby forest and to record faunal biodiversity of nearby forest.

Practical Examination Scheme

Distribution of Marks – **Total Marks: 25**

i Major experiment	06
ii Minor experiment	04
iii. Identification of consumers and planktons (Any four)	04
iv. Preparation of permanent slide of plankton	03
v. Submission of certified practical record	02
vi. Submission of photographic cards of consumers, zooplanktons	02
vii. Submission of tour diary	02
viii. Viva voce	02

List of recommended Books:

1. Ashthana D.K.(2001). **Environmental Problem and Solution,** S. Chand Publication, pp. 434.

2. Agrawal K.C.(1987). **Environmental Biology.** Agrobios Publishers, pp. 439.

3. Agrawal K.C. (1996). **Biodiversity.** Agrobios Publishers, pp. 144.

4. Mukharjee B. (1980). **Environmental Biology.** Mcgraw Hill, pp. 640.

5. Arora S. (2008). **Fundamentals of Environmental Biology.** Kalyani Publisher, pp. 294.

6. Sharma P.D.(2012). **Ecology and Environmental Biology.** Rastogi Publication, pp. 640.

7. Verma P.S. and Agrawal V.K. (2000). **Environmental Biology,** S. Chand Publication, pp. 434.

8. Trivedi & Rao **– Air Pollution**

9. Chapman J.L. and Reiss M.J. (1998). **Ecology-Principles and Applications**, 2nd ed., Cambridge University Press, pp. 336.

10. Chatterjee B (2003). **Environmental Laws-Implementation Problems and Perspectives.** Deep and Deep Publications,India, pp. 304

11. Sharma P.D. (1997). **Environmental Biology**, Rastogi Publication, Meerut, pp. 416.

12. Trivedi R.K. (19976). **Handbook of Environmental Laws, Acts, Rules, Guidelines, Compliances and Standards.** Enviro Media

13. Odum E.P. and Barret G,W, (2005). **Fundamentals of Ecology**, 5th edition. Thomson Brooks/ Cole , pp.598.

14. Smith R.L. (1996). **Ecology and Field Biology**, Harper Collins

15. Saxena D.N. **– Environmental Biology**, Studium Press (India)

16. Davis – **Behavioral Ecology**

17. Kumar U. and Asija M.J. (2000). **Biodiversity – Principle and Conservation.** Agrobios Publishers, pp. 302.

18. Rao M. and Rao H.V.N. (2017). **Air Pollution,** Mcgraw Hill, pp. 339.

19. Satyanarayan S., S. B. Zade S.B., S.R. Sitre S.R.and Meshram P.U. – **A Text Book of Environmental Studies**, Allied publisher (India)

20. Smitz R.J. (1996). **Introduction to Water Pollution.** Asian Books Private Limited, pp. 320

21. Subrahmnyam N.S. and. Sambamurthy A V.S.S (2000). **Ecology.** Narosa Publishing House, pp. 616.

B.Sc. Sem. I
VSC course : Vermicomposting BVS1P01
Credit: 2
.

Course outcomes: After completion of this course, student will –

- Get acquainted with hand on training of vermicomposting.
- Get acquainted with hand on training of vermiwash.
- Able to understand and learn about the vermicompost marketing.
- Able to do internship in any commercial vermicompost or vermiwash unit.

Practical:

1. Collection of Biodegradable wastes (Solid waste) and their segregation and processing
2. Bed Preparation for Pit/Windrow method
3. Pit Regulation, its maintenance and precautions
4. Earthworm collection and application on bed
5. Inspection of bed, watering and top up
6. Vermicompost collection, earthworm separation (Harvesting), air drying of vermicompost, sieving and storage of compost
7. Vermiwash: methods collection and processing
8. Cocoon formation, breeding methods of worms
9. Standardize technique with categorized biodegradable wastes
10. Analysis of vermicompost and vermiwash; soil testing
11. Applications/ packaging and marketing of byproducts
12. Visit to vermiculture farm/setup

Suggested reading:

Lekshmy MS and Santhi R. Vermitechnology. Saras Publication, pp. 416.

Singh K (2014). Textbook of vermicompost: vermiwash and biopesticides. Astral International, pp. 97.

Davies P. (2014). Vermicomposting and vermiculture, pp. 49.

Das M. (2013). Tools for vermitechnology. IK International Publishing House Pvt. Ltd., 1st ed., pp. 196

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr P.U. Meshram, Allied Publishers, New Delhi.
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

B.Sc. Sem. II

DSC: BZO1T03

Life and Diversity of Animals – Non-Chordates: Life and Diversity of Animals (Arthropoda to Hemichordata)

Theory- 2 Credits + Practical - 1 Credit

Course Outcomes (COs):

1. Students will learn, identify, explain and analyze the taxonomic position of animals belonging to phylum Arthropoda to Hemichordata
2. They could describe, explain and analyze phylogeny to understand the course of evolution in animals from phylum Arthropoda to Hemichordata
3. They will able to describe, explain and differentiate various morphological, anatomical structures and functions of animals of phyla from Arthropoda to Hemichordata.
4. Students will able to understand , describe, explain and differentiate the larval forms and development of the invertebrates from phylum Arthropoda to Hemichordata
5. Students will able to describe, explain and analyze the ecological and economic importance of invertebrates.
6. Students will understand, able to describe, explain and analyze the ecological role of invertebrates in the biodiversity.

UNIT: I **7 Hrs**

1.1. Arthropoda: General characters of the phylum and classification up to classes with suitable examples

1.2. Cockroach: Digestive system, Male and Female reproductive system

1.3. **Insects as Vectors** : Mosquito, Housefly, Tse-Tse fly

l. 4. Study of crustacean larvae: Nauplius, Zoea and Megalopa

UNIT: II **7 Hrs**

2.1 Mollusca: General characters and classification up to classes

2.2 Pila: Respiratory system and Mechanism of Aquatic and Pulmonary respiration.

2.3 Economic importance of Mollusca: Edible oyster farming, pearl forming mollusc, types of pearl culture

2.4 Molluscan larva: Glochidium and Veliger

UNIT: III **8 Hrs**

3 .1 Echinodermata: General characters and classification up to classes

3.2 Asterias: External morphology, Straight and Crossed type of Pedicellariae.

3.3 Water vascular system and locomotion in *Asterias*

3.4 Echinoderm larva: Bipinnaria and Auricularia

UNIT: IV **8 Hrs**

4.1 Hemichordata: General characters and Phylogeny

4.2 Balanoglossus: External features and digestive system

4.3 Pre-Larval Development in Balanoglossus, Tornaria larva

4.4 Affinities of Balanoglossus with Annelida, Echinodermata and Chordata

Practical - BZO1P03

1. **Study of museum specimens** (Classification of animals up to orders)

I. Arthropoda : Crab, Prawn, Scolopendra, Julus, Dragonfly, Moth, Limulus
II. Mollusca : Chiton, Dentalium, Pila, Mytilus, Sepia, Octopus
III. Echinodermata : Asterias, Ophiothrix, Holothuria, Antedon, Echinus
IV. Hemichordata : Balanoglossus, Saccoglossus

2. Study of permanent slides- Nauplius, Zoea and Megalopa larva of Arthopoda, Glochidium larva, Bipinnaria larva, T.S. Balanoglossus through branchiogenital region, Tornaria larva

3. Anatomical observation (Demonstration Only -Through You Tube Video and other ICT tools, Models, Charts) –

I. Digestive system of Cockroach
II. Male and Female Reproductive system of Cockroach
III. Water vascular system in *Asterias*.

4. Mounting (Any two) - I. Crustacean larvae and planktons

II. Mouth Parts of Insects – Cockroach/Mosquitoes

III. Gill lamella of Pila

5. Collection of photograph of insect vectors.

6. Examination of pond water to identify aquatic Arthropods and Molluscs.

Practical Examination Scheme

Distribution of Marks – **Total Marks: 25**

i Identification and Comment on Spots (4 Museum specimens + 2 slides)	06
ii Anatomical observation or Examination of pond water to identify invertebrates.	08
iii Permanent stained preparation	04
iv Submission of certified practical record	03
v. Submission of Slides	02
vi. Viva voce	02

List of recommended books:

1. Barnes **– Invertebrate Zoology (Halt-Saunders international)** Philadelphia, USA

2. Barradaile L.A. and Potts F.A. – **The Invertebrate**

3. Nigam **– Biology of Nonchordates**

4. Kotpal, Agrawal & Khetrapal **– Modern Text Book of Zoology - Invertebrates,**

Rastogi Publication, Meerut

5. Puranik P.G. and Thakur R.S. **– Invertebrate Zoology**

6. Majupuria T.C. **– Invertebrate Zoology**

7. Dhami and Dhami **– Invertebrate Zoology**

8. Parker and Hashwell, **Textbook of Zoology Vol. I (Invertebrates)** A.Z.T.B.S. Publishers and Distributors, New Delhi

9. Dr. S.S. Lal **Practical Zoology Invertebrates**. 9th edition**,** Rastogi Publication Meerut

10. EJW Barrington– **Invertebrate Structure and Function.** 8th Edition, ELBS III

11. R.L. Kotpal **– Phylum Protozoa to Echinodermata (series),** Rastogi and Publication, Meerut

12. Parker J. and Haswell W. – **Text Book of Zoology**, ELBS Edition

13. Vidyarthi – **Text Book of Zoology**, Agrasia Publishers, Agra

14. Jordan E.L. and Verma P.S. – **Chordate Zoology**, S. Chand and Co., New Delhi

15. Ayer E. – **Manual of Zoology**

16. M.D. Bhatia – **The Indian Zoological Memories – Leech**

17. Beni Prasad – **The Indian Zoological Memories – Pila**

18. P. K. Gupta – **Vermicomposting for Sustainable Agriculture**, Agrobios India Ltd

19. A manual of Practical Zoology Invertebrates – P. S. Verma

DSC: BZO1T04

Cell Biology
Theory- 2 Credits + Practical - 1 Credit

Course Outcomes (COs):

- Students will able to describe, sketch, analyze, and explain the structure and function of the cell organelles.
- Students could describe, sketch, analyze, and explain the structure and function of nucleus and chromatin structure, its location.
- Students will able to describe, sketch, analyze, and explain the basic principle of life. Theu could also demonstrate and explain how a cell divides leading to the growth of an organism.
- Students could describe, sketch, analyze, and explain how a cell communicates with its neighbouring cells.
- Students will able to describe, sketch, analyze, and explain the abnormality in structural and functional aspects of cells.
- Students will able handle and use microscopes and oculometer to elucidate and measure and explain the minor details of tissues.
- Students will able to demonstrate osmosis. They could also demonstrate and explain mitochondria, salivary gland chromosome and Barr body in cells.

UNIT: I **7 Hrs.**

1.1 Ultra-structure of Plasma membrane and it's chemical composition

1.2 Endomembrane system: Protein sorting, transport, exocytosis, endocytosis

1.3 Cell-cell interaction: Cell adhesion molecules, cellular junction

1.4 Golgi Complex: Structure and functions.

UNIT 2 **7 Hrs.**

2.1 Cytoskeleton: Microtubules, Microfilaments, intermediate filaments.

2.2 Mitochondria: Structure and Oxidative phosphorylation, ETS.

2.3 Peroxisome: Structure and functions.

2.4 Ribosome: Structure, types, Lake's model and functions.

UNIT 3 **8 Hrs.**

3.1 Lysosome: Structure, polymorphism and functions

3.2 Structure and function of Nucleus and Nuclear membrane

3.3 Chemical Composition and base composition of DNA and RNA

3.4 Chromatin Modelling: Supercoiling, Chromatin organization, structure of chromosome

UNIT 4 **8 Hrs.**

4.1 Cell cycle and its regulation, Apoptosis

4.2 Cell Division: Mitosis and Meiosis

4.3 Signal transduction: Intracellular signalling, cell surface receptors, G-protein coupled receptors

4.4 Cellular aging and cell death

Practical: BZO1P04

1. **Major Experiment**
   a. Study of Osmosis in human RBCs (Hypertonic, hypotonic and isotonic).
   b. Demonstration of Mitotic cell division in *Allium cepa.*
   c. Demonstration of Salivary gland chromosome in Mosquito/ *Chironomous* larvae.
   d. Demonstration of Barr body in blood smear.
2. **Minor Experiment**
   a. Use of Ocular micrometer and measurement of Micro objects.
   b. Demonstration of Meiotic cell division in *Tradescantia* buds or Grasshopper Testis (Virtual/Pictorial).
   c. Demonstration of mitochondria in buccal epithelium by Janus green B method.
3. **Reading/Preparation/Presentation a report** on Indian Scientist who contributed in the field of Cell biology/Molecular Biology (Dr. Hargovind Khurana, Dr. Lalji Singh, Dr/ Shantiswaroop Bhatnagar, Dr. Arunkumar Yadav etc.)
4. **Preparation of photographic cards on various cell organelles.**

Practical Examination scheme

Distribution of Marks –	**Total Marks: 25**
1. Major Cytology Experiment	06
2. Minor Cytology Experiment	04
3. Report (Indian Scientists)	02
4. Submission of Laboratory report/slides/photographs	03
5. Submission of certified Practical Record	05
6. Viva voce	05

List of recommended Books:

1. Powar C.B. (1991). **Cell Biology**. Himalaya Publication, New Delhi, pp. 782.

2. Dr. S.P. Singh, Dr. B.S. Tomar (2007). **Cell Biology.** 9th revised edition, Rastogi Publication, Meerut

3. Gupta P.K. (2018). **Cell and Molecular Biology.** Rastogi Publication, Meerut, pp. 942.

4. Veer Bala Rastogi. **Introduction to Cell Biology**, Rastogi Publication, Meerut

5. Gerald Karp (2007). **Cell and Molecular Biology-Concepts and Experiments**, John Wiley and Sons, pp. 843.

6. De Robertis, E. D. P., Nowinski, W. W., Saez, F. A. (1965). Cell Biology, Saunders, pp. 446.

7. Verma P.S. and Agrawal V.K. **Concepts of Cell Biology**

8. Dowben R.M. (1971). **Cell Biology.** Harper and Row Limited, pp. 570.

9. Witt **– Biology of Cell**

10. Ambrose E.J. and Easty D.M. (1970). **Cell Biology.** Thomas Nelson and Sons Ltd, pp.500.

B.Sc. Sem. II
VSC course: Culture of Indian Major Carps BVS1P03
Credit: 2
.

Course outcomes: After completion of this course, student will–

- Able to sketch, describe, Identify and classify the Indian major carps.
- Design the layout of the various types of ponds for the rearing of various stages of IMC.
- Get acquainted with hands on training of various breeding techniques.
- Get acquainted with hands on training of rearing of fry to fingerlings.
- Able to understand the different types of crafts and gears used in fish harvesting (Catching).
- Get hands on training of handling of various gear, crafts used in fish harvesting (Catching).
- Able to do internship and work in any commercial breeding centre .

Practical:

- Identification and classification of Indian major carps and other cultivable carps along with IMC (*Labeo, Catla and Mrigal, L. calbasu*, Grass carp, Silver carp, *Cyprinus*)
- Study of preparation of nursery, rearing and stocking pond by visiting Fish farm or with the help of ICT tools/ models/ charts/ photographs etc.
- Study of food and feeding habits of Indian major carps with the help of already available Food/ ICT tools/ models/ charts/ photographs etc.
- Study of carp seed rearing by visiting breeding centers or with the help of ICT tools/ models/ charts/ photographs etc.
- Study of rearing of fry to fingerlings by visiting breeding centers or help of ICT tools/ models/ charts/ photographs etc.
- Study of harvesting tools. (Crafts and Gears) with the help of already available crafts and gears / ICT tools/ models/ charts/ photographs etc.
- Study of fertilizers with the help of already available Fertilizers/ ICT tools/ models/ charts/ photographs etc..
- Study of stocking density to various ponds by visiting Fish farm or with the help of ICT tools/ models/ charts/ photographs etc.
- Study of preservation techniques with the help of ICT tools/ models/ charts/ photographs etc.
- Visit to breeding centers.
- Market survey.

Suggested reading:

- **Datta Munshi, JS and Shrivastva, M P (1988).** Natural history of fishes and systematic of fresh water fishes. Narendra Publishing House, pp. 381.
- **Jayaram KC (1981).** The freshwater fishes of India, Pakistan, Bangladesh, Burma and Shri Lanka Handbook: Zoological Survey of India, pp.475.
- **Mishra K. S. (2003).** An aid to the identification of common commercial fishes of India and Pakistan. Narendra Publishing House, pp. 320.
- **Bardach, J.E. (1974).** Aquaculture: The farming and husbandry of freshwater and marine organism. John Wiley and Sons, pp. 882.
- **Chonder S L(1970).** Handbook of breeding of Indian Major Carps by pituitary hormone injection. Satish Book Enterprises, pp. 100.
- **Jhingran V G (1991).** Fish and fisheries of India: Hindustan Publication Corporation, pp. 727.
- **Sinha VRP (1993).** A compemendium of aquaculture technologies:. Oxford and JBH Publication Co. New Delhi.
- **Pandey K and J.P. Shukla JP (2018).** A Textbook of fish and fisheries Rastogi Publication, Meerut, pp. 588.
- **Khanna SS and Singh HR (2014)**. A text book of fish biology and fisheries. 3rd edition, Narendra Publishing House.

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

B. Sc. in Applied Electronics & Software Technology

Submitted by

Board of Studies,

B. Sc. in Applied Electronics & Software Technology

FYUGP - Scheme I - VIII Semester as per NEP

B.Sc. in Applied Electronics & Software Technology (Honors/Research)
Four Year (Eight Semester Degree Course)Teaching and Examination Scheme

Semester I

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Computer Programming I	BET1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Computer Programming I	BET1P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Electrical Engineering	BET1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Electrical Engineering	BET1P02	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)	BET1T03	2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)	BET1P03	-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)	BET1T04	2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)	BET1P04	-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Engineering Mathematics I	BET1T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Social Science	BET1T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Communicative English	BET1T07	2	-	-	2	3	50	50	40	-	-	-
12	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
13	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-		100	50
Total				14	-	16	**22**		**530**	**170**		**200**	**200**	

Semester II

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Computer Programming I	BET2T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Computer Programming I	BET2P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Electrical Engineering	BET2T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Electrical Engineering	BET2P02	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 3 (Refer Minor Basket)	BET2T03	2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)	BET2P03	-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 4 (Refer Minor Basket)	BET2T04	2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)	BET2P04	-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Engineering Mathematics I	BET2T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Social Science	BET2T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Communicative English	BET2T07	2	-	-	2	3	50	50	40	-	-	-
12	VEC	Environmental Sci.	BVE2T01	2	-	-	2	3	80	20	40	-	-	-
13	CC	Refer CC Basket	BCC1P02	-	-	4	2	-				-	100	50
Total				14	-	16	**22**		**530**	**170**		**200**	**200**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

Semester III

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Computer Programming II	BET3T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Computer Programming II	BET3P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Digital Electronics	BET3T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Digital Electronics	BET3P02	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 5 (Refer Minor Basket)	BET3T03	2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 5 (Refer Minor Basket)	BET3P03	-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 6 (Refer Minor Basket)	BET3T04	2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 6 (Refer Minor Basket)	BET3P04	-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Engineering Mechanics	BET3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSEC	Engineering Drawing	BET3T06	-	-	4	2	-	-	-	-	50	50	50
11	VSEC	Workshop	BET3T07	-	-	4	2	-	-	-	-	50	50	50
12	AEC	Engineering Mathematics II	BET3T08	2	-	-	2	3	80	20	40	-	-	-
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**480**	**120**		**250**	**250**	

Semester IV

SN	Course Category	Name of Course	Course Code	ing Scheme(hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Computer Programming II	BET4T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Computer Programming II	BET4P01			2	1	-	-	-	-	25	25	25
3	DSC	Digital Electronics	BET4T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Digital Electronics	BET4P02			2	1	-	-	-	-	-	50	25
5	DSC	Electron Devices & Circuits	BET4T03	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Electron Devices & Circuits	BET4P03			2	1	-	-	-	-	25	25	25
7	DSC	Linear Network Analysis	BET4T04	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Linear Network Analysis	BET4P04			2	1	-	-	-	-	-	50	25
9	GE/OE	Engineering Mechanics	BET4T05	2	-	-	2	3	80	20	40	-	-	-
10	AEC	Engineering Mathematics II	BET4T06	2	-	-	2	3	80	20	40	-	-	-
11	VEC	Constitution ofIndia	BVS4T02	2	-	-	2	3	80	20	40	-	-	-
12	CEP	Community Service	BCM5P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P04	-	-	4	2		-	-	-	-	100	50
Total				14	-	16	**22**		**400**	**100**		**300**	**300**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

Semester V

SN	Course Category	Name of Course	Course Code	ing Scheme(hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Microprocessors	BET5T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Microprocessors	BET5P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Linear Integrated Circuits	BET5T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Linear Integrated Circuits	BET5P02	-	-	2	2	-	-	-	-	-	50	25
5	DSC	Digital Signal Processing	BET5T03	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Digital Signal Processing	BET5P03	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Instrumentation & Control System	BET5T04	2	-	-	2	3	80	20	40	-	-	-
8	DSE	Instrumentation & Control System	BET5P04	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Algorithm & Data Structure	BET5T05	2	-	-	2	3	80	20	40	-	-	-
10	DSE	Algorithm & Data Structure	BET5P05	-	-	2	1	-	-	-	-	25	25	25
11	GE / OE	Communication Electronics	BET5T06	2	-	-	2	3	80	20	40	-	-	-
12	VSCE	MatLab & LabView	BET5T07	-	-	4	2	-	-	-	-	50	50	50
13	CEP	Unnat Bharat Abhiyan	BCM5P02	-	-	6	3	-	-	-	-	75	75	75
Total				**12**	**-**	**20**	**22**	**-**	**480**	**120**	**--**	**250**	**250**	**-**

Semester VI

SN	Course Category	Name of Course	Course Code	ing Scheme(hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Microprocessors	BET6T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Microprocessors	BET6P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Linear Integrated Circuits	BET6T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Linear Integrated Circuits	BET6P02	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Digital Signal Processing	BET6T03	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Digital Signal Processing	BET6P03	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Instrumentation & Control System	BET6T04	2	-	-	2	3	80	20	40	-	-	-
8	DSE	Instrumentation & Control System	BET6P04	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Algorithm & Data Structure	BET6T05	2	-	-	2	3	80	20	40	-	-	-
10	DSE	Algorithm & Data Structure	BET6P05	-	-	2	1	-	-	-	-	25	25	25
11	GE / OE	Communication Electronics	BET6T06	2	-	-	2	3	80	20	40	-	-	-
12	VSCE	Simulation using MatLab & LabView	BET6T07	-	-	4	2	2	-	-	-	50	50	50
13	OJT	Industrial Training (Six Weeks)	BOJ6P01	-	-	6	3	-	-	-	-	75	75	75
Total				**12**	**-**	**20**	**22**	**-**	**480**	**120**	**--**	**250**	**250**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

Semester VII

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Microcontrollers	BET7T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Microcontrollers	BET7P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	System Design	BET7T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	System Design	BET7P02	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Advanced Programming	BET7T03	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Advanced Programming	BET7P03	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Circuit Design	BET7T04	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Circuit Design	BET7P04	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Database Management System	BET7T05	2	-	-	2	3	80	20	40	-	-	-
10	DSE	Database Management System	BET7P05	-	-	2	1	-	-	-	-	25	25	25
11	DSE	Industrial Organization & Management	BET7T06	2	-	-	2	3	80	20	40	-	-	-
12	DSE	Industrial Organization & Management	BET7P06	-	-	2	1	-	-	-	-	-	50	25
13	RM	Research Methodology	BET7T07	2	-	-	2	3	80	20	40	-	-	-
14	RM	Research Methodology	BET7P07	-	-	4	2	-	-	-	-	50	50	50
Total				14	-	16	**22**		**560**	**140**		**200**	**200**	

Semester VIII

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Advanced Microcontrollers	BET8T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advanced Microcontrollers	BET8P01	-	-	2	1	-	-	-	-	25	25	25
3	DSC	System Design	BET8T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	System Design	BET8P02	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Advanced Programming	BET8T03	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Advanced Programming	BET8P03	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Circuit Design	BET8T04	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Circuit Design	BET8P04	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Computer Network	BET8T05	2	-	-	2	3	80	20	40	-	-	-
10	DSE	Computer Network	BET8P05	-	-	2	1	-	-	-	-	25	25	25
11	DSE	Industrial Organization & Management	BET8T06	2	-	-	2	3	80	20	40	-	-	-
12	DSE	Industrial Organization & Management	BET8P06	-	-	2	1	-	-	-	-	-	50	25
13	RP	Project	BET8P01	-	-	8	4	-	-	-	-	100	100	100
Total				12	-	20	**22**		**480**	**120**		**250**	**250**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

Note:- Total Credits 176

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

FYUGP-I-VIII Semester
Applied Electronics & Software Technology
(Honors/Research)
Four Year (Eight Semester Degree Course)

(Question Paper Pattern for all subjects)
Scheme for Theory Examination
Duration for each theory Examination: **3 Hours**
Maximum Marks Allotted to each Theory: **80**

Instruction for paper setting and distribution of Marks-

1) The Examiner shall set a question paper of 8 questions. The examiner has to set **Eight** questions on all units. Preferably **one** question on each unit and a **last question** based on all units together. Each question will be of 16 marks, internal equal division is suggested.

2) The moderation committee shall retain 7 questions.

3) The student should answer any 5 questions out of 7.

Syllabus -- Eight Semesters

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER I

1-T-1 **APPLIED PHYSICS**

Scheme of Examination(Theory)

Sessional – 10
Paper - 40
Total - 50

Unit I: Motion of charges particles in uniform electric and magnetic fields, Thomson's method for determination of e/m of t1 electron, Electrostatic and magnetostatic focussi (qualitative idea); Bainbridge mass spectrograph, Cyclotron.
Unit II : Elementary ideas of C.R.O., electrostatic focusing in CRO,
Unit III : Crystals structure (cubic b.c.c. & f.c.c.), Atomic packing, Co-ordination numbers, Millers indices, Bragg's Law.
Formation of energy bands in solids (energy level approach) classification of solids in conductors, Insulators and semiconductors, Energy band diagram for silicon and germanium semiconductors, Fermi energy, Fermi level in intrinsic and extrinsic semiconductors, Dependence of Fermi level on impurity concentration and temperature, p-n junction, Transistor, Hall effect.
Unit IV : The quantum nature of radiation, Photoelectric effect, Compton effect, Wavelike character of particle, Davission and Germer's experiment, De Broglie wavelength, Heisenberg's uncertainty principle, Schroedinger's wave equation (qualitative aspect).
Unit V: Spontaneous and stimulated emission of radiation, Coherency Laser : Working principle, different types and application, Interference in thin films.

Books for reference:

1. Material Science and Engineering: V. Raghavan
2. Physics for students of science and Engineering Part II –David Haliday & Robert Resnick
3. Electronic Engineering material – John Allison (TMH)
4. Modern Physics – Sproul
5. Lasers and their application – M.L. Bessley (Tailer and France Ltd.)

1-P-1 **APPLIED PHYSICS**

Scheme of Examination;
No examination in semester I

Practical's

1. Determination of the resistivity of a semiconductor.
2. Determination of the band gap in a semiconductor using a p-n junction diode in reverse bias condition.
3. A study of the characteristics of a thermistor.
4. A study of single beam cathode ray oscilloscope (CRO) :-
5. A study of dual trace CRO:

i) Familiarization
ii) Determination of phase difference by direct method
iii) Determination of phase and frequency using lissajous patterns.

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY

Semester I

1-T-2 **APPLIED CHEMISTRY**

Scheme of Examination (Theory)

Sessional – 10
Paper - 40
Total - 50

Unit I : Structure of Molecules :
Isomerism, classification, optical isomerism, enatiomerism and distereoisomerism, geometrical isomerism; Conformational analysis of ethane and butane.

Unit II : Chemical bonding:
Introduction, Types of bonds, valence bond and molecular orbital approaches. Physical properties and chemical constitution, dipole moment and parachor.

Unit III : Air pollution and its control :
Introduction, causes of air pollution. Types of air pollutants, harmful effects of air pollution on human health. Control of air pollution.

Unit IV : Water treatment ;
Impurities in natural water (suspended, dissolved and bacterial), soft water and hard water, causes of hardness. Disadvantages of use of hard water for domestic and industrial purposes. Treatment of drinking water by filtration, coagulation, sedimentation and sterilization. Treatment of hard water for industrial purposes by Lime-soda method and ion-exchange method.

Unit V : Metals and Alloys ;
Introduction, characteristics of metals, alloys, purpose of making alloys, classification. Corrosion and protection of metals.

1-P-2 **APPLIED CHEMISTRY**

Scheme of examination (Practical)

No examination in semester I

1. Preparation and analysis of soap.
2. To determine the total hardness of hard water.
3. To determine the temporary hardness of hard water.
4. Determination of surface tension of liquid using stalagmometer.
5. Preparation of buffer solutions and determination of pH of buffer solution

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER I

Scheme of Examination(Theory)

Sessional – 10
Paper - 40
Total - 50

1-T-3 COMPUTER PROGRAMMING I

Unit I:
Introduction, History of computers, Generation of computer.
Unit II:
Basic computer organization: input-output devices, Storage devices.
Unit III:
Relationship between hardware and software, System Software, Application Software
Unit IV:
Working with DOS, Basic DOS commands & advanced DOS commands.
Unit V: Flow chart
Books: Computer Fundamentals – P.K.Sinha

1-P-3 COMPUTER PROGRAMMING I

Scheme of Examination (Practical):
No examination in semester - I
Minimum 5 practical based on the theory syllabus.

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER I

1-T- 4 **ELECTRICAL ENGINEERING**

Scheme of Examination (Theory)

Sessional – 10
Paper - 40
Total - 50

Unit I : Electric Circuits : Ohm's Law, Resistance in series, Resistances in parallel, Voltage source and current source (ideal and practical), Source Transformation

Unit II : Electric Circuits : Kirchoff's Current Law (KCL), Kirchoff's Voltage Law (KVL), Star-delta Transformation

Unit III: Magnetic Circuits: Magnetic field, Flux, Flux density, Magnetomotive force (mmf), Field intensity or magnetizing force, Magnetisation curve, Comparison of electric and magnetic circuits, Series and parallel magnetic circuits.

Unit IV : A.C. Circuits : Generation of single phase ac voltage and current, average and rms values, Form factor, Phasor representation of alternating quantity, Reactances and impedances,

Unit V : A.C. Circuits : A.C. through pure resistance, Inductance and capacitance, Power in ac circuit, Power factor, series and parallel as circuits, Resonance condition in series and parallel circuits.

Books :

1. A Text book of Electrical Technology : Volume I & II – B.L. Theraja
2. Worked Examples in Electrical Engineering – B.L. Theraja

1-P-4 **ELECTRICAL ENGINEERING**

Scheme of examination (Practical)
No examination in semester I

1. Verification of Kirchoff's Current Law.
2. Verification of Kirchoff's Voltage Law.
3. Verification of Superposition Theorem.
4. Study of B-H Curve.
5. Verification of various relations in R-L series circuit.

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER I

1-T-5 ENGINEERING MATHEMATICS I

Scheme of Examination (Theory)

Sessional – 10
Paper - 40
Total - 50

Unit I : Complex Numbers

Cartesian and polar form of complex numbers, D' – Movre's theorem, Exponential function of a complex variable, circular functions of a complex variable, Hyperbolic functions and their inverses

Unit II : Theory of Equations

General properties of polynomial equations, Relation between roots and coefficients, Transformation of equations, Horner's method of synthetic division, Reciprocal equations

Unit III : Tangents and Normals

Tangent and Normals, length of the tangent, subtangent, normal and subnormal

Unit IV : Expansion of functions

Maclaurins series, Taylor's theorem for functions of one variable

Unit V : Indeterminate Forms

Indeterminate forms, L' Hospital Rule for evaluating the indeterminate forms.

Books :

1 Higher Engineering Mathematics – Dr.B.S.Grewal
2 A Text Book of Engineering Mathematics – N.P.Bali, Manish Goyal
3 Engineering Mathematics – H.K.Das

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER I

1-P-5 COMMUNICATIVE ENGLISH

Course Outcomes :
By the end of the course the learners will be:

- Proficient in the four language skills namely Listening, Speaking, Reading and writing.
- Able to increase their vocabulary
- Able to master the basic grammatical concepts
- Able to produce good coherent Paragraphs and be adept at Writing.
- Able to understand the use of the Language through the Prose selections of eminent writers.
- Able to communicate effectively in their professional arena.

Applied Electronics and Software Technology
Semester I
Subject Communicative English

Theory: 40
Internal: 10
Total : 50

Unit I Reading Comprehension and Vocabulary Building 10
From the Prescribed Book: Glimpses, Board of Editors. Macmillan Education
A Snake in the Grass by R K Narayan
The Happy Prince by Oscar Wilde

Unit II Grammar 10

Subject word agreement
Tenses
Articles
Prepositions

Unit III Writing Skills 10

Job Application
Resume writing
Paragraph Writing
Precis Writing
Comprehension

Unit IV Use of Media and Technology in the Classroom **10**

Story Telling

PowerPoint Presentation

Unit V Speaking and Listening Skill **10**

Situational Conversation

Role Play

Voice Training and expression through Effective Public Speaking

Prescribed Book:

Glimpses, Board of Editors. Macmillan Education

Reference Books:

1. Professional Communication Skills : By Pravin S.R.Bhatia, A.M Sheikh: S.Chand and company
2. Presentations (The Business Skills Series) by Anne Laws Orient Black Swan
3. Mac Millan Foundation English R.K Diwedi and A.Kumar
4. Written and Spoken Communication in English- University Press
5. Applied English Grammar and Composition Dr. P.C.Das New Central Book Agency(P) Ltd
6. English Communication – A Textbook for the AECC – English As per the UGC Syllabus – Madhumita Chakraborty : Macmillan Education
7. Business Correspondence and Report Writing- Mc Graw Hill Education by R.C Sharma and Krishna Mohan
8. Soft Skills Dr. K. Alex by S. Chand

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER I

1-T-6 SOCIAL SCIENCE

Scheme of Examination(Theory)

Sessional – 10
Paper - 40
Total - 50

Unit I : Industrial Psychology

i) Meaning and Definition
ii) Scope

Unit II : Fatigue in Industry

i.)Meaning and Definition of Fatigue
ii) Internal environment
iii) Factors creating fatigue
iv) Techniques of lessening physical fatigue, Other Techniques
v)External environment
vi) boredom and monotony

Unit III : Recruitment , Selection and training

i) Recruitment: sources of Recruitment
ii) Selection: steps in selection process
iii) Training: methods of training, Advantages of Training

Unit IV : Indian Constitution and Federal System

i) Remarkable features
ii) Federal System
iii) A Quasifederal constitution

Unit V : Fundamental Rights and Directive Principles of state policy

i) Fundamental rights
ii) Characteristics
iii) Fundamental Right enshrined in the constitution
iv) The directive principles of state policy

Bibliography

1) A new Outlook into Social Science – S. Shabbir, A. M. Sheikh, Jaya Dwadashiwar, S. Chand, Delhi
2) T. Ramasamy, 2012, Principles of Management, Himalaya Publishing House, Mumbai.
3) Dr. Pratibha M. Siriya, 2011, Principles of Business Management, Sai Jyoti Publication, Nagpur.
4) King's, Personnel management & Industrial Relations, Harsha Rastogi, Delhi.

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY

Semester I

1-P-6 ENGINEERING DRAWING I

Scheme of Examination (Practical)

No examination semester -I

Minimum 10 sheets based on syllabus :

1. Lettering, dimensioning, plane scales, diagonal scales, vernier scales and scale of chords.
2. Conic sections, general method of constructions, oblong method and concentric circle method for ellipse, rectangle method and tangent method for parabola, rectangular hyperbola, normal and tangent to the curves.

Books for reference :

1. Engineering Drawing by N.D. Bhatt
2. Engineering Drawing by A.R. Bapat.

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER II

2-T-1 **APPLIED PHYSICS**

Scheme of Examination(Theory)

Sessional – 10
Paper - 40
Total - 50

Unit I : Magnetic Materials : Terminology and classification, Magnetic moments due to electron spin, Domain structure, Soft magnetic materials, Hard magnetic materials. Atomic Interpretation of diamagnetic paramagnetic, antiferromagnetic and ferromagnetic materials.

Ferromagnetic domains & polarization reversal, Alloys for care materials for rotating machines and transformers and for permanent magnets, non-magnetic steels. Non metallic magnetic materials, magnetic oxide, Thin film magnets, Magnetic materials for magnetic tape & memory devices.

Unit II : Dielectric Materials : Polarization Temperature & Frequency effects, electric breakdown, ferroelectric materials.

Unit III : Conductors & Resistors : Units and constants, The resistively range, Resistively of different materials. The free electron theory, conduction by free electrons, Conductor and resister materials, Superconductors.

Unit IV :Semiconductors : Introduction, The energy gap in solids, Entrinsic Semiconductors, extrinsic semiconductors, Semiconductor materials & their fabrication, Some Semiconductor devices.

Unit V :Semiconductor material technology : Method of materials preparation purification and doping, introduction to process of manufacturing semiconductor devices transistor.

Books for references :

1. Material Science and Engineering : V. Raghavan
2. Physics for students of science and Engineering Part II –David Haliday & Robert Resnick
3. Electronic Engineering material – John Allison (TMH)
4. Modern Physics – Sproul
5. Lasers and their application – M.L. Bessley (Tailer and France Ltd.)

2-P-1 **APPLIED PHYSICS**

Scheme of Examination (Practical)

Sessional - 20
Practical – 80
Total - 100

1. Study of the characteristics of germanium and silicon diodes and their comparison.
2. Study of the characteristics and verification of the stability action of zener diode.
3. Study of the input, output and transfer characteristics of a pnp-npn transistor in common base configuration.
4. Study of the input, output and transfer characteristics of a pnp/npn transistor in common emitter configuration.
5. Study of series and parallel combination laws for resistance and capacitance

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
Semester II

2-T-2 **APPLIED CHEMISTRY**

Scheme of Examination(Theory)

Sessional – 10
Paper - 40
Total - 50

Unit I : Thermochemistry
Introduction, heat of neutralization, heat of solution, heat of combustion, and their determination. Heat of reaction at constant volume and constant pressure. Laws of thermochemistry.

Unit II :Chemical kinetics
Introduction, molecularity, rate and order of reaction. Kinetics of first and second order reaction, their characteristics and methods for determination of order of reaction.

Unit III :Fuels
Introduction, classification, essential properties and selection of good fuels. Analysis of coal, refining of petroleum,synthetic fuels, biogas.

Unit IV : Non-metallic Engineering materials
a) Lime: Definition, classification and properties of lime.
b) Cement: Classification, manufacture of Portland cement. Chemistry of Portland cement, chemical composition, setting and hardening.

Unit V :Thermal insulators
Introduction, factors affecting thermal conductivity of insulators, characteristics of good thermal insulator, classification with examples. Glasswool, thermocole and cork.

Books :

1. Jain and Jain - Engineering Chemistry
2. Barrow G.M. - Physical Chemistry
3. Finer - Organic Chemistry
4. Bahl & Bahl - Organic Chemistry
5. Riggal - Industrial Chemistry
6. Martin Etal - Industrial and Manufacturing Chemistry.
7. Bahl & Tuli - Physical Chemistry

2-P-2 **APPLIED CHEMISTRY**

Scheme of examination(Practical)
Sessional : 20
Practical : 80
Total : 100

1. Preparation of an Azo dye and its application.
2. To study the heats of neutralization of

a) Strong acid by a strong base
b) Week acid by a strong base

3. To study heat of solution of a salt in water
4. To study the first order kinetics of the hydrolysis of Methyl acetate in an acid medium
5. To study second order kinetics of reaction of $K_2S_2O_8$ with KI

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER II

2-T-3 COMPUTER PROGRAMMING I

Scheme of Examination(Theory)

Sessional – 10
Paper - 40
Total - 50

Unit I :
Constants, Variables and keywords, Their types, rules to form keywords, constants and variable names , range of various types of constants. Hierarchy of various C operations.

Unit II
Control structure – 'if statement', 'if-else' statement, logical operators and conditional operators, relational operators

Unit III
Loop control structure : 'while', 'for loop', 'do-while' loop, break, continues statement.

Unit IV :
Functions : What is functions, Passing values between function, slope rule of functions, Function declaration and prototypes, Call by value, Call by reference, Recursion. Data types.

Unit V : Arrays
What are arrays, pointers and arrays, 2-dimensional arrays, Pointers and 2-dimensional arrays, Array of pointers, What are strings, Standard library string function, Array of pointers to strings structure.

Books for reference :

1. Computer Fundamentals – P.K. Sinha
2. Let us C - Yashwant Kanetkar
3. Exploring C - Yashwant Kanetkar
4. Mastering Turbo C - Dennis Ritchie
5. Programming in C - E.Balguruswamy
6. LABVIEW for everyone - Pravis Pring.

2- P-3 COMPUTER PROGRAMMING I

Scheme of Examination(Practical)

Sessional – 20
Paper - 80
Total - 100

Minimum 10 programs based on syllabus

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER II

2-T- 4 ELECTRICAL ENGINEERING

Scheme of Examination(Theory)

Sessional – 10
Paper - 40
Total - 50

Unit I : Single Phase Transformer
Introduction, Basic principle, Construction, Classification, EMF equation, Transformer on no-load and on load, Phasor diagram
Unit II : Single Phase Transformer
Equivalent circuit, Losses, Efficiency, Regulation, Open circuit test and short circuit test.
Unit III : DC Generator
Construction, Principles of operation, Classification, Emf equation, Losses and efficiency, Power stage diagram.
Unit IV : DC Motor
Construction, Principle of operation, Back emf, Voltage equation, Speed equation, Losses, Power stage diagram, Different types of motors.
Unit V : Single Phase Induction Motor
Construction, Principle of operation, Double field revolving theory, Types of single phase induction motor, split phase type, Capacitor start induction run & Capacitor start and run type.

Books :

1. A Text book of Electrical Technology : Volume I & II – B.L. Theraja
2. Worked Examples in Electrical Engineering – B.L. Theraja

2-P-4 ELECTRICAL ENGINEERING

Scheme of examination(Practical)
Sessional : 20
Practical : 80
Total : 100

1. Verification of various relations in R-C series circuit.
2. Verification of various relations in R-L-C series circuit.
3. Verification of various relations in R-L-C parallel circuit.
4. Study of single phase transformer
5. To open perform open circuit and short circuit test on single phase transformer.

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER II

2-T-5 ENGINEERING MATHEMATICS I

Scheme of Examination(Theory)

Sessional – 10
Paper - 40
Total - 50

Unit I : Matrices

Addition, scalar multiplication and product of matrices, Elementary row operations, Rank and inverse of a matrix, Consistency and solution of a system of linear equations, Eigen values and eigen vectors

Unit II : Curvature and radius of curvature (cartesian, parametric and polar form), centre of curvature and circle of curvature (cartesian form only)

Unit III : Partial differentiation

Functions of several variables of first and higher order, Homogeneous functions, Euler's theorem on homogeneous functions

Unit IV : Differential equations of first order and first degree

Variable separable form, homogeneous equations, linear equations and exact equations

Unit V : Linear Differential Equations

Linear differential equations with constant coefficient, method of variation of parameters

Books :

1) Higher Engineering Mathematics – Dr.B.S.Grewal
2) A Text Book of Engineering Mathematics – N.P.Bali, Manish Goyal
3) Engineering Mathematics – H.K.Das

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER II

2-P-5 COMMUNICATIVE ENGLISH

Course Outcomes :

By the end of the course the learners will be:

- able to develop comprehensive skills through reading and writing exercises.
- able to write reports.
- able to draft communication related to business.
- able to plan and conduct effective meetings.
- able to produce clear and concise written business documents.
- able to use media and technology in classroom and eventually in the real world.
- able to create content and spread message on social media.
- able to communicate effectively through mock group discussions and know the nuances of interview technique.

Applied Electronics and Software Technology
Semester II
Subject Communicative English

Theory: 40
Internal: 10
Total : 50

Unit I Reading Comprehension and Vocabulary **10**
From the Prescribed Book: Glimpses, Board of Editors. Macmillan Education

Living or Dead?
The Ant and the Grasshopper

Unit II Grammar **10**
Question Tags
Active Passive Voice
Identification of Clauses
Modal Auxiliaries
Use of Adjectives and Adverbs

Unit III Writing Skills **10**
Notice
Report Writing

Writing Advertisement
Interpreting Visuals
Letter of Inquiry/ Complaint/ Invitation
Write a biographical sketch of any of the following:
a) Sundar Pichai , b) Sudha Murthy, c) Parag Agrawal- Twitter
d) Roshani Nadar

Unit IV Use of Media and Technology in the Classroom. **10**
Content Creation (YouTube video, Reel – all creativity on Social Media)
Filmmaking of a minute – script writing for the film.

Unit V Listening and Speaking skills **10**
Group Discussion
Interview Techniques
Telephonic Conversation

Prescribed Book:
Glimpses, Board of Editors. Macmillan Education

Reference Books:

9. Professional Communication Skills : By Pravin S.R.Bhatia, A.M Sheikh: S.Chand and company
10. Presentations (The Business Skills Series) by Anne Laws Orient Black Swan
11. Mac Millan Foundation English R.K Diwedi and A.Kumar
12. Written and Spoken Communication in English- University Press
13. Applied English Grammar and Composition Dr. P.C.Das New Central Book Agency (P) Ltd
14. English Communication – A Textbook for the AECC – English As per the UGC Syllabus – Madhumita Chakraborty : Macmillan Education
15. Business Correspondence and Report Writing- Mc Graw Hill Education by R.C Sharma and Krishna Mohan
16. Soft Skills Dr. K. Alex by S. Chand

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr **P.U. Meshram, Allied Publishers, New Delhi.**
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
SEMESTER II

2-T-6 SOCIAL SCIENCE

Scheme of Examination(Theory)
Sessional – 10
Paper - 40
Total - 50

Unit I : Communication

i) Meaning and Definition
ii) Importance of Communication
iii) Objectives of Communication
iv) Principles of Effective communication
v) Media of Communication

Unit II : Industrial Sociology

i) Meaning and Definition
ii) Scope Industrial Sociology
iii) Nature of Industrial Sociology

Unit III : Work Organisation

i) Meaning and Definition
ii) Importance
iii) Forms of industrial organization: Line Organization, Line and Staff Organization, Functional Organization
iv) Authority – Meaning and definition
v) Delegation of authority
vi) Process of delegation

Unit IV : Industrial culture in India

i) Modernization : impact on Indian society
ii) Industrialisation: impact on Indian society
iii) Urbanization : impact on Indian society

Unit V : Leadership in Industry

i) Meaning and Definition
ii) Characteristics of Leadership
iii) Importance of Leadership
iv) Leadership Styles

Reference Books. :

1.Dr. Pratibha M. Siriya, 2011, Principles of Business Management, Sai Jyoti Publication, Nagpur
2 A new Outlook into Social Science – S. Shabbir, A. M. Sheikh, Jaya Dwadashiwar, S. Chand, Delhi
3. T. Ramasamy, 2012, Principles of Management, Himalaya Publishing House, Mumbai.
4.Dr. Pratibha M. Siriya, 2011, Principles of Business Management, Sai Jyoti Publication, Nagpur.
5 King's, Personnel management & Industrial Relations, Harsha Rastogi, Delhi.

APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY
Semester II

2-P-6 **ENGINEERING DRAWING I**

Scheme of Examination (Practical)
Sessional - 20
Practical – 80
Total - 100

Minimum 10 sheets based on syllabus :

1. Projection of points, Projections of lines inclined to both the planes and their applications, concept of traces.

2. Projection of planes.

Books for reference :
1.Engineering Drawing by N.D. Bhatt
2.Engineering Drawing by A.R. Bapat.

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus
B.Sc. in Cosmetic Technology

Submitted by
Board of Studies,
B.Sc. in Cosmetic Technology

FYUGP-Scheme I-VIII Semester
Cosmetic Technology (Honors/Research)
Four Year (Eight Semester Degree Course)
Teaching and Examination Scheme
BCT Semester-I

SN	Course Category	Name of Course	Course Code	Teaching Scheme Hrs.			Total Credits	Examination Scheme							
								Theory				Practical			
				TH	TU	P		Exam Hrs	SEE	CIE	Min	Exam Hrs	SEE	CIE	Min
1	DSC	Cosmetic Chemistry	BCT1T01	2	-	-	2	3	80	20	40	-	-	-	-
2	DSC	Cosmetic Chemistry	BCT1P01	-	-	2	1	-	-	-	-	3	25	25	25
3	DSC	Natural Cosmetic Agent	BCT1T02	2	-		2	3	80	20	40	-	-	-	-
4	DSC	Natural Cosmetic Agent	BCT1P02			2	1	-	-	-	-	3	-	50	25
5	GE/OE	Physical Chemistry	BCT1T03	1	-	-	1	2	40	10	20	-	-	-	-
6	GE/OE	Physical Chemistry	BCT1P03			2	1	-	-	-	-	3	25	25	25
7	GE/OE	Organic Chemistry	BCT1T04	1	-	-	1	2	40	10	20	-	-	-	-
8	GE/OE	Organic Chemistry	BCT1P04			2	1	-	-	-	-	3	-	50	25
9	VSEC	Dermatherapy & Beauty Culture	BCT1T05	1	-	-	2	2	40	10	20	-	-	-	-
10	VSEC	Dermatherapy & Beauty Culture	BCT1P05					-	-	-	-	3	25	25	25
11	VSEC	Anatomy & Physiology	BCT1T06	1	-		1	2	40	10	20	-	-	-	-
12	VSEC	Anatomy & Physiology	BCT1P06			2	1	-	-	-	-	3	-	50	25
13	AEC	English Communication Skills	BCT1T07	2	-	-	2	3	80	20	40	-	-	-	-
14	VEC	Environmental Science	BVE1T01	2	-	-	2	3	80	20	40	-	-	-	-
15	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-	-
16	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	-	100	50
				14		14	**22**		**560**	**140**			**150**	**250**	

BCT Semester-II

SN	Course Category	Name of Course	Course Code	Teaching Scheme Hrs.			Total Credits	Examination Scheme							
								Theory				Practical			
				TH	TU	P		Exam Hrs	SEE	CIE	Min	Exam Hrs	SEE	CIE	Min
1	DSC	Cosmetic Chemistry	BCT2T01	2	-		2	3	80	20	40	-	-	-	-
2	DSC	Cosmetic Chemistry	BCT2P01			2	1	-	-	-	-	3	25	25	25
3	DSC	Natural Cosmetic Agent	BCT2T02	2	-		2	3	80	20	40	-	-	-	-
4	DSC	Natural Cosmetic Agent	BCT2P02			2	1	-	-	-	-	3	-	50	25
5	GE/OE	Physical Chemistry	BCT2T03	1	-		1	2	40	10	20	-	-	-	-
6	GE/OE	Physical Chemistry	BCT2P03			2	1	-	-	-	-	3	25	25	25
7	GE/OE	Organic Chemistry	BCT2T04	1	-		1	2	40	10	20	-	-	-	-
8	GE/OE	Organic Chemistry	BCT2P04			2	1	-	-	-	-	3	-	50	25
9	VSEC	Dermatherapy & Beauty Culture	BCT2T05	1	-	-	2	2	40	10	20	-	-	-	-
10	VSEC	Dermatherapy & Beauty Culture	BCT2P05					-	-	-	-	3	25	25	25
11	VSEC	Anatomy & Physiology	BCT2T06	1	-		1	2	40	10	20	-	-	-	-
12	VSEC	Anatomy & Physiology	BCT2P06			2	1	-	-	-	-	3	-	50	25
13	AEC	Fundamentals of Mathematics & Statistics	BCT2T07	2	-	-	2	3	80	20	40	-	-	-	-
14	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-	-
15	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	80	20	40	-	-	-	-
16	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	-	100	50
				14		14	**22**		**560**	**140**			**150**	**250**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

BCT Semester-III

SN	Course Category	Name of Course	Course Code	Teaching Scheme Hrs.			Total Credits	Examination Scheme							
								Theory				Practical			
				TH	TU	P		Exam Hrs	SEE	CIE	Min	Exam Hrs	SEE	CIE	Min
1	DSC	Cosmetic Technology	BCT3 T01	2	-	-	2	3	80	20	40	-	-	-	-
2	DSC	Cosmetic Technology	BCT3 P01			2	1	-	-	-	-	3	25	25	25
3	DSC	Cosmetic Chemistry	BCT3 T02	2	-	-	2	3	80	20	40	-	-	-	-
4	DSC	Cosmetic Chemistry	BCT3 P02			2	1	-	-	-	-	3	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)	BCT3 T03	2	-	-	2	3	80	20	40	-	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)	BCT3 P03			2	1	-	-	-	-	3	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)	BCT3 T04	2	-	-	2	3	80	20	40	-	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)	BCT3 P04			2	1	-	-	-	-	3	-	50	25
9	GE/ OE	Introductory Pharmacology & Toxicology	BCT3 T05	2	-	-	2	3	80	20	40	-	-	-	-
10	VSEC	Dermatherapy & Beauty Culture	BCT3 T06	2	-	-	2	3	80	20	40	-	-	-	-
11	VSEC	Dermatherapy & Beauty Culture	BCT3 P06			2	1	-	-	-	-	3	25	25	25
12	AEC	Maintenance of Records	BCT3 T07	2	-	-	2	3	80	20	40	-	-	-	-
13	AEC	Maintenance of Records	BCT3 P07				1	-	-	-	-	3	-	50	25
14	CC	Refer CC Basket	BCC3 P03	-	-	4	2	-	-	-	-	-	-	100	50
							22		**560**	**140**			**200**	**200**	

BCT Semester-IV

SN	Course Category	Name of Course	Course Code	Teaching Scheme Hrs.			Total Credits	Examination Scheme							
								Theory				Practical			
				TH	TU	P		Exam Hrs	SEE	CIE	Min	Exam Hrs	SEE	CIE	Min
1	DSC	Cosmetic Technology	BCT4T01	2	-	-	2	3	80	20	40	-	-	-	-
2	DSC	Cosmetic Technology	BCT4P01	-	-	2	1	-	-	-	-	3	25	25	25
3	DSC	Cosmetic Chemistry	BCT4T02	2	-		2	3	80	20	40	-	-	-	-
4	DSC	Cosmetic Chemistry	BCT4P02	-	-	2	1	-	-	-	-	3	-	50	25
5	Minor	Minor3	BCT4T03	2	-		2	3	80	20	40	-	-	-	-
6	Minor	Minor3	BCT4P03			2	1	-	-	-	-	3	25	25	25
7	Minor	Minor4	BCT4T04	2	-		2	3	80	20	40	-	-	-	-
8	Minor	Minor4	BCT4P04			2	1	-	-	-	-	3	-	50	25
9	GE/ OE	Introductory Pharmacology & Toxicology	BCT4T05	2	-	-	2	3	80	20	40	-	-	-	-
10	VSEC	Dermatherapy & Beauty Culture	BCT4T06	1	-		1	3	40	10	50	-	-	-	-
11	VSEC	Dermatherapy & Beauty Culture	BCT4P06			2	1	-	-	-	-	3	25	25	25
12	VEC	German/French	BVE4T03	2	-	-	2	3	80	20	40	-	-	-	-
13	CEP	Community service	BCM4P01		-	4	2	-	-	-	-	-	50	50	50
14	CC	Refer CC Basket	BCC4P04	-	-	4	2	3	-	-	-	-	-	100	50
							22		**520**	**130**			**225**	**225**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

BCT Semester-V

SN	Course Category	Name of Course	Course Code	Teaching Scheme Hrs.			Total Credits	Examination Scheme							
								Theory				Practical			
				TH	TU	P		Exam Hrs	SEE	CIE	Min	Exam Hrs	SEE	CIE	Min
1	DSC	Perfumes	BCT5T01	2	-	-	2	3	80	20	40	-	-	-	-
2	DSC	Perfumes	BCT5P01	-	-	2	1	-	-	-	-	3	25	25	25
3	DSC	Cosmetic Technology	BCT5T02	3	-	-	3	3	80	20	40	-	-	-	-
4	DSC	Cosmetic Technology	BCT5P02	-	-	2	1	-	-	-	-	3	-	50	25
5	DSC	Principles of Cosmeceutics	BCT5T03	3	-	-	3	3	80	20	40	-	-	-	-
6	DSC	Principles of Cosmeceutics	BCT5P03	-	-	2	1	-	-	-	-	3	25	25	25
7	Minor	Minor5	BCT5T04	2	-	-	2	3	80	20	40	-	-	-	-
8	Minor	Minor5	BCT5P04	-	-	2	1	-	-	-	-	3	-	50	25
9	Minor	Minor6	BCT5T05	2	-	-	2	3	80	20	40	-	-	-	-
10	Minor	Minor6	BCT5P05	-	-	2	1	-	-	-	-	3	25	25	25
11	GE/OE	Pharmacology and Interactions	BCT5T06	2	-	-	2	3	80	20	40	-	-	-	-
12	VSEC	Cosmetic Validation	BCT5T07	2	-	-	2	3	80	20	40		-	-	-
13	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	-	25	25	25
							22		**560**	**140**			**200**	**200**	

BCT Semester-VI

SN	Course Category	Name of Course	Course Code	Teaching Scheme Hrs.			Total Credits	Examination Scheme							
								Theory				Practical			
				TH	TU	P		Exam Hrs	SEE	CIE	Min	Exam Hrs	SEE	CIE	Min
1	DSC	Perfumes	BCT6T01	2	-	-	2	3	80	20	40	-	-	-	-
2	DSC	Perfumes	BCT6P01			2	1	-	-	-	-	3	25	25	25
3	DSC	Cosmetic Technology	BCT6T02	3	-	-	3	3	80	20	40	-	-	-	-
4	DSC	Cosmetic Technology	BCT6P02			2	1	-	-	-	-	3	-	50	25
5	DSC	Principles of Cosmeceutics	BCT6T03	3	-	-	3	3	80	20	40	-	-	-	-
6	DSC	Principles of Cosmeceutics	BCT6P03			2	1	-	-	-	-	3	25	25	25
7	DSE	Cosmetic Engineering	BCT6T04	1	-	-	1	2	40	10	20	-	-	-	-
8	DSE	Cosmetic Engineering	BCT6P04			2	1	-	-	-	-	3	-	50	25
9	Minor	Minor 7	BCT6T05	1	-	-	1	2	40	10	20	-	-	-	-
10	Minor	Minor 7	BCT6P05			2	1	-	-	-	-	2	25	25	25
11	GE/OE	Pharmacology and Interactions	BCT6T06	2	-	-	2	3	80	20	40	-	-	-	-
12	VSEC	Cosmetic Validation	BCT6T07	-	-	2	1	-	-	-	-	2	25	25	25
13	OJT	Industrial Training **(Six Weeks)**	BOJ6P01	-	-	8	4	-	-	-	-	-	100	100	100
							22		**400**	**100**			**300**	**300**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

BCT Semester-VII

SN	Course Category	Name of Course	Course Code	Teaching Scheme Hrs.			Total Credits	Examination Scheme							
								Theory				Practical			
				TH	TU	P		Exam Hrs	SEE	CIE	Min	Exam Hrs	SEE	CIE	Min
1	DSC	Perfumes &Colours	BCT7T01	3	-	-	3	3	80	20	40	-	-	-	-
2	DSC	Perfumes &Colours	BCT7P01	-	-	2	1	-	-	-	-	3	25	25	25
3	DSC	Cosmetic Technology	BCT7T02	3	-	-	3	3	80	20	40	-	-	-	-
4	DSC	Cosmetic Technology	BCT7P02	-	-	2	1	-	-	-	-	3	-	50	25
5	DSC	Plant Design	BCT7T03	2	-	-	2	3	80	20	40	-	-	-	-
6	DSC	Plant Design	BCT7P03	-	-	2	1	-	-	-	-	3	25	25	25
7	DSE	Quality Assurance Techniques	BCT7T04	2	-	-	2	3	80	20	40	-	-	-	-
8	DSE	Quality Assurance Techniques	BCT7P04	-	-	2	1	-	-	-	-	3	-	50	25
9	DSE	Herbal Cosmetics	BCT7T05	3	-	-	3	3	80	20	40	-	-	-	-
10	DSE	Herbal Cosmetics	BCT7P05	-	-	2	1	-	-	-	-	3	25	25	25
11	DSE	Elective-1(Refer Basket)	BCT7T06	2	-	-	2	3	80	20	40	-	-	-	-
12	RM	Research Methodology	BCT7T07	2	-	-	2	3	80	20	40	-	-	-	-
							22		**560**	**140**			**200**	**200**	

BCT Semester-VIII

SN	Course Category	Name of Course	Course Code	Teaching Scheme Hrs.			Total Credits	Examination Scheme							
								Theory				Practical			
				TH	TU	P		Exam Hrs.	SEE	CIE	Min	Exam Hrs.	SEE	CIE	Min
1	DSC	Perfumes &Colours	BCT8T01	3	-	-	3	3	80	20	40	-	-	-	-
2	DSC	Perfumes &Colours	BCT8P01	-	-	2	1	-	-	-	-	3	25	25	25
3	DSC	Cosmetic Technology	BCT8T02	3	-	-	3	3	80	20	40	-	-	-	-
4	DSC	Cosmetic Technology	BCT8P02	-	-	2	1	-	-	-	-	3	-	50	25
5	DSC	Plant Design	BCT8T03	2	-	-	2	3	80	20	40	-	-	-	-
6	DSC	Plant Design	BCT8P03	-	-	2	1	-	-	-	-	3	25	25	25
7	DSE	Quality Assurance Techniques	BCT8T04	3	-	-	3	3	80	20	40	-	-	-	-
8	DSE	Quality Assurance Techniques	BCT8P04	-	-	2	1	-	-	-	-	3	-	50	25
9	DSE	Herbal Cosmetics	BCT8T05	3	-	-	3	3	80	20	40	-	-	-	-
10	DSE	Herbal Cosmetics	BCT8P05	-	-	2	1	-	-	-	-	3	25	25	25
11	DSE	Elective-2(refer basket)	BCT8T06	2	-	-	2	3	80	20	40	-	-	-	-
12	RP	Project	BCT8P01	-	-	2	1	-	-	-	-	3	25	25	25
							22		**480**	**120**			**250**	**250**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

Note:- Total Credits 176

Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Cosmetic Technology)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Dermatherapy & Beauty Culture	Cosmetic Technology	**BVS1P01**
II	**VSC**	Dermatherapy & Beauty Culture	Cosmetic Technology	**BVS2P03**
III	**VSC**	Dermatherapy & Beauty Culture	Cosmetic Technology	**BVS3P05**
V	**VSC**	Cosmetic Validation	Cosmetic Technology	**BVS5P07**
VI	**VSC**	Cosmetic Validation	Cosmetic Technology	**BVS6P08**

Basket for Elective (DSE) Category for Bachelor of Cosmetic Technology

Semester	Course Category	Name of Course	Course Code
VII	Elective 1	A. Personnel Management in Cosmetic Industries	BCT7T06
		B. Production Management in Cosmetic Industries	BCT7T06
VIII	Elective2	A. Marketing Management of Cosmetics B. Financial Management of Cosmetics	BCT8T06

FYUGP-I-VIII Semester

Cosmetic Technology (Honors/Research)

Four Year (Eight Semester Degree Course)

(Question Paper Pattern for all subjects)

Scheme for Theory Examination

Duration for each theory Examination: **3 Hours for 80 Marks & 2 hours for 40 Marks**

Maximum Marks Allotted to each Theory: **80/40**

Instruction for paper setting and distribution of Marks-

1) The Examiner shall set a question paper of 8 questions. The examiner has to set **Eight** questions on all units. Preferably **one** question on each unit and a **last question** based on all units together. Each question will be of 16 marks (for 80 Marks question Paper) and 10 Marks (for 40 Marks question Paper), internal equal division is suggested.

2) The moderation committee shall retain 7 questions.

3) The student should answer any 5 questions out of 7 in case of paper of 80 marks
4) The student should answer any 4 questions out of 6 in case of paper of 40 marks

Syllabus for Four year degree course
COSMETIC TECHNOLOGY
Semester - I

BCT1T01 Cosmetic Chemistry

Theory - 80
Sessional – 20

Total - 100

1] Sources of impurities and their control in Cosmetic raw materials. (6 Periods)

2] Limit tests, limit test of chlorides, sulfates, lead, arsenic and heavy metals.

(8 Periods)

3] Acid base theory, concept of pH, Buffer solutions, Acid Base titrations, Standard solutions, Acid base Indicators, Theory of Acid base titration curves (8 Periods)

4] Non-aq. titration of weak acid and weak bases – indicators used and application.

(8 Periods)

5] Theoretical basis of qualitative inorganic analysis. 6 Periods)

Reference Books:

1. Text book of Practical Pharmaceutical Chemistry by Beckette and Stentake.
2. Quantitative Inorganic analysis be I. Vogal.
3. Cosmetic Chemistry -1 by Dr. Sheela Kulkarni

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BCT1T02 Natural Cosmetic Agents

Theory - 80
Sessional – 20

Total - 100

1] History, development and role of natural product in cosmetic & medicine. (2Periods)

2] Different systems of classification of drugs of natural origin their merits & demerits.

(6 Periods)

3] Herbs description and morphology of organized and unorganized herbs. Organized herbs root, stem, leaf and fruit and seed. Unorganized herbs – mucilage, latex and extracts.

(4 Periods)

4] Carbohydrate-

a) Definition, classification and general identification tests.

b) study of following carbohydrates used in cosmetics with respect to their source,
chemical constituents and uses-i) Starches – Wheat, maize, rice, potato ii) Gums-Acacia, gaur-gum. pectin, agar, and cellulose (12 Periods)

5] Lipids-

a) Definition, classification and general identification tests.

b) i) oils – castor, linseed, olive, sesame, coconut, arachise oil

ii) fat and waxes – kokum butter, lanoline, beeswax, spermaceti, carnauba wax,
candellila wax, shea butter. (12 Periods)

Books recommended:

1. Text book of Pharmacognosy – Trease and Evan's
2. Pharmacognosy – By Claus and Tayler.
3. Text Book of Pharmacognosy – T. E. Wallis.
4. Materia Medica – By Nadkarni.
5. Wealth of India – CSIR
6. Indian medical plants: by Kirtikar & Basu
7. Pharmacognosy – by Dr. Kokate
8. Naturals and Cosmetics – by Dr. Satish Sakharwade

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BCT1T03 Physical Chemistry

Theory - 40
Sessional – 10

Total- 50

1] Thermo chemistry –Introduction, heat of reaction at constant volume and constant
pressure, Heat of combustion, heat of neutralization, heat of solution and their determination.
Laws of thermo chemistry.
(8 periods)

2] Physical Properties and properties of liquids molecules.
i) Surface tension ii) Viscosity
iii) Intermolecular forces and it's impact on states of matter, physical properties and chemical constitution, parachor, dipole moment.
(8 periods)

3] Osmotic pressure, osmosis, semi – permeable membrane, osmotic pressure measurement, laws of osmotic pressure Molecular wt. Calculations.
(8 periods)

4] Faraday's laws of electrolysis, conductivity of solutions, equivalent conductivity and
it's determination, principles of conductometric titration.
(6 periods)

5] E.M.F. of Galvanic cell, Std. Oxidation Potential of an electrode, glass, calomel, redox electrodes, Principles of potentiometric titration.
(6 periods)

Books recommended:
1. A.N. Martin – Physical Pharmacy
2. Glasstone – Elements of Physical Chemistry
3. A. J. Med – Physical Chemistry
4. Vogel- Quantitative Inorganic Analysis.
5. Bahl and Tuli : Essentials of Physical Chemistry

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BCT1T04 Organic Chemistry

Theory - 40
Sessional – 10
Total - 50

1] Hydrocarbons (Saturated)
Alkanes, Terahedral natural of carbon, SP3 hybridisation, isomerism, liquid paraffin,
hard paraffin, preparation and reaction of cyclolkanes……
(7 Periods)

2] Hydrocarbon (Unsaturated) Alkenes SP2 Hybridisation, Markonikoff Rules, Cis-trans
Isomerism, Dienes: preparation properties chemical reaction classification of dienes Alkynes SP – hybridization, preparation, properties, reactions of acetylene. (7 Periods)

3] Estimation and Quantitative Analysis: Estimation of elements and their principals,
Determination of equivalent weight of acids and bases. Determination of empirical and
molecular formula of acids and bases.
(6 periods)

4] Ethers- Definition,Classificationpreparation, physical and chemical properties and reactionof ethers, diethyl ether, an aesthetic ether, thioether and vinyl ethers and their cosmetic uses(6Periods)

5] I) Aldehyde & Ketones-Definition and nomenclature, preparation,Classificationpreparation,physical and chemicalproperties and chemical reaction of aldehyde and ketones and their cosmetic uses (6 Periods)

II) Carboxylic Acid – classification, structure, preparation and chemical reaction of monocharboxylic acid Optical isomerism and their cosmetic uses (4Periods)

Books Recommended:

1. Text Book of Organic Chemistry by Morrison and Boyd.
2. L.M. Atherton, Bentley and Driver's Text Books of Pharmaceutical Chemistry. Oxford University Press, London.
3. Text book of Organic Chemistry by Bahl & Bahl.

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BCT1T05 Dermatherapy and Beauty Culture

Theory - 40

Sessional – 10
Total - 50

1. Skin: structure and functions of skin
i) Skin cleansing methods
ii) Skin hygiene
iii) Skin types
iv) Skin Tonning Methods
v) Skin Astringents

2. Bleaching
Preparation of paste.
i) Patch test
ii) Face bleaching
iii) Hand bleaching
iv) Leg bleaching
v) Precautions.

3. Hand
i) Skin Types
ii) Hand Cleansing
iii) Manicure
a. Requirement for Manicure
b. Procedure
c. Nail shaping
d. Cuticle removing
e. Hand Massage.
f. Application of varnish
iv) Electric Manicure

4. Nails
i) Disorders
ii) Treatment

iii) Care

5. Foot
i) Hygiene
ii) Pedicure
a. Requirement for Pedicure
b. Procedure.
c. Massage for pedicure.
d. Application of varnish

Books recommended:
1. Ann Eaton and Flurence Openshaw, Cosmetic Make – Up and Manicure.
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BCT1T06 Anatomy & Physiology

Theory - 40
Sessional – 10
Total - 50

1] Cell Structure & Elementary tissues of body-

i) Epithelial Tissues ii) Connective Tissues
iii) Nervous Tissues iv) Muscular Tissues (8 Periods)

2] i) Detail knowledge of structure and function of Skin (4 Periods)

ii) Skin appendages –
1 Sweat gland & Sebaceous gland
2 Nails
iii) Eye
iv) Tooth (10 Periods)

3] a) Keratinisationand
b) Colour & Pigmentation ,skin disorders due to external factors and treatment

c) Baby skin and adult skin (4 Periods)

4. Equipments used to determine Skin damage (5 Periods)
5. Suppliments used for maintaining skin health (8 Periods)
6. Temperature conservation – Temperature regulation and heat balance of body. (2 Periods)

Books Recommended:

1. Best and Taylor – The Living Body.
2. Kimber and Gray – Human Physiology and Anatomy
3. Fransis – Introduction to Human Anaomy.
4. Pharmacology and Pharmacotherapeutics By R.S. Satoskar and S. Bhandarkar
5. Ross & Wilson – Anotomy and physiology in health and illness – Ross & Wilson
6. Anatomy and physiology for Nurse – Windwood R.S.

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BCT1T07 English Communication Skills

Theory - 80
Sessional – 20

Total - 100

1] Writing skills:- Letter Writing, Informal letter, Formal letter, Bio-data/Resume, job Application (7 Periods)

2] Report Writing: Dialogue writing, Advertisement
(5 Periods)

3] Personality Development: Effective Public speaking, Goal setting, time management, stress management (7 Periods)

4] Speech Writing : View and Counterview, Expansion of Ideas, completion and Developing a story
(5 Periods)

5] Listening skills: Loud Reading, Speaking, Conversations, Telephonic conversation.
(7 Periods)

6] Interview techniques, group discussion, situational role play.
(5 Periods)

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BVE1T01 Environmental Science

Theory - 80
Sessional – 20

Total - 100

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr P.U. Meshram, Allied Publishers, New Delhi.
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.

Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

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BIK1T01 Indian Knowledge System

Theory - 80
Sessional – 20
Total - 100

SEM1 : VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

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BCT1P01(Practical) Cosmetic Chemistry

1] Preparation of Standard solutions: 1 normal, 1 molar, % w/v solution, % v/v solution
2] Standardization of volumetric apparatus.
3] Volumetric estimation involving Acidimetry, Alkalimetry oxidation & reductions.
4] Experiments based on limit tests of chlorides, Arsenic, ions sulphate & Heavy metals.
5] Practical significance of MSDS.

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BCT1P02 (Practical) Natural Cosmetic Agents

1]. Carbohydrates:
i. Study of organoleptic properties, identification and microscopic studies of:
a. Rice Starch b. Maize starch
c. Potato starch d. Wheat starch
ii. a. Agar b. Gum Acacia.
c. Tragacanth. d. Gaur Gum
e. Pectin f. Cellulose
2] Study of chemical identification of fixed oils and waxes.
3] Detection of Adulteration in Olive oil, Coconut oil, Almond oil, and other vegetable oil.

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BCT2P03 (Practical) Physical Chemistry

1. Study of surface tension of liquids using a stalagmometer.
2. Study of Viscosity of liquids using Ostwald's Viscometer.
3. Study of variation of viscosity of liquid mixtures using an Ostwald's viscometer and its use to determine the concentration of such mixtures.
4. Study the total hardness of water
5. Study the temporary hardness of water.
6. Study the heat of solution of a salt in water.
7. Study the heat of neutralization of a strong acid by a strong base as well as weak acid and strong base using a calorimeter.

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BCT2P04 (Practical) Organic Chemistry

1] Organic Preparations based on:
i) Alkaline Hydrolysis
ii) Acidic Hydrolysis
iii) Acetylation
iv) Oxidation

****

BCT1P05 (Practical) Dermatherapy and Beauty Culture

Practicals based on methods and practices as per the following contents

1. Skin
   i) Skin cleansing methods
   ii) Skin hygiene
   iii) Skin types
   iv) Skin Tonning Methods
   v) Skin Astringents

2. Bleaching Preparation of paste.
   vi) Patch test
   vii) Face bleaching
   viii) Hand bleaching
   ix) Leg bleaching
   x) Precautions.
3. Hand
   i) Skin Types
   ii) Hand Cleansing
   iii) Manicure

g. Requirement for Manicure
h. Procedure
i. Nail shaping
j. Cuticle removing
k. Hand Massage.
l. Application of varnish
iv) Electric Manicure

4. Nails
   i) Disorders
   ii) Treatment
   iii) Care

5. Foot
   i) Hygiene
   ii) Pedicure
e. Requirement for Pedicure
f. Procedure.
g. Massage for pedicure.
h. Application of varnish

****

BCT1P06 (Practical) Anatomy & Physiology

1. Study with the help of Charts and models of-
   a) Skin
   b) Hair
   c) Eye
   d) Tooth
2. Microscopic examination of Epithelial, Cardiac, Smooth Muscles, Skeletal muscles and other tissues.

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SEMESTER – II

BCT2T01 Cosmetic Chemistry

Theory - 80
Sessional – 20
Total - 100

1] Nernst eq. Calculation of std. Potential, oxi-red titrations, study of common oxidizing agents and reducing agents, oxi-red curves, ceric ammonium sulfate, titanous chloride, 2-6 dichlor phenol indo phenol titration, their theory and applications. (12 Periods)

2] Iodometry and iodimetry, Gravimetric analysis. Quantitative separation, solubility product. Fractional precipitation, CO - & post precipitation Practical aspects of gravimetry and applications.

(8 Periods)

3] Precipitation titration, Precipitation and complex forming reactions. Argentometric Titration, Gay-Iusac, Volhard's Mohr's and Fujan's Method. Mercuric nitrate titration. (8 Periods)

4] Complexometric titration, concepts of complexation and chelation, co-ordination number stability constant, titation curves, metal ion indicator, Masking and demasking agents, types of complexometic titration and applications (12 Periods)

5] Determination & significance of acid value, saponification value, iodine value, ester value. (6 Periods)

Reference Books:
1. Text book of Practical Pharmaceutical Chemistry by Beckette and Stentake.
2. Quantitative Inorganic analysis by I. Vogal.
3. Cosmetic Chemistry -1 by Dr. Sheela Kulkarni

****

BCT2T02 Natural Cosmetic Agents

Theory - 80
Sessional – 20
Total - 100

1] Adulteration - types of adulteration, Method of adulteration and methods of detection of adulteration in Natural ingredient (9 Periods)

2] Resin and balsum -
a) Definition, classification and general identification tests.
b) Study of following - Balsum of Tolu, Balsum of Peru, Benzoin, Storax, Colophony, Asafoetida. (9 Periods)

3] Tannins – Definition, Classification and Identification test.
Study of the following – Black Catechu, Tannic Acid, Amla, Behra, Hirda, Arjun, Pale catechu, Ashok. (9 Periods)

4] Study of mineral ingredients. Kaolin, Bentonite, Talc., Fuller's earth, Mica, Calamine. (5 Periods)

5] Herbs description and morphology of organized and unorganized herbs. (4 Periods)

Books recommended:
1. Text book of Pharmacognosy – Trease and Evan's
2. Pharmacognosy – By Claus and Tayler.
3. Text Book of Pharmacognosy – T. E. Wallis.
4. Materia Medica – By Nadkarni.
5. Wealth of India – CSIR
6. Indian medical plants: by Kirtikar & Basu
7. Pharmacognosy – by Dr. Kokate
8. Naturals and Cosmetics – by Dr. Satish Sakharwade

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BCT2T03 Physical Chemistry

Theory - 40
Sessional – 10
Total- 50

1] Phase rule : Phase rule, the terms involved in it and applications to one component system, water and sulphur system. Introduction to two component systems. (8 periods)

2] Solutions,: Raoult's law, and it's application, molecular weight determination by measuring vapour pressure, Boiling Pt. & freezing point. (8 periods)

3] Law of mass action, Le-Chatelier's principle, homogeneous gaseous equilibria and homogeneous equilibra in liquid system. (8 periods)

4] Chemical kinetics: Introduction, molecularity, order and rate of reaction. Kinetics of
first and second order reaction, their characteristics and some methods of determination. (8 periods)

5] pH metry: pH and hydrogen ion concentration, pH calculation for weak acids and weak bases. Buffer solutions and types, mechanism of buffer action of acidic and basic buffers. Theories of acid base indicators. (8 periods)

Books recommended:
1. A.N. Martin – Physical Pharmacy
2. Glasstone – Elements of Physical Chemistry
3. A. J. Med – Physical Chemistry
4. Vogel- Quantitative Inorganic Analysis.
5. Physical Chemistry by Bahl & Tuli.

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BCT2T04 Organic Chemistry

Theory - 40
Sessional – 10
Total - 50

1] Halohydrocarbon: Preparation and reaction of alkyl halide and Grignard reagents and chloroform. (6 periods)

2] Alcohols – Definition, classification, preparation, properties and chemical reaction of alcohols, fermentation, manufacture of ethyl alcohol, proof spirit, denatured alcohol, glycol and glycerol. (8 periods)

3] Benzene and other aromatic compounds:
i) Benzene Resonance and structure – o-p & meta directing effect.
ii) Aromatic nitro compound (Nitrobenzenes): preparation & properties,
iii) Aromatic amines (Aniline) – Prearation & Properties.
iv) Aromatic carboxylic acids (Benzoic and Cinnamic acid, Salicylic acid.)
(7 periods)

4] Fats & Oil : Definition, uses, properties. Analysis of fats and oils. Application of fats and oils in cosmetics. (7 periods)

5] I) Proteins and Amino Acid : Introduction, Peptides, amino Acids, definition, hydrolysis, polypeptides, qualitative test and colour reaction, essential amino acid. (7 periods)

II) Carbohydrates and Glucose : Classification and Qualitative test, structure of Glucose, Lactose (excluding derivation). (5 periods)

Books Recommended:
1. Text Book of Organic Chemistry by Morrison and Boyd.
2. L.M. Atherdon, Bentley and Driver's Text Books of Pharmaceutical Chemistry. Oxford University Press, London.
3. Text book of Organic Chemistry by Bahl & Bahl.

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BCT2T05 Dermatherapy and Beauty Culture

Theory 40
Sessional 10
Total 50

1. Eye Brows:
xi) Factors affecting eye brow shaping.
xii) Determination of correct length of eye brow.
2. Different methods for eyebrow shaping:
xiii) Threading.
xiv) Tweezing
3. Treatment for superfluous hair waxing.
a. Hot wax treatment
b. Cold wax treatment
i) Leg waxing
ii) Hand waxing

iii) Under arm waxing.
4. Nail Arts / Nail designing
5. Application of false nails

****

BCT2T06 Anatomy & Physiology

Theory - 40
Sessional – 10
Total - 50

1] I) Cardiovascular system Anatomy of Heart, flow of blood through heart, blood pressure, structure of artery, vein and capillaries.
II) Blood –
i) Composition & Function ii) Blood groups
iii) Coagulation of blood (12 Periods)

2] Respiratory system –Anatomy of organs, mechanism of respiration,Introduction with respect to Aerosols and Aromatherapy (6 Periods)

3] Digestive system – Anatomy of digestive organs, Digestion of carbohydrate, protein and fat. (6 Periods)

4]. Hair- Detailed study of hair, Structure, types, Chemistry, Disorders such as Hair damage reasons and treatments equipments used to determine hair damage , Supplements for healthy hair.

5] Excretory system – organs of excretion, structure of kidney, Mechanism of urine formation , mechanism of excretion via skin (6 Periods)

6] Nervous system – CNS, Brain, anatomy in short, spinal cord, ganglion cranial nerves, reflex action and reflex arch. (6 Periods)
7]. Endocrine glands and Hormones. (8 Periods)

Books Recommended:

1. Best and Taylor – The Living Body.
2. Kimber and Gray – Human Physiology and Anatomy
3. Fransis – Introduction to Human Anatomy.
4. Pharmacology and Pharmacotherapeutics By R.S. Satoskar and S. Bhandarkar
5. Ross & Wilson – Anotomy and physiology in health and illness – Ross & Wilson
6. Anatomy and physiology for Nurse – Windwood R.S.

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BCT2T07 Fundamentals of Mathematics & Statistics

Theory - 80
Sessional – 20
Total - 100

1] Algerbra: - Profit and loss, percentage calculation, Logarithms (6 Periods)

2] Trigonometry: - Degrees and Radians trigonometric ratios. Identities for sum and difference of angles, multiple angles (8 Periods)

3] Statistics: - Frequency Distribution, Histogram, Representation of data in a curve, Mean, Median mode, Standard deviation, mean deviation from mean, Measures of Central tendency, Correlation, Coefficient of correlation only. (8 Periods)

4] Derivatives (6 Periods)

5] Application of Derivatives:
a) Maxima, Minima b) Rates and motion c) Velocity acceleration (8 Periods)

Books Recommended :

1. Higher Engineering Mathematics by B. S. Grewal (Unit I, II,V).
2. Higher Algebra by Hall and Knight (Unit I)
3. Plane Trigonometry Part I by S.L. Loney (Unit II)

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BVE2T02 Constitution of India

Theory - 80
Sessional – 20
Total - 100

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity
- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

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BIK2T02 Indian Knowledge System

Theory - 80
Sessional – 20
Total - 100

INDIAN ASTRONOMY

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, VedangJyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of BhaskarAcharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media

4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf

BCC2P02 Health & Wellness

Total - 100

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BCT2P01 (Practical) Cosmetic Chemistry

1] Preparation and standardization of Cerric Ammonium Sulphate Potassium Iodate, Assays Based on use of above agents.

2] Preparation and standardization of Perchloric Acid and Sodium Methoxide. Assay based on above.

3] Preparation and standardization of Sodium EDTA. Assay based on EDTA.

4] Preparation and Standardization of Silver Nitrate and Amonium Thiocynate. Assay Based on above.

5] Gravimetric analysis: experiments based on gravimetric analysis

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BCT2P02 (Practical) Natural Cosmetic Agents

1] Organoleptic study and identification of
a. Tolu Balsum b. Peru Balsum
c. Benzion d. Storax
e. Colophony f. Asfoetida
2] Morphological study and identification of following tannin containing agents:
a. Black Catechu. b. Amls
c. Behra d. Hirada
e. Ashoka Bark f. Arjua Bark.
3] Organoleptic study of Kaolin, Bentonite, Talc., Fuller's earth, Mica, Calamine.
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BCT2P03 (Practical) Physical Chemistry

1] Study the phenol – water two phase system and determine the critical temperature of
the system.

2] Determine the molecular weight of a nonvolatile compound by the Rast's Camphor method.

3] Study of partition of iodine between Carbon Tetrachloride and water and determine

the partition coefficients of iodine between the two solvents.

4] Study the first order kinetics of the hydrolysis of Methyl Acetate in an acid medium.

5] Study the second order kinetics of the reaction of K2S2O8 with KI.

6] Study of Buffer solutions and hence determine the pH of buffer solution using a comparator

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BCT2P04 (Practical) Organic Chemistry

1] Systematic Organic analysis of unknown organic substance (i.e. preliminary tests, detection of elements, groups, determination of physical constants and specific tests and confirmation by derivatives preparation)

a) Acetic acid
b) Benzoic acid
c) Salicylic acid
d) Urea
e) Thiourea
f) Aniline
g) Glucose

****

BCT2P05 (Practical) Dermatherapy and Beauty Culture

Practicals based on methods and practices as per the following contents

1. Eye Brows:
xv) Factors affecting eye brow shaping.
xvi) Determination of correct length of eye brow.
2. Different methods for eyebrow shaping:
xvii) Threading.
xviii) Tweezing
3. Treatment for superfluous hair waxing.
c. Hot wax treatment
d. Cold wax treatment
i) Leg waxing
ii) Hand waxing
iii) Under arm waxing.
4. Nail Arts / Nail designing
5. Application of false nails

****

BCT2P06 (Practical) **Anatomy & Physiology**

1] Determination of clotting time.
2] Determination of bleeding time
3] Determination of hemoglobin content.
4] Determination of R.B.C. count, D.L.C., T.L.C.
5] Study with the help of charts and models of
   a) Cardiovascular system
   b) Excretory system
   c) Digestive system
   d) Nervous system
6] Skin Patch Test with products
7] Recording of body temperature, Pulse and Heart rate and Blood Pressure.

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Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

B. Sc. Interior Design

Submitted by

Board of Studies,

B.Sc. Bachelor of Interior Design

TEACHING AND EXAMINATION SCHEME

Interior Design
Four Year (Eight Semester Course)
Interior Design Sem. – I

Sr. No.	Course category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Interior Design I	BHD1T01	2	_	_	2	6*	100	-	40	_	_	_
2	DSC	Interior Design I	BHD1P01	_	_	4	2	_	_	_	_	50	50	50
3	DSC	Material & Construction Techniques I	BHD1T02	2	_	_	2	3	80	20	40	_	_	_
4	GE/OE	Graphics I	BHD1T03	_	_	4	2	_	_	_	_	50	50	50
5	GE/OE	Mathematics I	BHD1T04	2	_	_	2	3	80	20	40		_	_
6	VSC	Presentation Techniques I	BHD1T05	-	_	4	2	_	_	_	_	50	50	50
7	SEC	Workshop I	BHD1T06	_	_	4	2	_	_	_	_	50	50	50
8	AEC	Communication Skill I	BHD1T07	2	_	_	2	3	80	20	40	_	_	_
9	VEC	Environmental Science	BVE1T01	2	_	_	2	3	80	20	40	_	_	_
10	IKS	Vedic Mathematics	BIK1T01	2	_	_	2	3	80	20	40	_	_	_
11	CC	Refer CC Basket	BCC1P01	-	_	4	2	_	_	_	_	_	100	50
Total				**12**	**–**	**20**	**22**		**500**	**100**	**–**	**200**	**300**	

Total Marks 1100

* The exam duration for Interior Design I is 6 hours (3 hours in two sittings) as the students have to design full project of interiors with all details.

TEACHING AND EXAMINATION SCHEME

Interior Design
Four Year (Eight Semester Course)
Interior Design Sem. – II

Sr. No.	Course category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Interior Design II	BHD2T01	2	_	-	2	6*	100	_	40	_	_	_
2	DSC	Interior Design II	BHD2P01	-	-	4	2					50	50	50
3	DSC	Material & Construction Techniques II	BHD2T02	2	_	_	2	3	80	20	40	_	_	_
4	GE/ OE	Graphics II	BHD2T03	_	_	4	2	_	_	_	_	50	50	50
5	GE/ OE	Mathematics II	BHD2T04	2	–	_	2	3	80	20	40	_	_	
6	VSC	Presentation Techniques II	BHD2T05	_	_	4	2	_	_	_	_	50	50	50
7	SEC	Workshop II	BHD2T06	_	_	4	2	_	_	_	_	50	50	50
8	AEC	Communication Skill II	BHD2T07	2	_	_	2	3	80	20	40	_	_	_
9	VEC	Constitution of India	BVE2T02	2	_	_	2	_	80	20	40	_	_	_
10	IKS	Indian Astronomy	BIK2T02	2	_	_	2	_	-	-	-	50	50	50
11	CC	Refer CC Basket	50	50	_	4	2	_	_	_	_	_	100	50
Total				**12**	**_**	**20**	**22**		**500**	**100**		**200**	**300**	

Total Marks 1100

* The exam duration for Interior Design II is 6 hours (3 hours in two sittings) as the students have to design full project of interiors with all details.

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

Interior Design
Four Year (Eight Semester Course)
Sem. – III

Sr. No.	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Interior Design III	BHD3T01	2	–	-	2	12*	100	–	40	-	-	-
2	DSC	Interior Design III	BHD3P01	-	-	4	2	-	-	-	-	50	50	50
3	DSC	Material & Construction Techniques III	BHD3T02	2	–	–	2	3	80	20	40	–	–	–
4	MINOR	Minor 1	BHD3T03	–		4	3	–	80	20	40	-	-	-
5	MINOR	Minor 1	BHD3P03					-	-	-	-	25	25	25
6	MINOR	Minor 2	BHD3T04	–	–	4	3	3	–	–	–	50	100	75
7	GE	History of Art and Architecture I	BHD3T05	2	–	–	2	3	80	20	40	–	–	–
8	VSC	Refer VSC Basket	BHD3T06	2	–	-	2	3	80	20	40	–	–	–
9	AEC	Interior Environment Control I	BHD3T07	2	–	–	2	3	80	20	40	–	–	–
10	AEC	Structure I	BHD3T08	2	–	–	2	3	80	20	40	–	–	–
11	GE	PROD WORKSHOP II	BHD3T09	–	–	2	1	3	–	–	–	25	25	25
12	CC	Refer CC Basket	BCC3P03	–	–	2	1	–	–	–	–	-	100	50
Total				**10**	**0**	**24**	**22**	**-**	**580**	**120**	**-**	**175**	**225**	

Total Marks : 1100

* The exam duration for Interior Design III is 12 hours (3 hours in two sittings for two days) as the students have to design full project of interiors with all details.

Interior Design
Four Year (Eight Semester Course)
Sem. – IV

Sr. No.	Course Category	Name of Course	Course Code	Teaching Scheme(hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Interior Design IV	BHD4T01	2	–	-	2	12*	100	-	40	-	-	-
2	DSC	Interior Design IV	BHD4P01	-	-	4	2	-	-	-	-	50	50	50
3	DSC	Material & Construction Techniques IV	BHD4T02	2	–	–	2	3	80	20	40	–	–	–
4	Minor	Minor 3	BHD4T03	2	-	-	2	3	80	20	40	-	-	-
5	Minor	Minor 3	BHD4P03	-	-	2	1	-	-	-	-	**25**	**25**	**25**
6	Minor	Minor 4	BHD4T04	–	–	4	3	–	**–**	**–**	**–**	**50**	**100**	**75**
7	GE	History of Art and Architecture II	BHD4T05	2	–	–	2	3	**80**	**20**	**40**	**–**	**–**	**–**
8	VSC	Refer VSC Basket	BHD4T06	–	–	4	2	–	**80**	**20**	**40**	**–**	**–**	**–**
9	AEC	Interior Environment Control II	BHD4T07	2	–	–	2	3	**80**	**20**	**40**	**–**	**–**	**–**
10	AEC	Structure II	BHD4T08	2	–	–	2	3	**–**	**–**	**–**	**25**	**25**	**25**
11	CEP	Community Service	BCM4P01	–	–	2	1	–	**–**	**–**	**–**	**25**	**25**	**25**
12	CC	Refer CC Basket	BCC4P04	–	–	2	1	–	**–**	**–**	**–**	**-**	**100**	**50**
Total				**12**	**0**	**18**	**22**	**18**	**500**	**100**		100	-	40

Total Marks 1100

* The exam duration for Interior Design IV is 12 hours (3 hours in two sittings for two days) as the students have to design full project of interiors with all details.

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

Interior Design
Four Year (Eight Semester Course)
Sem. – V

Sr. No.	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Interior Design V	BHD5T01	2	_	-	2	12*	100	_	40	-	-	-
2	DSC	Interior Design V	BHD5P01	-	-	6	3	-	-	-	-	100	50	75
3	DSC	Material & Construction Techniques V	BHD5T02	2	_	_	2	3	80	20	40	_	_	_
4	DSC	STRUCTURE III	BHD5T03	2	_	_	2	_	80	20	40	_	_	_
5	DSE	Elective 1	BHD5T04	2	_	_	2	3	80	20	40	_	_	_
6	Minor	Minor 5	BHD5T05	_	_	6	3	3	_	_	_	100	50	75
7	Minor	Minor 6	BHD5T06	2	_	-	2	3	80	20	40	_	_	_
8	Minor	Minor 6	BHD5P06	-	-	2		-	-	-	-	25	25	25
9	VSC	Refer VSC basket	BHD5T07	_	_	4	2	2	_	_	_	50	50	50
10	AEC	Estimation and Costing –I	BHD5T08	2	_	_	2	3	80	20	40	_	_	_
11	CEP	Community Service	BCM5P02	_	_	2	1	_	_	_	_	25	25	25
Total				**12**		**20**	**22**	-	500	100		300	200	

Total Marks 1100

* The exam duration for Interior Design V is 12 hours (3 hours in two sittings for two days) as the students have to design full project of interiors with all details.

Interior Design
Four Year (Eight Semester Course)
BID Sem. – VI

Sr. No.	Course category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Interior Design VI	BHD6T01	2	–	-	2	12*	100	–	40	–	–	–
2	DSC	Interior Design VI	BHD6P01	-	-	6	3	-	-	-	-	100	50	75
3	DSC	Material & Construction Techniques VI	BHD6T02	2	–	–	2	3	80	20	40	–	–	–
4	DSC	Furniture Design IV	BHD6T03	–	–	4	2	–	80	20	40	–	–	–
5	DSE	Elective 2	BHD6T04	2	–	–	2	3	80	20	40	–	–	–
6	Minor	Minor 7	BHD6T05	2	–	2	3	3	–	–	–	100	50	75
7	VSC	Refer VSC basket	BHD6T06	–	–	4	2	–	80	20	40	–	–	–
8	AEC	**STRUCTURE IV**	BHD6T07	2	–	–	2	3	80	20	40	–	–	–
9	AEC	Estimation and Costing – II	BHD6T08	2	–	–	2	3	80	20	40	–	–	–
10	OJT	Internship (Related to DSC)	BHD6T09	–	–	4	2	–	–	–	–	50	50	50
Total				**12**		**20**	**22**	**-**	**500**	**100**	**-**	**300**	**200**	

Total Marks 1100

* The exam duration for Interior Design VI is 12 hours (3 hours in two sittings for two days) as the students have to design full project of interiors with all details.

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

Interior Design
Four Year (Eight Semester Course)
BID Sem. – VII

Sr. No.	Course category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Interior Design VII	BHD7T01	2	_	-	2	12*	100	_	40	-	-	-
2	DSC	Interior Design VII	BHD7P01	-	-	6	3	-	-	-	-	100	50	75
3	DSC	Interior Detailing I	BHD7T02	_	_	4	2	_	_	_	_	50	50	50
4	DSC	Interior Landscape I	BHD7T03	2	_	_	2	3	80	20	40	_	_	_
5	DSC	Structure – V	BHD7T04	2	_	_	2	3	80	20	40	_	_	_
6	DSE	Elective 3	BHD7T05	2	_	_	2	3	80	20	40	_	_	_
7	RM	Research Methodology	BHD7T07	2	_	-	2	3	80	20	40	-	-	-
8	RM	Research Methodology	BHD7P07	-	-	4	2	-	-	-	-	50	50	50
9	OJT	Internship Apprentice Training I	BHD7T08	_	_	10	5	_	_	_	_	150	100	125
Total				**12**		**24**	**22**	-	**420**	**80**	-	**350**	**250**	

Total Marks 1100

* The exam duration for Interior Design VII is 12 hours (3 hours in two sittings for two days) as the students have to design full project of interiors with all details.

Interior Design
Four Year (Eight Semester Course)
BID Sem. – VIII

Sr. No.	Course category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Interior Design VIII	BHD8T01	2	_	-	2	12*	100	_	40	-	-	-
2	DSC	Interior Design VIII	BHD8P01	-	-	6	3	-	-	-	-	100	50	100
3	DSC	Interior Landscape – II	BHD8T02	2	_	_	2	3	80	20	40	_	_	_
4	DSC	Structure – VI	BHD8T03	2	_	_	2	3	80	20	40	_	_	_
5	DSE	ELECTIVE 4	BHD8T04	2	_	_	2	3	80	20	40	_	_	_
6	AEC	GREEN BUILDING TECHNOLOGY	BHD8T05	2	_	_	2	3	80	20	40	_	_	_
7	AEC	ENVIRONMENTAL PSYCHOLOGY	BHD8T06	2	_	_	2	3	80	20	40	_	_	_
8	RP	Project	BHD8T07	_	_	14	7	_	_	_	_	175	175	175
Total				**12**	**-**	**20**	**22**	_	**500**	**100**		**275**	**225**	

Total Marks 1100

* The exam duration for Interior Design VIII is 12 hours (3 hours in two sittings for two days) as the students have to design full project of interiors with all details.

DSC -- Department Specific Core , AEC -- Ability Enhancement Course , GE-- Generic Elective V SEC -- Vocational Skill Enhancement Course, IKS –Indian Knowledge System.

VSC Basket (BID)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Presentation Techniques I	BID	**BVS1P01**
II	**VSC**	Presentation Techniques II	BID	**BVS2P03**
III	**VSC**	Cultural Anthropology I	BID	**BVS3P05**
V	**VSC**	Digital Application –I	BID	**BVS5P07**
VI	**VSC**	Digital Application II	BID	**BVS6P08**

Basket for ELECTIVE Category Courses (Interior Design)

Semester	Course Category	Name of Course	Course Code	credits
V	Elective 1	History of Art and Architecture III	BHD5T04	4
		Heritage Interiors I		
VI	Elective 2	History of Art and Architecture IV	BHD6T04	4
		Heritage Interiors II		
VII	Elective 3	Professional Practice I	BHD7T05	4
		Vaastu Shastra		
VIII	Elective 4	Professional Practice II	BHD8T04	4
		Critical Appreciation		

FYUGP-I-VIII Semester

Design (Honors/Research)

Four Year (Eight Semester Degree Course)

(Question Paper Pattern for all subjects)

Scheme for Theory Examination

Duration for each theory Examination: **3 Hours**

Maximum Marks Allotted to each Theory: **80**

Instruction for paper setting and distribution of Marks-

1) The Examiner shall set a question paper of 8 questions. The examiner has to set **Eight** questions on all units. Preferably **one** question on each unit and a **last question** based on all units together. Each question will be of 16 marks, internal equal division is suggested.

2) The moderation committee shall retain 7 questions.

3) The student should answer any 5 questions out of 7.

Interior design I AND II:

The Examiner shall set a question on all units

* The exam duration for Interior Design II is 6 hours (3 hours in two sittings) as the students have to design full project of interiors with all details.

Interior design III AND VIII:
The Examiner shall set one design project as a question

* the exam duration for interior design viii is 12 hours (3 hours in two sittings for two days) as the students have to design full project of interiors with all details.

INTERIOR DESIGN
SEMESTER I

BHD1T01 INTERIOR DESIGN I

PAPER - 100

Passing Marks - 40
Total Marks - 100

AIM: The aim of the subject is to understand the principles of design and its application to interior design. Visual perception through simple design elements and organization.

UNIT I

Understanding visual perception of forms analyzed through spatial elements like, line , plane and volume through graphic tools and 3D explorations. Understanding their combinational character.

UNIT II

Impact of variables like size, shape, colour, tone, texture and light on spatial elements of design. Compositions as symmetrical, asymmetrical, balanced/ unbalanced, steady/ dynamic etc. perception of forms through movement in space.

UNIT III

Understanding design issue though order, pattern, rhythm- ISSUES Composition. Synthesis of these elements evolves understanding of order in space and form, Variation, issues of geometry, principles of perception, proximity, closure similarity form in content, figure and ground relationships, static and dynamic aspects of spaces.

UNIT IV

Analysis of visual elements of design leading to establishment of design principles like Unity and Balance.

UNIT V

Geometrical character of design elements leading to principles like contrast, Harmony, Rhythm, Proportion, emphasis and subordination, repletion etc.

SESSIONAL WORK:

The exercises shall be based on:

1. Understanding and application of design elements and variables.
2. Understanding and application of design principles through 2D and 3D compositions.
3. Quantitative and qualitative aspects of space though design exercise.

REFERENCES:

1. Time Saver Standards
2. Visual Arts: A Basic Study by Bhagwat Desai
3. Form Space and Order by D. K. Ching

INTERIOR DESIGN
SEMESTER I
BHD1T02 MATERIAL AND CONSTRUCTION TECHNIQUES I
PAPER II

Theory : 80
Sessional: 20
Total Marks: 100
Passing Marks: 40

Aim: Understanding building as a system. Introduction to basic building material and construction methods. General idea about their chemical and physical properties leading to structural strength and aesthetic qualities. Emphasis should be given on developing understanding about making choice of appropriate building materials in a given situation.

UNIT I

Building Terminology, Building components, its characteristics and behavior. Relationship between building components& building material

UNIT II

Materials - Clay, brick, stone their physical and behavioral properties, process of manufacture, tools and techniques of application to built form and interiors

UNIT III

Openings in masonry, arches, lintels

UNIT IV

Material – Sand, cement, aggregate, mortar, concrete. Process of manufacture, in situ reinforced cement concrete construction, physical and behavioral properties, application in built forms and interiors, Cane and bamboo, tools and techniques of joinery, application to built forms and interiors

Sessional Work: Plates, Site visit reports, tutorials, notes, sketches and market surveys.

REFERENCES:

1. Building Construction by Sushil Kumar
2. Building Construction by Rangwala
3. Building Construction by Barry and Mckay

INTERIOR DESIGN
SEMESTER I
BHD1T03 GRAPHICS I
PAPER III

Practical exam :50
Sessional: 50
Total Marks:100
Passing Marks: 50

AIM : To introduce students to technical drawing methods and equipment , language of graphics i.e. vocabulary and grammar enabling students to express simple three dimensional objects by developing their skill for communicating graphically objects so as to later adopt the same for depicting buildings and building components.

UNIT 1

Familiarization of equipment and recapitulation: Ability to handle and use various drawing instruments and media for technical drawing and sketching. Introduction to graphic language and its components viz. Line types; meaning and application, lettering , use of various metric scales, conventions ,standard annotations and format .Principles of plane geometry and geometrical constructions .systems of measurement MKS and FPS.

UNIT II

Understanding scales: study of scales, their use in practice and construction of plain and diagonal scale. Concept of enlargement and reduction of objects.

UNIT III

Introduction to orthographic projections : The concept of representing objects and elements of drawing such as point , line , planes and simple regular geometric forms / 3 dimensional objects as plan/s section/s and elevation/ learning the basics of drawing orthographic projections for simple combinations of point , line , planes and solids primarily as first angle projections and or third angle projections.

UNIT IV

Orthographic projections: Drawing Orthographic Projections of simple and complex solids based on geometrical constructions , either single or in combinations.

UNIT V

Understanding and drawing views: learning the basics of drawing isometric views and Axonometric projections for representing various simple and complex geometrical shapes and forms and rendering the same to understand materials .

SESSIONAL WORK:

- Exercises should be based on simple and complex geometrical shapes and cover all units in plate forms.
- Sessional work should be planned to cover all the units mentioned in course outline with thrust on skill development, accuracy and understanding of the topic.
- Maximum weight age of 10 percent in assessment should be given to the assignments of geometrical constructions.
- Manually drafted assignments to cover the course outline based on all units.

REFERENCES:

1. Ching Francis D.K.: Architectural Graphics
1. Leslie Martin: Architectural graphics:
2. Jolhe D A : Engineering Graphics , Tata McGraw Hill , New Delhi
3. Bhat N D, “Elementary Engineering Drawing-Plane and Solid Geometry”, Charotar Publishing House, Anand (1988)
4. M .S .Kumar : Engineering Drawing, DD publications, Chennai
5. I.H. Morris : Geometrical Drawing for Art Students, Orient Longman Chennai.

INTERIOR DESIGN
SEMESTER- I
BHD1T04 MATHEMATICS I
PAPER IV

Theory : 80
Sessional: 20
Total Marks: 100
Passing Marks: 40

AIM:

- To understand elementary principles of mathematics.
- To apply mathematics in practical problems.
- To obtain accuracy in calculations and results of various mathematical experiments.

CONTENTS:

UNIT I

- Sets, Relations and Functions
    - Definition
    - Domain
    - Range
    - Cartesian Product
    - Even-Odd Functions
    - Inverse Functions

UNIT II

- Logarithms
    - Product
    - Division
    - Use of Log Tables
    - Simple Calculations using Log Tables

UNIT III

- Trigonometry
    - Trigonometric Ratios
    - Ratios of Sum and Differences of Angles
    - Multiple Angles and Half Angles

UNIT IV

- Plane Co-ordinate Geometry
    - Distance Formula
    - Equation to a Line
    - Section Formula and their applications

UNIT V

- Angle between the Lines
    - Parallel Lines
    - Perpendicular Lines
    - Length of Perpendicular

SESSIONAL WORK

Two unit tests per semester and assignments

REFERENCES

1. Algebra by K P Basu
2. Set Theory, Schaum Series
3. Trigonometry by S L Loney
4. Plane Co-ordinate Geometry by S L Loney

INTERIOR DESIGN
SEMESTER I
BHD1T05 PRESENRATION TECHNIQUES I
PAPER V

Practical exam :50
Sessional: 50
Total Marks:100
Passing Marks: 50

AIM :-To improve drawing and sketching skills. To transfer the design ideas. With visual aid from designer to the client.

UNIT - I

Introduction to various tools used for sketching such as pencil, charcoal , crayons , water colour etc.

UNIT - II

Line drawing of nature by using various techniques as shades of pencil. Introduction of light and shade in nature drawing. Line drawing of exterior of building. Building drawing in perspective.

UNIT - III

Landscape elements by using various mediums. Introduction of colour in the same i.e. poster , pencil & water colour.

SESSIONAL WORK:

- Assignments based on sketching technique
- Assignments based on graphic representations of interior and exterior buildings.
- Assignments based on exterior & interior Landscapes.

REFERENCES:

1. Rendering with Pen and Ink by Gill
2. Ching Francis D.K.: Architectural Graphics

INTERIOR DESIGN

SEMESTER I

BHD1T06 PRODUCT WORKSHOP I

PAPER VI

Practical exam :50
Sessional: 50
Total Marks:100
Passing Marks: 50

UNIT - I CLAY WORKSHOP

- Introduction to mud and clay as a material. Process and techniques of forming and decorating using clay as a material. Having feel of materials and creating innovative products. Interior finishes with mud.

UNIT - II COLOUR WORKSHOP

Aim :- Colour as an important part of our environment and its importance in design and colour as a scientific base.

- Study of colour as science. Light and the spectrum. Different Wave lengths of coloured light.
- Colour as a system and its application.
- Colour perception. Harmony in vision and basic principles of Harmony.
- Colour and textures of various natural materials.
- Modifying factors to colours and their depiction; namely, light, depicting the ability of reflection / absorption of colours in different material, surface quality, distance and scale.
- Manifestation of colours in various cultures. Colours symbolism basic characteristic of various hues.

UNIT – III CERAMIC WORKSHOP

Aim :- Understanding of ceramic products by working with materials, having feel of material and creating innovative products.

- A brief study of ceramics of various cultures.
- Process and techniques of forming and decorating.
- Colour pigments and design qualities.
- Site visits to ceramic product factories, sample collection, documentation, display of creative work.

SESSIONAL WORK:

- Assignments based on colouring technique
- Assignments based on graphic representations of interior and exterior buildings
- Assignments based on exterior& interior Landscape.

REFERENCES:

1. Rendering with Pen and Ink by Gill
2. Ching Francis D.K.: Architectural Graphics

INTERIOR DESIGN
SEMESTER I
BHD1T07 COMMUNICATION SKILLS I
PAPER VII

Theory : 80
Sessional: 20
Total Marks: 100
Passing Marks: 40

AIM: To provide an adequate mastery of technical and communicative English Language training primarily, reading and writing skills, secondarily listening and speaking skills. To develop all the four skills and nurture the personality of the students, to enable them to survive in the competitive world and become professionally competent. In Language acquisition four Skills plays a significant role.

UNIT I: LISTENING: a) Importance of Listening Skills, b)Developing Listening Skills, c)Seminar Presentation Techniques
UNIT II :SPEAKING : a)Voice training and expression b)Non verbal communication)Role Playing)Group Discussion)Report Presentation)Professional Manners and Etiquettes)Personal Interview Techniques.Hygiene1)Voice training and expression (*Effective Public Speaking*)2)Non verbal communication: Body Language
UNIT III: READING : a)Book review 'Reflections on Vital issues'
UNIT IV:WRITING : a)Paragraph writing)Correction of Errors)Précis Writing d)Unseen Passage)Technical report writing, Essay writing Letter writing Dialogue writing.
UNIT V :SOFT SKILL DEVELOPMENT : a) Effective Public Speaking, Goal Setting, Time Management)Team Building)Stress Management f) Health and
SESSIONAL WORK:

1. Activities related to Listening Skills, Telephonic conversation
2. Situational listening Skills (Meeting, Dialogue, Seminars etc.)
3. Essay writing ,Letter writing, Correction of Errors ,Précis Writing
4. Comprehension Passage, Paragraph writing (Related to structures building interiors or exteriors e.g. Interior of a Mall, Monument, etc.).
5. Goal Setting and Three- minute Presentation
6. Presentation of a Research Paper-Syllabus based topic

REFERENCES:

1. Professional Communication Skills : By Pravin, S.R. Bhatia, A.M Sheikh: S. Chand and company
2. English Grammar Composition and Effective Business Communication By M.A. Pink, S. E. Thomas : S. Chand
3. Contemporary English Grammar Structures and Compositions by David Green Macmillan Publication
4. Reflections on Vital issues Edited by P.J. George
5. Publication Orient Black Swan
6. Presentations (The Business Skills Series) by Anne Laws Orient Black Swan
7. Black Swan Fifty ways to improve your Presentation Skills in English By Bob Dignen Publication Orient

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr **P.U. Meshram, Allied Publishers, New Delhi.**
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

INTERIOR DESIGN
SEMESTER II
BHD2T01 INTERIOR DESIGN II
PAPER I

Theory- 80
Sessional: 20
Total Marks: 100
Passing Marks - 40

AIM: Space making in order to understand elements and organization. Visual perception of Interior spaces by creating Comfortable, functional and arithmetically appearing harmonious Interior Environment.

UNITI
Introduction to concept of space. Elements of enclosed form- Combinations, resultant configurations & Characters.

UNIT II
Man and his basic living activity. Relationship of space with that of function for basic living activity. Organizational types and their correlation to linkages, types of routes and movement.
UNIT III
Functional analysis, minimum space requirements, anthropometrics, space planning for living activity.
UNIT IV
Quantitative and qualitative aspects of space through case studies and design exercise. Functional efficiency and qualitative aspects of relation to space.
UNIT V
Analysis of existing spaces and built forms, materials and structural systems, built form and its expression. Lighting, air views & issue.
SESSIONAL WORK: The exercises shall be based on:

1) Analysis of space and in relation to function.
2) Data collection: Survey and analysis of existing space.

REFERENCES:

1. Time Saver Standards
2. Visual Arts: A Basic Study by Bhagwat Desai
3. Form Space and Order by D .K. Ching

INTERIOR DESIGN
SEMESTER II
BHD2T02 MATERIAL AND CONSTRUCTION TECHNIQUES – II
PAPER II

Theory : 80
Sessional: 20
Total Marks: 100
Passing Marks: 40

AIM: Understanding timber and timber joinery and its application. Understanding wood products and derivatives.

UNIT I

Material –timber – classification of trees, characteristics of good timber, sawing methods, tools and techniques of basic timber joinery.

UNIT II

Application of timber to openings like doors and windows, Timber paneled, partly paneled and partly glazed and fully glazed doors including hardware, design standards and criteria of opening.

UNIT III

Application of timber to partition and paneling .

UNIT IV

Material –Reconstituted wood, plywood, block boards, particle boards, fiber boards, cement fiber board's etc- their properties, process of manufacturing, tools and techniques of joinery.

Surface finishes to reconstituted wood like laminates, veneer, and other proprietary material.

SESSIONAL WORK:

1. Plates, Site visit reports, tutorials, notes, sketches and market surveys.

REFERENCES:

4. Building Construction by Sushil Kumar
5. Building Construction by Rangwala
6. Building Construction by Barry and Mckay

INTERIOR DESIGN
SEMESTER II
BHD2T03 GRAPHICS II
PAPER III

Practical exam :50
Sessional: 50
Total Marks:100
Passing Marks: 50

AIM: drawing skills as tools to design thinking and visualization to enable the students to understand and express Composite three-Dimensional objects as perspective views. to understand objects formed by additive and interpenetrated solids using various graphical projection systems including sections and rendering suitably to understand materials , tones and textures.

UNIT I:

Development of Surfaces: development of simple geometrical shapes, cut solids / complex forms using the conventional methods viz.. Unfold, unroll and radial.

UNIT II:

Orthographic projections: drawing orthographic projections of cut solids, true sections etc. of single or combination solids .simple and complex cuts i.e. single plane cutting an object and two planes cutting an object.

UNIT III:

Interpenetration of solids: using projections to derive lines, curves and planes formed by the intersection of planes with solids and solids with solids.

UNIT IV:

Geometrical Drawing of special and complex curves: Geometrical construction of Sine curve, Geometrical mean, Golden Section, Archimedean Spiral, Logarithmic Spiral. Geometrical construction of Ellipse.

UNIT V:

Introduction to perspective drawing: types of perspective drawing (Vanishing point, picture plane and eye level) , difference between isometric view and perspective view. Parallel and angular perspective views of objects

SESSIONAL WORK:

- Sessional work should be planned to cover all the units mentioned in course outline with thrust on skill development, accuracy and understanding of the topic.
- Maximum weightage in assessment should be given to the assignments and use of model making skills to understand methods taught.
- Manually drafted assignments to cover the course outline based on above units.

REFERENCE:

1. Ching Francis D.K.: Architectural Graphics
2. Leslie Martin: Architectural graphics:
3. Jolhe D A : Engineering Graphics , Tata McGraw Hill , New Delhi
4. Bhat N D, “Elementary Engineering Drawing-Plane and Solid Geometry”, Chartotar Publishing House, Anand (1988)
5. M.S. Kumar : Engineering Drawing, DD publications, Chennai
6. I.H. Morris : Geometrical Drawing for Art Students, Orient Longman Chennai

INTERIOR DESIGN
SEMESTER- II
BHD2T04 MATHEMATICS II
PAPER VI

Theory : 80
Sessional: 20
Total Marks: 100
Passing Marks: 40

AIM

- To understand elementary principles of mathematics.
- To apply mathematics in practical problems.
- To obtain accuracy in calculations and results of various mathematical experiments.

UNIT I

- Limits
    - Definition
    - Standard forms
    - Special Cases as : Limit tends to Infinity

UNIT II

- Derivatives (I)
    - Derivatives from definition
    - Standard forms
    - Product rule, Quotient rule
    - Parameter form, Logarithmic derivatives
    - Implicit functions

UNIT III

- Derivatives (II)
    - Rate measuring
    - Maxima-minima

UNIT IV

- Integration (I)
    - Standard forms
    - Substitution Method, Integration by parts
    - Algebraic forms, Partial fractions

UNIT V

- Integration (II)
    - Definite Integrals
    - Area by definite integration

SESSIONAL WORK
Two unit tests per semester

REFERENCES

1. Differential Calculus by Gorakh Prasad
2. Integral Calculus by Gorakh Prasad

INTERIOR DESIGN
SEMESTER II
BHD2T05 PRESENTATION TECHNIQUES II
PAPER V

Practical exam :50
Sessional: 50
Total Marks:100
Passing Marks: 50

AIM: To understand colour as a media of representation, conceptual and preoperational skills & techniques.

UNIT I :

Sketching of transport elements, Human figures studies in line, drawings, shade & sculptural mass.

UNIT II:

Conceptual sketches using different media. Application of rendering techniques suitable for architectural & interior drawings. Rendering of two dimensional representations for eg. Plans & elevations.

UNIT III:

Perspective of forms, geometric solids, spaces: formal and informal (sketch views)

Rendering techniques and use of colour.

REFERENCES

1. Rendering with Pen and Ink by Gill
2. Ching Francis D.K.: Architectural Graphics

INTERIOR DESIGN
SEMESTER II
BHD2T06 PRODUCT WORKSHOP II
PAPER VI

Practical exam :50
Sessional: 50
Total Marks:100
Passing Marks: 50

UNIT – I

PLASTER OF PARIS WORKSHOP

Aim: Introduction to Plaster of Paris material, having feel of material and by creating products for interior spaces.

- Introduction to plaster as material.
- Process of mixing and its use in reproduction.
- mould making and casting.
- Use for plaster with other materials like cloth, thread, wires etc.

UNIT – II

BAMBOO AND CANE WORSHOP

Aim :- Understanding of materials and preventive measures for bamboo and cane.

- The processing on bamboo (seasoning, treatment)
- Tools for working on bamboo
- Precautions for safety in workshops.
- Cutting, Joinery details, strength, finishes, Application to constriction and furniture Interior.

Assignments based on transfers elements

1. Assignments based on human figures
2. Assignments based on perspective of solids & spaces.

REFERENCES:

3. Rendering with Pen and Ink by Gill
4. Ching Francis D.K.: Architectural Graphics

INTERIOR DESIGN

SEMESTER II
BHD2T07 COMMUNICATION SKILLS II
PAPER VII

Theory : 80
Sessional: 20
Total Marks: 100
Passing Marks: 40

AIM : To prepare students for participation in seminars, group discussions, paper presentation and general personal interaction at the professional level

UNIT I : Book review

UNIT II :1)Technical report writing , Official Report Writing ,Progress Report , Industrial Visit Report , Travel Report , Workplace Report , Inventory Report , 2)Stress Management

UNIT III : Dialogue writing , Group Discussion , Role Playing , *Health and Hygiene*

UNIT IV : Seminar Presentation Techniques

UNIT V : Professional Manners and Etiquettes , Personal Interview Techniques ,Meeting Agendas and minutes writing

SESSIONAL WORK:

1. Presenting a seminar on a selected topic
2. Book Reading and Reviews (Discussing the various books read).
3. Mock personal interviews
4. Report Writing
5. Mock Professional situations
6. Dialogue writing
7. Group Discussion Role Playing

REFERENCES:

1. Professional Communication Skills : By Pravin S. R. Bhatia, A.M Sheikh: S. Chand and company
2. English Grammar Composition and Effective Business Communication By M.A. Pink, S .E. Thomas : S .Chand
3. Contemporary English Grammar Structures and Compositions by David Green Macmillan Publication
4. Reflections on Vital issues Edited by P.J. George ,Publication Orient Black Swan
5. Presentations (The Business Skills Series) by Anne Laws Orient Black Swan
6. Fifty ways to improve your Presentation Skills in English By Bob Dignen Publication Orient Black Swan

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture using astronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phase transitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the past dramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao. Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan, Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin%20of%20Astronomy.pdf

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

B.Sc. Fashion Design

Submitted by

Board of Studies,

B.Sc. Fashion Design

FYUGP-Scheme I-VIII

Fashion Design (Honors/Research)
Four Year (Eight Semester Degree Course)
Teaching and Examination Scheme
SEM-I

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Elements of Design	BFD1 T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Elements of Design	BFD1 P01	-	-	2	1	-	-	-	-	-	50	25
3	DSC	Fundamentals of Textile-I	BFD1 T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Fundamentals of Textile-I	BFD1 P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1 T01	1	-	-	1	2	40	10	20	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1 P01	-	-	2	1	-	-	-	-	-	50	25
7	GE/OE	Refer GE/OE Basket	BGO1 T02	2	-	-	2	3	80	20	40	-	-	-
8	VSC	Elements of clothing construction	BVS1 P01	-	-	4	2	-	-	-	-	50	50	50
9	SEC	Refer SEC Basket	BVS1 P02	-	-	4	2	-	-	-	-	50	50	50
10	AEC	Functional English	BAE1 T01	2	-	-	2	3	80	20	40	-	-	-
11	VEC	Environmental Science	BEV1 TO1	2	-	-	2	3	80	20	40	-	-	-
12	IKS	IKS (Traditional Indian Textile-I)	BIK1 T01	2	-	-	2	3	80	20	40	-	-	-
13	CC	Refer CC Basket	BCC1 P01	-	-	4	2	-				-	100	50
Total				13	-	18	**22**		**520**	**130**		**100**	**350**	

Fashion Design SEM-II

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Colour Composition	BFD2 T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Colour Composition	BFD2 P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Fundamentals of Textile-II	BFD2 T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Fundamentals of Textile-II	BFD2 P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2 T03	1	-	-	1	2	40	10	20	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2 P03	-	-	2	1	-	-	-	-	25	25	25
7	GE/OE	Refer GE/OE Basket	BGO2 T04	2	-	-	2	3	80	20	40	-	-	-
8	VSC	Fabric Craft	BVS2 P03	-	-	4	2	-	-	-	-	50	50	50
9	SEC	Refer SEC Basket	BVS2 P04	-	-	4	2	-	-	-	-	50	50	50
10	AEC	English and communication Skills	BAE2 T02	2	-	-	2	3	80	20	40	-	-	-
11	VEC	Constitution of India	BEV2 T02	2	-	-	2	3	80	20	40	-	-	-
12	IKS	IKS (Traditional Indian Textile-II)	BIK2 T02	2	-	-	2	3	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC2 P02	-	-	4	2	-	-	-	-	-	100	50
Total				13	-	18	22	-	520	**130**		**125**	**325**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

Fashion Design **SEM III**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Basics of Pattern Making -I	BFD3 T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Basics of Pattern Making -I	BFD3 P05	-	-	2	1	-	-	-	-	-	50	25
3	DSC	Construction Technique - I	BFD3 T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Construction Technique - I	BFD3 P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40			
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1					-	50	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40			
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1					-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3 T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3 P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Fashion Illustration	BAE3 P01	-	-	4	2	-	-	-	-	50	50	50
12	FP	Industrial Visits	BAE2 T03	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3 P03	-	-	4	2	-	-	-	-		100	50
Total				10	-	24	**22**		**400**	**100**		**150**	**450**	

Fashion Design **SEM IV**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Basics of Pattern Making - II	BFD4 T07	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Basics of Pattern Making - II	BFD4 P07	-	-	2	1					25	25	25
3	DSC	Construction Technique - II	BFD4 T08	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Construction Technique - II	BFD4 P08	-	-	4	2					50	50	50
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 4 (Refer Minor Basket)		-	-	6	3	3	-	-	-	100	50	50
7	GE/OE	Refer GE/OE Basket	BGO4 T06	-	-	4	2	-	-	-	-	25	25	25
8	SEC	Refer SEC Basket	BVS4 P06	-	-	4	2	3	-	-	-	50	50	50
9	AEC	Creative writing	BAE4 T03	2	-	-	2	3	80	20	40	-	-	-
10	CEP	Craft Documentation	BCM4 P01	-	-	4	2	-	-	-	-	50	50	50
11	CC	Refer CC Basket	BCC3 P04	-	-	4	2	-	-	-	-	-	100	50
Total				8	-	28	**22**		**320**	**80**		**325**	**375**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

Fashion Design **SEM V**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Basics of Pattern Making – I	BFD5 T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Basics of Pattern Making – I	BFD5 P09	-	-	4	2	-	-	-	-	-	100	50
2	DSC	Fundamental of Apparel Production – I	BFD5 T10	2	-	-	2	3	80	20	40	-	-	-
3	DSC	Leatherwear Designing	BFD5 T11	2	-		2	3	80	20	40			
	DSC	Leatherwear Designing	BFD5 P11	-	-	2	1					-	50	25
4	DSE	Elective 1 (Refer DSE Basket)	BFD5 T12	2	-		2	3	80	20	40			
	DSE	Elective 1 (Refer DSE Basket)	BFD5 P12	-	-	4	2					-	100	50
5	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40			
	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1					-	50	25
6	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
7	VSC	Refer VSC Basket	BVS3 P07	-	-	4	2	-	-	-	-	50	50	50
8	CEP	Presentation Skills	BCM5 P02	-	-	4	2	-	-	-	-	50	50	50
Total				**12**	**-**	**20**	**22**	**-**	**480**	**120**	**--**	**100**	**400**	**-**

Fashion Design **SEM VI**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Pattern Making-II	BFD6 T13	2	-		2	3	80	20	40			
2	DSC	Pattern Making-II	BFD6 P13			4	2					50	50	50
3	DSC	Fundamentls of Apparel Production - II	BFD6 T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Grading - II	BFD6 T15	2	-		2	3	80	20	40			
5	DSC	Grading - II	BFD6 P15			4	2					50	50	50
6	DSE	Elective 2 (Refer DSE Basket)	BFD6 T16	2	-		2	3	80	20	40			
7	DSE	Elective 2 (Refer DSE Basket)	BFD6 P16			2	1					-	50	25
8	Minor	Minor 7 (Refer Minor Basket)		2	-		2	3	80	20	40			
9	Minor	Minor 7 (Refer Minor Basket)				2	1					-	50	25
10	VSC	Refer VSC Basket	BVS3 P08	-	-	4	2	-	-	-	-	50	50	50
11	OJT	Industrial Training	BOJ6 P01	-	-	8	4	-	-	-	-	100	100	100
Total				10	-	24	**22**		**400**	**100**		**250**	**350**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

Fashion Design **SEM VII (HONORS)**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Applied Statistics	BFD7 T17	2	-	-	2	3	80	20	40			
2	DSC	Applied Statistics	BFD7 P17			2	1					-	50	25
3	DSC	Trend Forecasting	BFD7 T18	2	-	-	2	3	80	20	40			
4	DSC	Trend Forecasting	BFD7 P18			2	1					-	50	25
5	DSC	Red Carpet Design	BFD7 T19	2	-	-	2	3	80	20	40			
6	DSC	Red Carpet Design	BFD7 P19			4	2					50	50	50
7	DSC	Line Creation	BFD7 T20	2	-	-	2	3	80	20	40			
8	DSC	Line Creation	BFD7 P20			4	2					50	50	75
9	DSE	Elective 3 (Refer DSE Basket)	BFD7 T21	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BFD8 T22	2	-	-	2	3	80	20	40			
11	RM	Research Methodology	BFD8 P22			4	2					-	100	50
Total				12	-	16	**20**		**480**	**120**		**100**	**300**	

Fashion Design **SEM VIII (HONORS)**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Stylized Fashion Illustration	BFD8 T23	2	-	-	2	3	80	20	40	-	-	-
	DSC	Stylized Fashion Illustration	BFD8 P23	-	-	6	3	-	-	-	-	100	50	75
2	DSC	Fashion Business	BFD8 T24	2	-	-	2	3	80	20	40	-	-	-
3	DSC	Human Resource and Management	BFD8 T25	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Research Project	BFD8 T26	2	-	-	2	3	80	20	40	-	-	-
	DSC	Research Project	BFD8 P26	-	-	4	2	-	-	-	-	50	50	50
5	DSE	Elective 4 (Refer DSE Basket)	BFD8 T27	2	-	-	2	3	80	20	40	-	-	-
	DSE	Elective 4 (Refer DSE Basket)	BFD8 P27	-	-	2	2	-	-	-	-	-	50	25
6	OJT	Internship (Boutique Study)	BOJ8 P02	-	-	8	4	-	-	-	-	100	100	100
Total				**10**	**-**	**20**	**20**		**400**	**100**		**250**	**250**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

Fashion Design **SEM VII (Research)**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Applied Statistics	BFD7 T17R	2	-	-	2	3	80	20	40			
2	DSC	Applied Statistics	BFD7 P17R	-	-	2	1					-	50	25
3	DSC	Natural Dyeing	BFD7 T18R	2	-	-	2	3	80	20	40			
4	DSC	Natural Dyeing	BFD7 P18R	-	-	2	1					-	50	25
5	DSC	Quality Assurance in Fashion Industry	BFD7 T19R	2	-	-	2	3	80	20	40			
6	DSC	Quality Assurance in Fashion Industry	BFD7 P19R	-	-	2	1					-	50	25
7	DSE	Elective 3 (Refer DSE Basket)	BFD7 T20R	2	-	-	2	3	80	20	40	-	-	-
8	RM	Research Methodology	BFD7 T21R	2	-	-	2	3	80	20	40			
9	RM	Research Methodology	BFD7 P21R	-	-	4	2					-	100	50
10	RP	Dissertation	BRP7 P01	-	-	10	5	3	-	-	-	150	100	125
Total				10	-	20	**20**		**400**	**100**		**150**	**350**	

Fashion Design SEM VIII (Research)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Fashion Art & Design	BFD8 T22R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Fashion Art & Design	BFD8 P22R	-	-	2	1	-	-	-	-	-	50	25
3	DSC	Advanced Draping Techniques	BFD8 T23R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Advanced Draping Techniques	BFD8 P23R	-	-	4	2	-	-	-	-	50	50	50
5	DSC	Sustainable Textiles	BFD8 T24R	2	-	-	2	3	80	20	40	-	-	-
6	DSE	Elective 4 (Refer DSE Basket)	BFD8 T25R	2	-	-	2	3	80	20	40			
7	DSE	Elective 4 (Refer DSE Basket)	BFD8 P25R	-	-	4	2					50	50	50
8	RP	Dissertation	BRP8 P02R	-	-	14	7 (4+2+1)	-	-	-	-	150	200	175
Total				8	-	24	**20**		**320**	**80**		**250**	**350**	

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Fashion Design**)**

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Elements of clothing construction	BFD	**BVS1P01**
II	**VSC**	Fabric Craft	BFD	**BVS2P03**
III	**VSC**	Embroidery Techniques-I	BFD	**BVS3P05**
V	**VSC**	Computer Aided Fashion Design	BFD	**BVS5P07**
VI	**VSC**	Advance Computer Aided Fashion Design	BFD	**BVS6P08**

Basket for ELECTIVE (DSE) **category courses (**Fashion Design**)**

Semester	Course Category	Name of Course	Course Code
V	Elective 1	Leatherwear Design	BFD5 TO12
VI	Elective 3	Fashion Studies	BFD6 TO16
VII (Honors)	Elective 5	Line Creation	BFD7 TO21
VIII (Honors)	Elective 7	Research Project	BFD8 TO27
VII (Research)	Elective 5	Boutique Management	BFD7 TO20R
VIII (Research)	Elective 7	Fashion Art Designing	BFD8 TO25R

Fashion Design
Four Year (Eight Semester Degree Course)
Semester – I
Elements of Design
DSC
BFD1 T01

Theory Marks : 100			**Practical**	**: 50**		**Total Credits**	**: 3** SEE :
80		SEE	: 25		Theory	: 2	
CIE	: 20		CIE	: 25		Practical	: 1

Time Required: 60Hours

Theory **(30 Hours)**

Objectives :

1.To study the basic elements and principles of design.
2.To study the different types of motifs.

Unit I : **(8 Hours)**

1.1 Design definition – Meaning &Importance
1.2 Importance and role of design elements –Point, Line, Shape, Size, Colour, Value, Texture
1.3 Introduction to Textile Design
1.4 Introduction to Fashion Design

Unit II : **(7 Hours)**

2.1 Classification of Motifs
2.2 Study of different motifs of textile design
- Natural
- Decorative
- Geometric
- Abstract

2.3 Principles of design – importance and role in designing
- Proportion
- Repetition
- Balance
- Variety
- Unity
- Gradation
- Emphasis
- Dominance & Sub dominance

Unit III : **(8 Hours)**

3.1 Illusion
3.2 Perception
3.3 After image
3.4 Optical Illusion

Unit IV: **(7 Hours)**

4.1Percentage of cover area in design
4.2Preparation of motifs using design elements

4.3Preparation for design Borders, all over designs, Bed sheet

Practical: **(30 Hours)**

1. Design of points and line
2. Advance exercises in basic designs and rendering of simple designs
3. Study of traditional motifs of natural, decorative, geometric
4. One sheet of formal and informal balance
5. Study of positive and negative spaces
6. Prepare dress materials
7. Prepare bed sheet
8. Border – natural, geometric – 2 sheets
9. Design – scarf, table cloth – 2 sheets

References:

1. Designer's Guide- Volume 1- James Stockton
2. Basic Design and Anthropometry- S.V. Bapat
3. Design Sanvad- Mihir Bhole
4. A Basic Study- Bhagwat Gajanan and Arvind Desai
5. Fundamentals of designing for textiles and other end uses – J.W.Parchure

Fashion Design
FourYear(EightSemesterDegreeCourse)
Semester – I
Fundamentals of Textile – I
DSC
BFD1 T02

Theory Marks	**: 100**	**Practical**	**: 50**	**Total Credits**	**: 3**
SEE	: 80	SEE	: --	Theory	: 2
CIE	: 20	CIE	: 50	Practical	: 1

Time Required: 60 Hours

Theory **(30 Hours)**

Objectives:

1. To know about textile fibers.
2. To know about the types of yarns, their properties & end uses.
3. To understand the yarn numbering system.

Learning outcomes:

After undergoing the subject, the students will be able to deal with the different types of fibres and yarns for producing variety of textile fabrics. The students are expected to know the different materials of the textile.

Unit I: **(7 Hours)**

Textile fibres

1.1 Definitions of fibre, filament

1.2 Classification of textile fibres according to origin

1.3 Essential & desirable properties of textile fibres
1.4 Identification of different fibres

Unit II: **(8 Hours)**

Yarns
2.1 Introduction to cotton spinning and its processes
2.2 Carded Yarn Spinning
2.3 CombedYarn Spinning
2.4 Introduction to open end spinning

Unit III: **(7 Hours)**

Different types of yarn and their properties and end uses
3.1 Fancy and Novelty yarn
3.2 Textured yarn
3.3 Embroidery yarn
3.4 Sewing yarn
3.5 Blended yarn (PV, PC, PW, CV, CS)

Unit IV: **(8 Hours)**

Concept of Yarn Numbering system
4.1 Introduction to various yarns numbering system for various textile yarns
4.2 Importance of Yarn numbering system
4.3 Indirect yarn numbering system
4.4 Direct yarn numbering system

Practical: **(30 Hours)**

1. Collection of different textile fibres.
2. Identification of different fibres.
3. Collection of different types of yarn.
4. Understanding various yarn packages.

References:

1. Textiles Norma -Hollen
2. Weaving calculations -Sen Gupta
3. Watson’s Textile Design and Colour - Z Grosicki
4. Textiles Fiber to Fabric – Bernard Corbman
5. Textiles – Sara J. Kadolph

Fashion Design

Four Year (Eight Semester Degree Course)

Semester – I
Computer Basics
GE/OE
BGO1 TO1

Theory Marks	**: 50**	**Practical**	**: 50**	**Total Credits**	**: 2**
SEE	: 40	SEE	**: -**	Theory	: 1
CIE	: 10	CIE	**: 50**	Practical	: 1

Time Required: 45 Hours

Theory **(15 Hours)**

Objectives:

1. Students should understand the significance and utility of computer.
2. To describe basic computer architecture.
3. To understand the working of Networking.
4. To help student to learn basic presentation skills

Learning outcomes:

After undergoing the subject, the students will be able to understand the working of computers.
The students are expected to know the different parts and flow of data in computer and network.
Students are expected to develop their skills in application software.

Unit I: **(3 Hours)**

Computer Fundamentals

1.1 Basic component of computer system
1.2 Characteristics of computer
1.3 Classification of Computers

Unit II: **(4 Hours)**

Computer Memory

2.1 Primary Memory
2.2 Secondary Memory
2.3 Types of Primary Memory
2.4 Types of Secondary Memory

Unit III : **(4 Hours)**

Software

3.1 System Software
3.2 Operating System
3.3 Functions of Operating System
3.4 Multiprogramming, Multitasking OS

Unit IV: **(4 Hours)**

Networking

4.1 Network Types
4.2 LAN
4.3 WAN
4.4 MAN

Practical **(30 Hours)**

1. Introduction to Ms. Paint, Motif development for specific end use symmetrical/asymmetrical.
2. Introduction to MS Word, Menus, Working with Documents, Formatting, Setting Margins, Editing, Creating Tables, Table settings, Tools, Word Completion, Spell Checks, Drawing and printing Importing and Exporting, Sending files to others, Inserting and Deleting, Find, Search, Replace Commands

Reference:

1. Computer Fundamentals -Sinha P.K. -Vol I, II, III, IV
2. Introduction to Computers - Peter Nartons
3. Microsoft Windows 98 - Lery J.O. Linda, Leary
4. Micro soft Office 2000 - Lery J.O. Linda, Leary 10
5. Computer for Beginners - Arora Pawan,
6. Fundamentals of Computer -V.Rajaram.

Fashion Design

Four Year (Eight Semester Degree Course)

Semester - I
Chemical Processing – I
GE/OE
BGO1 TO2

Theory Marks : 100
SEE : 80
CIE : 20

Total Credits : 2
Theory : 2

Time Required: 30 Hours
Theory **(30 Hours)**

Objectives
1. To study the chemical processing of textile Material.
2. To become aware about Textile Chemistry.

Unit I: **(8 Hours)**
1.1 Comparison of organic & Inorganic compounds
1.2 Water (Required for Textile Industry)
- Impurities in water
- Purification softening of water by using
- Lime soda Treatment
- Zeolite or Base Exchange plant.

Unit II: **(7 Hours)**
2.1 Fiber Classification according to Chemical group
2.2 Textile fibres: Physical and Chemical properties of following fibers-
i.Cottonii. iiwool iii. Silk iv. Viscose v. polyester
vi. Nylon vii. Acrylic viii. polypropylene

Unit III: **(8 Hours)**
1.1 Cotton Fabric processing sequence
1.2 Shearing & cropping
1.3 Singeing & Desizing
1.4 Scouring

Unit IV: **(7 Hours)**
1.1 Souring
1.2 Bleaching: (i) Hypochlorite(ii) Peroxide

1.3 Mercerizing – Fabric & Yarn &Barium number test

References:

1 Technology of Textile Processing - Vol 1(Textile Fiber) - Dr. V.A. Shenoi

2 Technology of Textile Processing - Vol III (Technology of Bleaching) - V.A. Shenoi

3 Technology of Textile Processing - Vol IX (Fundamental Principal of Textile Processing) - V.A. Shenoi

4 Chemical technology of Fibre materials - F. Sadav

5 Textile scouring &Bleaching - E.R. Trotman

Fashion Design
Four Year (Eight Semester Degree Course)
Semester – I
ELEMENTS OF CLOTHING CONSTRUCTION
VSC
BVS1 PO1

Theory Marks	**: --**	**Practical**	**: 100**	**Total Credits**	**: 2**
SEE	: --	SEE	: 50	Theory	: -
CIE	: --	CIE	: 50	Practical	: 2

Time Required: 60Hours

Practical (60Hours)

OBJECTIVES

- To develop skills in clothing construction
- To Equip the students with various stitching techniques

UNIT 1 **(15 Hours)**

1.1 Tools and equipments required for sewing
1.2 Taking body measurements.
1.3 Introduction to domestic sewing machine : Sewing machine parts and their functions

UNIT 2 **(15 Hours)**

2.1 Temporary Hand stitches

- Pin basting
- Even basting
- Uneven basting
- Diagonal basting

2.2 Permanent stitches

- Machine basting
- Running stitch

2.3 Edge Finishing

- overlock
- Hemmimg
- Pico

UNIT 3 **(15 Hours)**

Shaping Devices

3.1 Darts

- Single Dart
- Double Dart

3.2 Tucks

- Pin tucks
- Cross tucks
- Shell tucks
- Released tucks.

UNIT 4 **(15 Hours)**

4.1 Pleats

- Knife pleat
- Box Pleat
- Inverted Box Pleat

4.2 Ruffles

- Single Ruffle
- Double Ruffle

4.3 Gathers

Practical
Prepare a Portfolio of all the samples mentioned in syllabus

Refernce

1. Complete Guide To Sewing – Reader's Digest
2. Encyclopedia Of Dress Making – Raul Jewel
3. Basics of Fashion Design Construction – Annette Fischer

Fashion Design
Four Year (Eight Semester Degree Course)
Semester – I
Hand Painting I
VSEC
BVS1 PO2

Theory Marks	**: --**	**Practical**	**: 100**	**Total Credits**	**: 2**
SEE	: --	SEE	: 50	Theory	: -
CIE	: --	CIE	: 50	Practical	: 2

Time Required: 60Hours .

Practical **(60 Hours)**

Objectives -

- To become familiar with the basic methods, techniques and tools ofdrawing.
- Identify different tones made with different value or textures.

UNIT I **(15 Hours)**

1.1 Basic Brush Handling Techniques for Painting.

1.2 Understanding edges, spaces, light and shadow relations, these basicskills of drawing make up the components of finished works of art.

UNIT II **(15 Hours)**

2.1 How to hold brush (Hard brush, soft brush and dry brush)

2.2 The most basic stoke is the line. It is also one of the most versatile.

2.3 How to use a water brush and handle any given paint brush (washbrush, flat brush, round brush, liner brush)

UNIT III **(15 Hours)**

3.1 Shading techniques for drawing

3.2 Rendering, hatching, random line, stripling

3.3 Shading is the process of adding value to create the illusion of form,space and light in a drawing.

UNIT IV **(15 Hours)**

4.1 Observe and record 10 texture patterns in pen, color and ink.

4.2 Figurative gestures

4.3 2D and 3D perspective. Create a sense of depth and perspective.

Portfolio :

This will make up the majority of your work in the class.

Practice above mentioned techniques.

Sketchbook-

Students will be responsible for keeping a sketchbook throughout thesemester.

References:

Fundamentals of Visual art	Author: Muneesh Kumar
Art is Fundamental	Author: Eileen S. Prince.

Fashion Design

Four Year (Eight Semester Degree Course)

Semester - I
Functional English
AEC
BAE1T01

Theory Marks : 100
SEE : 80
CIE : 20

Total Credits : 2
Theory : 2

Time Required: 30 Hours
Theory **(30 Hours)**

Objectives: 1) To help students in developing speaking and writing proficiency in English language.

Unit 1: **(8 Hours)**
-Remedial grammar
1.1Articles & determiners.
1.2 Forms & functions of nouns, pronouns, prepositions.
1.3 Verbs,adverbs and adjectives
1.4 Tenses

Unit 2: **(7 Hours)**
Functional grammar
2.1 Transformation of sentences
2.2 Figures of speech: - Simile, Metaphor, Irony, Personification, Hyperbole & Alliteration

Unit 3: **(8 Hours)**
3.1 Introduction to Phonetics
3.2 Understanding sociolinguistics:-
Langue, parole, pidgin, creol and dialect

Unit 4: **(7 Hours)**
Creative writing
4.1 Use of Idioms and phrases
4.2 Report writing
4.3 Formal letter & Application writing
4.4 Composing advertisements

Students are expected to practice effective oral and written communication
i. Paper reading session (presented by the students)
ii. Practice of face to face conversation
iii. Listening & summarizing (listening carefully to passage & summarizing the important points)
iv. Letter writing
Continuous assessment of the above mentioned assignment & one presentation on any given topic.

Reference:

1. Secrets of face to face communication -Peter urs Bender (Mecmillan Publications)
2 Learning to learn by Kenneth a Kiewra Nelson F. Dubros Publishers -Allyn & Bacon.
3 English for practical purpose - Z.N. Patil and B.S. Valke Ashok Thorat, Zeaneet Merchant (Macmillan Publications)
4 Teaching Material
5 Business communication - Dr. Urmila Rai
6 Professional Communication skills - A.K. Jain, S.R. Bhatia, A.M. Sheikh

Fashion Design

Four Year (Eight Semester Degree Course)

Semester - I
ENVIRONMENTAL SCIENCE
VEC
BEV1 T01

Theory Marks	**: 100**	**Total Credits**	**: 2**
SEE	: 80	Theory	: 2
CIE	: 20		

Time Required: 30 Hours

Theory **(30 Hours)**

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere-Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr **P.U. Meshram, Allied Publishers, New Delhi.**
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Fashion Design

Four Year (Eight Semester Degree Course)

Semester - I
Traditional Indian Textiles – I
IKS
BIK1 TO1

Theory Marks	**: 100**	**Total Credits**	**: 2**
SEE	: 80	Theory	: 2
CIE	: 20		

Time Required: 30 Hours
Theory **(30 Hours)**

Objectives

1. To learn about traditional Indian Textiles
2. To understand various ornamentation techniques

Unit I: **(8 Hours)**

Evolution of Textile Design

1.1 History of Indian textile design
1.2 Importance of study of Textile Design
1.3 Journey of designing skills since ages
1.4 Influence of Religion, Art and Royalty on Textile Design
1.5 Influence of trade and media on textile design

Unit II: **(7 Hours)**

Textile design

2.1 Design -Definition & classification
2.2 Methods of creating design on fabric

- Structural ornamentation
- Surface ornamentation

Unit III: **(8 Hours)**

Textiles woven on pit loom

3.1 Meaning and introduction of sari weaving – parts of sari
3.2 Pit – loom weaving
  3.2.1 Chanderi Sari (with reference to its motifs, techniques and color combination etc.)
  3.2.2. Maheshwari Sari (with reference to its motifs, techniques and color combination etc.)
  3.2.3 Mau sari
  3.2.4 Shantipur Sari

Unit IV: **(7 Credit)**

Hand woven Textiles

4.1 Limitation and scope of hand loom weaving
  4.1.1 Bhandara Karvat Kathi Sari
  4.1.2 Nagpuri Sari
  4.1.3 Jamdani Sari
  4.1.4 Balrampuri Sari with refrence to its motif, technique, colour combination and products

References:

1. The sari styles – patterns – History – Techniques Linda Lynton
2. Textile Arts of India Kokyo Hatanaka
3 Indian Saris Traditions Perspectives, Design – Vijai Singh Katiyar
4 Decorative Design History In India Textiles & Costumes Parul Bhatnagar
5 Handcrafted Indian Textiles (Tradition And Beyond) Martand Singh Rta Kapur Chisti Rahul Jain
6 Traditional Textiles ShakeelaShaik
7 Costume, Textile and Jewellery of India Tradition in Rajasthan Vandana Bhandari
8 Traditional Indian Textiles John Gillow and Nicholas Barnard
9. Traditonal Indian Constumes& Textiles Parul Bhatnagar

Fashion Design

Four Year (Eight Semester Degree Course)

Semester – I
Sports/ Cultural/ Yoga/ Music/ NSS/ NCC

CC
BCC1 PO1

Practical Marks: 100
SEE : --
CIE : 100

Total Credits : 2
Practical : 2

Time Required: 60 Hours

Practical: 60 Hours

As per university Rules

Fashion Design
Four Year (Eight Semester Degree Course)
Semester – II
Colour Composition
DSC
BFD2 T03

Theory Marks	**: 100**	**Practical: 50**		**Total Credits**	**: 3**
SEE	: 80	SEE:--25		Theory	: 2
CIE	: 20	CIE: 25		Practical	: 1

Time Required: 60 Hours

Theory **(30 Hours)**

Objectives:

1 Students should know the basics of color theories& their role in designing.
2 To make students understand color combinations and textures.

Unit I : **(7 Hours)**

1.1 Definition of color
1.2 The meaning of color
1.3 Theories of color [light & pigment]
1.4 Chromatic circle
1.5 Complementary colors
1.6 After Image of colors

Unit II : **(8 Hours)**

2.1 Role of color in designing
2.2 Color modification
2.3 Value Scale
2.4 Qualities of color [Hue, Value, chrome]
2.5 Color Measurement

Unit III : **(7 Hours)**

3.1 Color Schemes
3.2 Basic Techniques for creating color schemes
3.3 Color Contrast

Unit IV : **(8 Hours)**

4.1 Psychological impact of color- style and colour
4.2 Role of color to create mood - Powerful, Romantic, Vital, Earthy, Friendly, Soft, Elegant, Trendy
4.3 Understanding of texture effects

Practical : **(30 Hours)**

Chromatic circle
Grey Scale
Colour Modification
Key System
Color Wheel
Colour Harmonies
Different Color Schemes
Prepare linear drawing with colored inks or poster colors
Prepare design related to 3 dimensional effects
Prepare different motifs with various tonal effects in different color media

Reference:

1. Color Harmony a Guide to creative color combinations-Bride M. Whelan
2. Designer guide to color-Volume - 1 - 5 -James Stockton
3. A Basic Study- Bhagwat Gajanan
4. Basic Design & Anthropometry-S.V. Bapat
5. Colour Harmony -A Guide to creative colour combinations by Hideaki Ghijirwa,
6. Fundamentals of designing for Textiles and other end uses – J.W.Parchure

Fashion Design
FourYear(EightSemesterDegreeCourse)
Semester – II
Fundamentals of Textile – II
DSC
BFD2 T04

Theory Marks	**: 100**	**Practical**	**: 50**	**Total Credits**	**: 3**
SEE	: 80	SEE	:	Theory	: 2
CIE	: 20	CIE	: 50	Practical	: 1

Time Required: 60 Hours
Theory **(30 Hours)**

Objectives: Students should be able to
1. Differentiate between different types of fabrics.
2. Understand the process of weaving.
3. Understand Loom and its attachments.
4. Know the Relation between Design, Draft & lifting plan.
5. Develop the simple weaves on point paper.
6. To understand the classification of standard fabrics

Learning outcomes:
After undergoing the subject, the students will be able to deal with the different types of designs over variety of textile fabrics. Before going through the design aspect one must know about the different types of Machines used in fabric manufacture.

Unit I: **(7 Hours)**
Fabrics
1.1 Fabric - Definition
1.2 Definition of weaving, properties and end uses of woven fabrics
1.3 Definition of knitting, types of knitting, properties and end uses of knitted fabrics
1.4 Definition on non-woven, properties and end uses of non-woven.
1.5 Flowchart for manufacturing and input, output objectives and machinery used for
- Simple fabrics
- Striped fabrics
- Checks fabrics

Unit II: **(8 Hours)**
Weaving preparatory processes
2.1 Introduction to Winding - Passage of material
2.2 Introduction to Warping - passage of material through beam warping and sectional warping
2.3 Introduction to Sizing - passage of material through sizing machine
2.4 Introduction to Drawing - in & denting
2.5 Introduction to Tying - in

Unit III: **(7 Hours)**
Loom
3.1 Classification of loom
3.2 Passage material through loom
3.3 Motions of loom

Unit IV: **(8 Hours)**
4.1 Definition of design, draft and lifting plan
4.2 Weave representation methods
4.3Simple weaves, (Plain, Twill, and Satin)
4.4 Characteristics and end uses of simple weaves

Practical: **(30 Hours)**

1. Collection of standard fabrics such as muslin, poplin, organdie, cambric, mulmul,

   Crepe, georgette, satin, denim, flannel, felt, fur, woolen, worsted.
2. Collection of Woven, knitted and non-woven fabrics.
3. Collection of Simple, Stripes and Checks fabrics.
4. Collection of figured fabrics.
5. Preparation of simple weave samples (Plain, Twill, and Satin) using various materials.

References:

1. Textiles -Norma Hollen
2. Textile Science -E.P.G.Gohl - L.D. Vilensky
3. Weaving Mechanism - N. N. Banerjee
4. Weaving Mechanism- N. N. Banerjee
5. Watson's Textile Design and Colour-Z.Grosicki
6. Plain Weaving Motions - K. T. Aswani

Fashion Design

Four Year (Eight Semester Degree Course)

Semester - II
Computer Application in Design
GE/OE
BGO2 TO3

Theory Marks	**:50**	**Practical**	**: 50**	**Total Credits**	**: 2**
SEE	:40	SEE	: 25	Theory	: 1
CIE	:10	CIE	: 25	Practical	: 1

Time Required: 45 Hours
Theroy **(15 Hours)**

Objectives

1. To help student to understand the fundamentals and principle of CAD
2. To explain the structure, features and concept of Hardware and software.
3. To help student to learn basic presentation skill
4. To help students to learn basic e mail and web use

Learning outcomes: Students will be able to understand the basic uses of MS Office and develop assignments by using the software effectively. Students will be able to understand the concept of E mail basics and handling.

Unit I: (3 Hours)

In Put Device

1.1 CAD – Definition
1.2 Digitizers
1.3 Image Scanners
1.4 Bar Code Reader, OMR & OCR,

Unit II : (4 Hours)

Out Put Device

2.1 Printers
2.2 Classification of Printers
2.3 Plotters

Unit III: (4 Hours)

Communication System

3.1 Basic elements of a communication system, Simplex
3.2 Half Duplex
3.3 Full Duplex
3.4 Types of communication Channels

Unit IV: (4 Hours)

Internet

4.1 Internet working tools: Bridge
4.2 Routers
4.3 Gateways
4.4 Introduction to 2G, 3G, 4G, Technology
4.4 Search Engines

Practical: **(30 Hours)**

1. Introduction to Excel, Spreadsheet & its Applications, Menus, Toolbars, Working with Spreadsheets, Converting files to different formats, Computing data, Formatting spreadsheets, Working with sheets, Sorting, Filtering, Validation,

Consolidation, Subtotal

2. Introduction to presentation, Formatting a presentation, Adding style, Color, gradient fills, Arranging objects, Slide Background, Slide layout, Adding Graphics to the presentation, Inserting pictures, movies, tables, etc into the presentation, Drawing Pictures using Draw, Adding effects to the presentation, Setting Animation & transition effect, Adding audio and Video.

Internet and web use, E-mail basics,

Reference:

1. Computer fundamentals-Sinha P.K.
2. Introduction to Computers-Peter Nartons
3. Computer for Beginners-Arora Pawan
4. Computer Network-Andrew Tanenbaum,
5. Fundamentals of Computer-V.rajaram

Fashion Design
Four Year (Eight Semester Degree Course)

Semester - II
Chemical Processing – II
GE/OE
BGO2 TO4

Theory Marks : 100 **Total Credits : 2** SEE : 80 Theory : 2
CIE : 20

Time Required: 30Hours
Theory **(30 Hours)**
Objectives
1. To study the chemical processing of
2. To make students aware about Textile Chemistry

Unit I: **(8 Hours)**
1.1 Flow chart for manufacturing process of manmade fibre by
- Dry spinning – Acrylic
- Wet spinning – Viscose
- Melt spinning – Polyester and polypropylene
- Introduction and terms used in the POY, FDY and Texturing process

Unit II : **(7 Hours)**
Introduction to finishing of Fabric & Garment
2.1 Object of Finishing
2.2 Classification of Finishing
2.3 Mechanical Finishing
- Calendar Finishing
- Dimensional Stability Finishing

Unit III: **(7 Hours)**
3.1 Hot Air Stanter Finishing
3.2 Chemical Finishing
- Resin Finishing
- Water Repellent Finishing

Unit IV: **(8 Hours)**
Chemical Finishing
4.1 Fire Retardant Finishing
4.2 Enzyme Finishing
4.3 Back filling
4.4 Types of softner used in Finishing

References:

1. Technology of Textile Processing -Vol 1(Textile Fiber)-Dr. V.A. Shenoi
2. Technology of Textile Processing -Vol III (Technology of Bleaching)-V.A. Shenoi
3. Technology of Textile Processing -Vol IX (Fundamental Principal of Textile Processing) - V.A. Shenoi
4. Chemical technology of Fibre materials - F. Sadav
5. Textile scouring & Bleaching-E.R. Trotman

Fashion Design

Four Year (Eight Semester Degree Course)

Semester - II
FABRIC CRAFT
VSEC
BVS2 PO3

Theory Marks	**: --**	**Practical**	**: 100**	**Total Credits**	**: 2**
SEE	: --	SEE	: 50	Theory	: -
CIE	: --	CIE	: 50	Practical	: 2

Time Required: 60Hours

Practical (60Hours)

OBJECTIVES: To impart ability of creating art pieces made up of fabric.
To understand suitability of fabric for art pieces

UNIT I:
1.1 Understanding nature of fabric
1.2 Understanding Geometry of different art pieces- Estimation for bulk production
1.3 Designing of fabric art pieces
1.4 Appliques

UNIT II:
2.1 Flower
2.2 Buttons
2.3 Bows
2.4 Belts
2.5 Cords
2.6 Braids
2.7 Tassels

UNIT III:
3.1 Home Décor Items:
3.2 Table mats
3.3 Doormats
3.4 Wall Hangings
3.5 Wall Pieces
3.6 Lamp Shade
3.7 Cushion covers

UNIT IV:
4.1 Mask
4.2 Jewellery
4.3 Specs Cover
4.4 Wardrobe organiser
4.5 Bottle Covers
4.6 Shoe Cover
4.7 Saree Cover
4.8 Kitchens

References:
Complete Guide to Sewing- Readers Digest
Fabric Blooms Megan Hunt

Fashion Design
Four Year (Eight Semester Degree Course)
Semester – II
Hand Painting II
VSEC
BVS2 PO4

Theory Marks	**: --**	**Practical**	**: 100**	**Total Credits**	**: 2**
SEE	: --	SEE	: 50	Theory	: -
CIE	: --	CIE	: 50	Practical	: 2

Time Required: 60Hours

Practical (60Hours)

Objectives -

- Identify the appropriate different types of folk art of different states in India.
- Practice different techniques, mediums and styles of folk art.
- Develop the skills and aesthetic sense to appreciate folk art.
- Decorate their floors, walls, clothes, etc.

UNIT I

1.1 Introduction to folk and Tribal art
1.2 Forms of folk and tribal art
1.3 Medium, techniques and styles

UNIT II

2.1 Role of Proportion in drawing
2.2 Warli
2.3 Gond

UNIT III

3.1 Miniature painting
3.2 Madhubani art
3.3 Mandala art

UNIT IV

4.1 Floor painting (Chawk) festivals and ceremonies (different types of states)
4.2 Dhokra

Portfolio :
Fundamental painting techniques. Students need to get creating their own masterpiece.

Sketchbook-
Students will be responsible for keeping a sketchbook throughout the semester.

References:

Fundamentals of Visual art Author: Muneesh Kumar
Art is Fundamental Author: Eileen S. Prince.

Fashion Design
Four Year (Eight Semester Degree Course)
Semester - II
English and Communication Skills
AEC
BAE2 T02

Theory Marks : 100 | **Total Credits : 2**
SEE : 80 | Theory : 2
CIE : 20

Time Required: 30 Hours
Theory **(30 Hours)**
Objectives

1. To improve Communication skills of students.
2. TIP: This subject should be taught in English only

UNIT I : **(8 Hours)**
Communication

1.1 Meaning and definition of communication
1.2 Process, elements, objectives and methods of communication
1.3 Principles of effective communication
1.4 Channels of Communication
1.5 Barriers of communication

Unit-II: **(7 Hours)**
2.1 Verbal vs non-verbal communication

- Oral Communication
- Conversation at a bank, at office, at a bus-stop and at a shop
- Telephonic Conversation: formal and informal
- Written Communication
- Content Writing: style and structure
- Resume writing

Unit III : **(8 Hours)**
Listening

3.1 Principles and Importance of Listening
3.2 Social etiquettes and manners
3.3 Areas of self development
3.4 Motivation

Unit IV: **(7 Hours)**
4.1Presentation skills : To acquire convincing presentation skills

- Leadership Skills
- Group Discussions
- Team work building
- Interview Technique

Reference :

1. Secrets of face to face communication - Peter Bender
2. Learning to learn by Kenneth a Kiewra Nelson F. Dubros
3. English for practical purpose by Z.N. Patil and B.S. Valke Ashok Thorat, Zeaneet Merchant
4. Teaching Material
5. Business Communication - Dr. Urmila Rai

6. Professional Communication Skills - A.K Jain, S.R. Bhatia
7. Managerial Communication – Urmila Rao, S.M.Rai – Himalaya Publishing House
8. Communication Skills – Mrs.Jaya Kulkarni Moholkar – Central Techno Publication

Fashion Design
Four Year (Eight Semester Degree Course)

Semester - II
Constitution of India
VEC
BEV2 T02

Theory Marks : 100
SEE : 80
CIE :20

Total Credits : 2
Theory : 2

Time Required: 30 Hours
Theory **(30 Hours)**

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Fashion Design

Four Year (Eight Semester Degree Course)

Semester - II
Traditional Indian Textiles – II
IKS
BIK2 TO2

Theory Marks : 100
SEE : 80
CIE : 20

Total Credit : 2
Theory : 2

Time Required: 30 Hours
Theory **(30 Hours)**
Objectives

1. To learn about the traditional Indian textiles
2. To understand the culture of India pertaining to the different states

Unit I : **(8 Hours)**
Tribal Weaving
Study of following textiles with reference to region, raw material, techniques, motifs end use etc.
1.1 Backstrap loom weaving
1.2 Assam – Mekhala
1.3 Meghalaya Garo

Unit II : **(7 Hours)**
Tribal Weaving
Study of following textiles with reference to region, raw material, techniques, motifs end use etc.
2.1 Manipuri Phanek
2.2 Innaphi
2.3 Nagaland Blanket

Unit III : **(8 Hours)**
Shawls of India
Study of following textiles with reference to region, raw material, techniques, motifs end use etc.
3.1 Kullu Shawl
3.2 Kanikar
3.3 Gujarat Shawl
3.4 Do rukha

Unit IV : **(7 Hours)**
Floor Coverings
Study of following textiles with reference to region, raw material, techniques, motifs end use etc.
4.1 Namda
4.2 Dharri
4.3 Kashmiri Galicha

Reference:

1. The sari styles - patterns - History - Techniques Linda Lynton
2. Dhurrie Flat woven Rugs Of India Shyam Ahuja
3. Textiles and crafts of India (Arunachal Pradesh Assam. Manipur) Dr. Vardona Bhandari NIFT Pub. Division
4. Textile Arts of India KokyoHatanaka

5. Indian Sarees Traditions Perspectives, Design Vijai Singh Katiyar
6. Decorative Design History In India Textiles & Costumes PorulBhatnagar
7. (Tradition And Beyond) Handcrafted Indian Textiles Martand Singh RtaKapurChisti Rahul Jain
8. Traditional TextilesShakeelaShaik
9. Costume, textile and Jewelry of India Tradition S/n Rajasthan Vandanabhandari
10. Traditional Indian Textiles John Gillow and Nicholas Bornard
11. Traditonal Indian Constumes& Textiles ParulBhatnagar

Fashion Design

Four Year (Eight Semester Degree Course)

Semester - II
Sports/ Cultural/ Yoga/ Music/ NSS/ NCC

CC
BCC2 PO2

Practical Marks: 100		**Total Credits**	**: 2**
SEE	: --	Practical	: 2
CIE	: 100		

Time Required: 30 Hours
Practical **(30 Hours)**

As per University rules

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

B.Sc. Textile Science

Submitted by

Board of Studies,

B.Sc. Textile Science

FYUGP-Scheme I-VIII Semester

Textile Science (Honors/Research)
Four Year (Eight Semester Degree Course)
Teaching and Examination Scheme
SEM-I

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Elements of Design	BTS1 T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Elements of Design	BTS1 P01	-	-	2	1	-	-	-	-	-	50	25
3	DSC	Fundamentals of Textile-I	BTS1 T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Fundamentals of Textile-I	BTS1 P02	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1 T01	1	-		1	2	40	10	20	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1 P01			2	1	-	-	-	-	-	50	25
7	GE/OE	Refer GE/OE Basket	BGO1 T02	2	-	-	2	3	80	20	40	-	-	-
8	VSC	Elements of clothing construction	BVS1 P01	-	-	4	2	-	-	-	-	50	50	50
9	SEC	Refer SEC Basket	BVS1 P02	-	-	4	2	-	-	-	-	50	50	50
10	AEC	Functional English	BAE1 T01	2	-	-	2	3	80	20	40	-	-	-
11	VEC	Environmental Science	BEV1 T01	2	-	-	2	3	80	20	40	-	-	-
12	IKS	IKS (Traditional Indian Textile-I)	BIK1 T01	2	-	-	2	3	80	20	40	-	-	-
13	CC	Refer CC Basket	BCC1 P01	-	-	4	2	-				-	100	50
Total				13	-	18	**22**		**520**	**130**		**100**	**350**	

Textile Science **SEM-II**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Colour Composition	BTS2 T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Colour Composition	BTS2 P03	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Fundamentals of Textile-II	BTS2 T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Fundamentals of Textile-II	BTS2 P04	-	-	2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2 T01	1	-		1	2	40	10	20			
6	GE/OE	Refer GE/OE Basket	BGO2 P01			2	1	-	-	-	-	25	25	25
7	GE/OE	Refer GE/OE Basket	BGO2 T04	2	-	-	2	3	80	20	40	-	-	-
8	VSC	Fabric Craft	BVS2 P03	-	-	4	2	-	-	-	-	50	50	50
9	SEC	Refer SEC Basket	BVS2 P04	-	-	4	2	-	-	-	-	50	50	50
10	AEC	English and communication Skills	BAE2 T02	2	-	-	2	3	80	20	40	-	-	-
11	VEC	Constitution of India	BEV2 TO2	2	-	-	2	3	80	20	40	-	-	-
12	IKS	IKS (Traditional Indian Textile-II)	BIK2 T02	2	-	-	2	3	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC2 P02	-	-	4	2	-				-	100	50
Total				13	-	18	22	-	520	**130**		**125**	**325**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

Textile Science **SEM III**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Basic WovenStructure – I	BTS3 T05	2	-	-	2	3	80	20	40			
2	DSC	Basic WovenStructure – I	BTS3 P05	-	-	2	1	-	-	-	-	-	50	25
3	DSC	Applied Textile Design – I	BTS3 T06	2	-	-	2	3	80	20	40			
4	DSC	Applied Textile Design – I	BTS3 P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40			
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40			
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BTGO3 T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Refer VSC Basket	BVS3 P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Hand Printing Technology	BAE3 T03	-	-	4	2	-	-	-	-	50	50	50
12	FP	Industrial Visit	BAE3 T03	-	-	4	2	-	-	-	-	-	100	50-
13	CC	Refer CC Basket	BCC3 P03	-	-	4	2	-	-	-	-	-	100	50
Total				10	-	24	**22**		**400**	**100**		**100**	**500**	

Textile Science **SEM IV**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Basic Woven Structure – II	BTS4 T07	2	-		2	3	80	20	40	-	-	-
2	DSC	Basic Woven Structure – II	BTS4 P07	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Applied Textile Design – II	BTS4 T08	2	-		2	3	80	20	40	-	-	-
4	DSC	Applied Textile Design – II	BTS4 P08	-	-	2	1	-	-	-	-	25	25	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
6	Minor	Minor 3 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-		2	3	80	20	40	-	-	-
8	Minor	Minor 4 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4 TO6	2	-	-	2	-	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4 P06	-	-	4	2	3	-	-	-	50	50	50
11	AEC	Creative writing	BAE4 T04	2	-	-	2	-	80	20	-	-	-	50
12	CEP	Craft Documentation	BCM4 P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4 P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**480**	**120**		**150**	**350**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor

Textile Science **SEM V**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Advance Woven Structure-I	BTS5 T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advance Woven Structure-I	BTS5 P09	-	-	4	2	-	-	-	-	50	50	50
3	DSC	Technical Textiles	BTS5 T010	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Intricate Traditional Textile-I	BTS5 T011	2	-	-	2	3	80	20	40	-	-	-
5	DSE	Elective 1 (Refer DSE Basket)	BTS5 T012	2	-	-	2	3	80	20	40	-	-	-
6	DSE	Elective 1 (Refer DSE Basket)	BTS5 P012			2	1	-	-	-	-	-	50	25
7	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 5 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
9	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 6 (Refer Minor Basket)				2	1	-	-	-	-	-	50	25
11	VSC	Refer VSC Basket	BVS5 P07	-	-	4	2	-	-	-	-	50	50	50
12	CEP	Presentation Skills	BCM5 P02	-	-	6	3	-	-	-	-	75	75	75
Total				**12**	**-**	**20**	**22**	**-**	**480**	**120**	**--**	**175**	**325**	**-**

Textile Science **SEM VI**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Advance Woven Structure - II	BTS6 T013	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Advance Woven Structure - II	BTS6 P013	-	-	6	3	-	-	-	-	100	50	75
3	DSC	Weaving Calculations	BTS6 T014	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Weaving Calculations	BTS6 P014	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Intricate TraditionalTextile-II	BTS6 T015	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Intricate TraditionalTextile-II	BTS6 P015	-	-	2	1	-	-	-	-	-	50	25
7	DSE	Elective 2 (Refer DSE Basket)	BTS6 T016	2	-	-	2	3	80	20	40	-	-	-
8	DSE	Elective 2 (Refer DSE Basket)	BTS6 P016	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
11	VSC	Refer VSC Basket	BVS6 PO8	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Industrial Training	BOJ6 P01	-	-	6	3	-	-	-	-	75	75	75
Total				10	-	24	**22**		**400**	**100**		**225**	**375**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

Textile Science **SEM VII (HONORS)**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Applied Statistics	BTS7 T017	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Applied Statistics	BTS7 P017	-	-	2	1	-	-	-	-	-	50	25
3	DSC	Trend Forecasting	BTS7 T018	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Trend Forecasting	BTS7 P018	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Theme Based Designing	BTS7 T019	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Theme Based Designing	BTS7 P019	-	-	4	2	-	-	-	-	50	50	75
7	DSC	Brand Management	BTS7 T020	2	-	-	2	3	80	20	40	-	-	-
8	DSE	Elective 3 (Refer DSE Basket)	BTS7 T021	2	-	-	2	3	80	20	40	-	-	-
9	DSE	Elective 3 (Refer DSE Basket)	BTS7 P021	-	-	4	2	-	-	-	-	50	50	75
10	RM	Research Methodology	BTS7 T022	2	-	-	2	3	80	20	40	-	-	-
11	RM	Research Methodology	BTS7 P022	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	16	**20**		**480**	**120**		**100**	**300**	

Textile Science **SEM VIII (HONORS)**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Intricate weaving Techniques	BTS8 T023	2	-	-	4	3	80	20	40			
2	DSC	Intricate weaving Techniques	BTS8 P023	-	-	4		-	-	-	-	-	100	50
3	DSC	Elements of fabrics Costing	BTS8 T024	2	-	-	3	3	80	20	40			
4	DSC	Elements of fabrics Costing	BTS8 P024	-	-	2		-	-	-	-	-	50	25
5	DSC	Human Resource and Management	BTS8 T025	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Recycling of Textiles	BTS8 T026	2	-	-	3	3	80	20	40			
7	DSC	Recycling of Textiles	BTS8 P026	-	-	2		-	-	-	-	-	50	25
8	DSE	Elective 4 (Refer DSE Basket)	BTS8 T027	2	-	-	4	3	80	20	40			
9	DSE	Elective 4 (Refer DSE Basket)	BTS8 P027	-	-	4		-	-	-	-	50	50	50
10	OJT	Internship	BOJ8 P02	-	-	8	4	-	-	-	-	100	100	100
Total				10	-	20	**20**		**400**	**100**		**150**	**350**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

Textile Science **SEM VII (Research)**

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Applied Statistics	BTS7 T017R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Applied Statistics	BTS7 P017R	-	-	4	2	-	-	-	-	50	50	50
3	DSC	Natural Dyeing	BTS7 T018R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Natural Dyeing	BTS7 P018R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Quality Assurance in Textile Industry	BTS7 T019R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Quality Assurance in Textile Industry	BTS7 P019R	-	-	2	1	-	-	-	-	-	50	25
7	DSE	Elective 3 (Refer DSE Basket)	BTS7 T020R	2	-	-	2	3	80	20	40	-	-	-
8	RM	Research Methodology	BTS7 T021R	2	-	-	2	3	80	20	40	-	-	-
9	RM	Research Methodology	BTS7 P021R	-	-	4	2	-	-	-	-	-	100	50
10	RP	Dissertation	BRP7 P01R	-	-	8	4	-	-	-	-	100	100	100
Total				10	-	20	**20**		**400**	**100**		**150**	**350**	

Textile Science SEM VIII (Research)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Hand crafts and textiles	BTS8 T022R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Hand crafts and textiles	BTS8 P022R	-	-	2	1	-	-	-	-	-	50	25
3	DSC	Designing of Non apparel and Upholstery	BTS8 T023R	2	-	-	2	3	80	20	40	-	-	-
	DSC	Designing of Non apparel and Upholstery	BTS8 P023R	-	-	2	1	-	-	-	-	-	50	25
3	DSC	Sustainable Textiles	BTS8 T024R	2	-	-	2	3	80	20	40	-	-	-
4	DSE	Elective 4 (Refer DSE Basket)	BTS8 T025R	2	-	-	2	3	80	20	40	-	-	-
	DSE	Elective 4 (Refer DSE Basket)	BTS8 P025R			4	2	-	-	-	-	50	50	50
5	RP	Dissertation	BRP8 P02R	-	-	16	8 (4+2+2)	-	-	-	-	200	200	200
Total				8	-	24	**20**		**320**	**80**		**250**	**350**	

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS,Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Textile Science**)**

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Elements of clothing construction	BTS	**BVS1P01**
II	**VSC**	Fabric Craft	BTS	**BVS2P03**
III	**VSC**	Computer Aided Textile Design	BTS	**BVS3P05**
V	**VSC**	Home Linen Design	BTS	**BVS5P07**
VI	**VSC**	Design Development	BTS	**BVS6P08**

Basket for ELECTIVE (DSE) category courses (Textile Science)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	Printing Technology-I	BTS5 TO12
VI	Elective 3	Printing Technology-II	BTS6 TO16
VII (Honors)	Elective 5	Applied Art on Textiles	BTS7 TO21
VIII (Honors)	Elective 7	Research Project	BTS8 TO27
VII (Research)	Elective 5	Non Wovens	BTS7 TO20R
VIII (Research)	Elective 7	Handicrafts and Textiles	BTS8 TO25R

Textile Science
Four Year (Eight Semester Degree Course)
Semester – I
Elements of Design
DSC
BTS1 T01

Theory Marks	**: 100**		**Practical**	**: 50**	**Total**
Credits	**: 3**	SEE	: 80	SEE	: 25
		Theory	: 2		
CIE	: 20		CIE	: 25	Practical : 1

Time Required: 60Hours

Theory
(30 Hours)

Objectives :

1.To study the basic elements and principles of design.
2.To study the different types of motifs.

Unit I :
(8 Hours)

1.1 Design definition – Meaning &Importance
1.2 Importance and role of design elements –Point, Line, Shape, Size, Colour, Value, Texture
1.3 Introduction to Textile Design
1.4 Introduction to Fashion Design

Unit II :
(7 Hours)

2.1 Classification of Motifs
2.2 Study of different motifs of textile design

- Natural
- Decorative
- Geometric
- Abstract

2.3 Principles of design – importance and role in designing

- Proportion
- Repetition
- Balance
- Variety
- Unity
- Gradation
- Emphasis
- Dominance & Sub dominance

Unit III :
(8 Hours)

3.1 Illusion
3.2 Perception
3.3 After image
3.4 Optical Illusion

Unit IV:
(7 Hours)
4.1Percentage of cover area in design
4.2Preparation of motifs using design elements
4.3Preparation for design Borders, all over designs, Bed sheet

Practical:

(30 Hours)

1. Design of points and line
2. Advance exercises in basic designs and rendering of simple designs
3. Study of traditional motifs of natural, decorative, geometric
4. One sheet of formal and informal balance
5. Study of positive and negative spaces
6. Prepare dress materials
7. Prepare bed sheet
8. Border – natural, geometric – 2 sheets
9. Design – scarf, table cloth – 2 sheets

References:

1. Designer's Guide- Volume 1- James Stockton
2. Basic Design and Anthropometry- S.V. Bapat
3. Design Sanvad- Mihir Bhole
4. A Basic Study- Bhagwat Gajanan and Arvind Desai
5. Fundamentals of designing for textiles and other end uses – J.W.Parchure

Textile Science
FourYear(EightSemesterDegreeCourse)
Semester – I
Fundamentals of Textile – I
DSC
BTS1 T02

Theory Marks	**: 100**	**Practical**	**: 50**	**Total**
Credits	**: 3**			
SEE	: 80	SEE	: --	Theory : 2
CIE	: 20	CIE	: 50	Practical : 1

Time Required: 60 Hours

Theory **(**
30 Hours)

Objectives:

1. To know about textile fibers.
2. To know about the types of yarns, their properties & end uses.
3. To understand the yarn numbering system.

Learning outcomes:

After undergoing the subject, the students will be able to deal with the different types of fibres and yarns for producing variety of textile fabrics. The students are expected to know the different materials of the textile.

Unit I:

(7 Hours)

Textile fibres

1.1 Definitions of fibre, filament
1.2 Classification of textile fibres according to origin
1.3 Essential & desirable properties of textile fibres
1.4 Identification of different fibres

Unit II:

(8 Hours)

Yarns

2.1 Introduction to cotton spinning and its processes
2.2 Carded Yarn Spinning
2.3 CombedYarn Spinning
2.4 Introduction to open end spinning

Unit III:

(7 Hours)

Different types of yarn and their properties and end uses

3.1 Fancy and Novelty yarn
3.2 Textured yarn
3.3 Embroidery yarn
3.4 Sewing yarn
3.5 Blended yarn (PV, PC, PW, CV, CS)

Unit IV:

(8 Hours)

Concept of Yarn Numbering system

4.1 Introduction to various yarns numbering system for various textile yarns
4.2 Importance of Yarn numbering system
4.3 Indirect yarn numbering system
4.4 Direct yarn numbering system

Practical:

(30 Hours)

1. Collection of different textile fibres.
2. Identification of different fibres.
3. Collection of different types of yarn.
4. Understanding various yarn packages.

References:

1. Textiles Norma -Hollen
2. Weaving calculations -Sen Gupta
3. Watson's Textile Design and Colour - Z Grosicki
4. Textiles Fiber to Fabric – Bernard Corbman
5. Textiles – Sara J. Kadolph

Textile Science

Four Year (Eight Semester Degree Course)

Semester – I
Computer Basics
GE/OE
BGO1 TO1

Theory Marks	**: 50**	**Practical**	**: 50**	**Total**
Credits	**: 2**			
SEE	: 40	SEE	**: -**	Theory : 1
CIE	: 10	CIE	**: 50**	Practical : 1

Time Required: 45 Hours

Theory
(15 Hours)

Objectives:

1. Students should understand the significance and utility of computer.
2. To describe basic computer architecture.
3. To understand the working of Networking.
4. To help student to learn basic presentation skills

Learning outcomes:

After undergoing the subject, the students will be able to understand the working of computers.

The students are expected to know the different parts and flow of data in computer and network.

Students are expected to develop their skills in application software.

Unit I:
(3 Hours)

Computer Fundamentals

1.1 Basic component of computer system
1.2 Characteristics of computer
1.3 Classification of Computers

Unit II:
(4 Hours)

Computer Memory

2.1 Primary Memory

2.2 Secondary Memory

2.3 Types of Primary Memory

2.4 Types of Secondary Memory

Unit III :

(4 Hours)

Software

3.1 System Software

3.2 Operating System

3.3 Functions of Operating System

3.4 Multiprogramming, Multitasking OS

Unit IV:

(4 Hours)

Networking

4.1 Network Types

4.2 LAN

4.3 WAN

4.4 MAN

Practical

(30 Hours)

1. Introduction to Ms. Paint, Motif development for specific end use symmetrical/asymmetrical.

2. Introduction to MS Word, Menus, Working with Documents, Formatting, Setting Margins,

Editing, Creating Tables, Table settings, Tools, Word Completion, Spell Checks,

Drawing and printing Importing and Exporting, Sending files to others, Inserting and

Deleting, Find, Search, Replace Commands

Reference:

1. Computer Fundamentals -Sinha P.K. -Vol I, II, III, IV
2. Introduction to Computers - Peter Nartons
3. Microsoft Windows 98 - Lery J.O. Linda, Leary
4. Micro soft Office 2000 - Lery J.O. Linda, Leary 10
5. Computer for Beginners - Arora Pawan,
6. Fundamentals of Computer -V.Rajaram.

Textile Science

Four Year (Eight Semester Degree Course)

Semester - I
Chemical Processing – I
GE/OE
BGO1 TO2

Theory Marks : 100 **Total**
Credits : 2
SEE : 80 Theory : 2
CIE : 20

Time Required: 30 Hours
Theory
(30 Hours)

Objectives

1. To study the chemical processing of textile Material.
2. To become aware about Textile Chemistry.

Unit I:
(8 Hours)

1.1 Comparison of organic & Inorganic compounds
1.2 Water (Required for Textile Industry)

- Impurities in water
- Purification softening of water by using
- Lime soda Treatment
- Zeolite or Base Exchange plant.

Unit II:
(7 Hours)

2.1 Fiber Classification according to Chemical group
2.2 Textile fibres: Physical and Chemical properties of following fibers-
i.Cotton ii. iiwool iii. Silk iv. Viscose v. polyester
vi. Nylon vii. Acrylic viii. polypropylene

Unit III:
(8 Hours)

1.1 Cotton Fabric processing sequence
1.2 Shearing & cropping
1.3 Singeing & Desizing
1.4 Scouring

Unit IV:
(7 Hours)

1.1 Souring
1.2 Bleaching: (i) Hypochlorite(ii) Peroxide
1.3 Mercerizing – Fabric & Yarn &Barium number test

References:

1 Technology of Textile Processing - Vol 1(Textile Fiber) - Dr. V.A. Shenoi

2 Technology of Textile Processing - Vol III (Technology of Bleaching) - V.A. Shenoi

3 Technology of Textile Processing - Vol IX (Fundamental Principal of Textile

Processing) -

V.A. Shenoi

4 Chemical technology of Fibre materials - F. Sadav

5 Textile scouring &Bleaching - E.R. Trotman

Textile Science
Four Year (Eight Semester Degree Course)
Semester – II
ELEMENTS OF CLOTHING CONSTRUCTION
VSEC
BVS1 PO1

Theory Marks	**: --**	**Practical**	**: 100**	**Total**
Credits	**: 2**			
SEE	: --	SEE	: 50	Theory : -
CIE	: --	CIE	: 50	Practical : 2

Time Required: 60Hours

Practical
(60Hours)

OBJECTIVES

- To develop skills in clothing construction
- To Equip the students with various stitching techniques

UNIT 1
(15 Hours)

1.1 Tools and equipments required for sewing
1.2 Taking body measurements.
1.3 Introduction to domestic sewing machine : Sewing machine parts and their functions

UNIT 2
(15 Hours)

2.1 Temporary Hand stitches

- Pin basting
- Even basting
- Uneven basting
- Diagonal basting

2.2 Permanent stitches

- Machine basting
- Running stitch

2.3 Edge Finishing

- overlock
- Hemmimg
- Pico

UNIT 3
(15 Hours)

Shaping Devices

3.1 Darts

- Single Dart
- Double Dart

3.2 Tucks

- Pin tucks
- Cross tucks
- Shell tucks
- Released tucks.

UNIT 4
(15 Hours)

4.1 Pleats

- Knife pleat
- Box Pleat
- Inverted Box Pleat

4.2 Ruffles

- Single Ruffle
- Double Ruffle

4.3 Gathers

Practical
Prepare a Portfolio of all the samples mentioned in syllabus

Refernce

1. Complete Guide To Sewing – Reader's Digest
2. Encyclopedia Of Dress Making – Raul Jewel
3. Basics of Fashion Design Construction – Annette Fischer

Textile Science
Four Year (Eight Semester Degree Course)
Semester – I
Hand Painting I
VSEC
BVS1 PO2

Theory Marks	**: --**	**Practical**	**: 100**	**Total Credits**	**: 2**
SEE	: --	SEE	: 50	Theory	: -
CIE	: --	CIE	: 50	Practical	: 2

Time Required: 60Hours .

Practical
(60 Hours)

Objectives -

- To become familiar with the basic methods, techniques and tools ofdrawing.
- Identify different tones made with different value or textures.

UNIT I
(15 Hours)

1.1 Basic Brush Handling Techniques for Painting.

1.2 Understanding edges, spaces, light and shadow relations, these basicskills of drawing

make up the components of finished works of art.

UNIT II
(15 Hours)

2.1 How to hold brush (Hard brush, soft brush and dry brush)
2.2 The most basic stoke is the line. It is also one of the most versatile.
2.3 How to use a water brush and handle any given paint brush (washbrush, flat brush, round brush, liner brush)

UNIT III
(15 Hours)

3.1 Shading techniques for drawing
3.2 Rendering, hatching, random line, stripling
3.3 Shading is the process of adding value to create the illusion of form,space and light in a drawing.

UNIT IV
(15 Hours)

4.1 Observe and record 10 texture patterns in pen, color and ink.
4.2 Figurative gestures
4.3 2D and 3D perspective. Create a sense of depth and perspective.

Portfolio :
This will make up the majority of your work in the class.
Practice above mentioned techniques.

Sketchbook-
Students will be responsible for keeping a sketchbook throughout the semester.

References:

Fundamentals of Visual art	Author: Muneesh Kumar
Art is Fundamental	Author: Eileen S. Prince.

Textile Science

Four Year (Eight Semester Degree Course)

Semester - I
Functional English
AEC
BAE1T01

Theory Marks	**: 100**	**Total**
Credits	**: 2**	
SEE	: 80	Theory
: 2		
CIE	: 20	

Time Required: 30 Hours
Theory
(30 Hours)

Objectives: 1) To help students in developing speaking and writing proficiency in English language.

Unit 1:
(8 Hours)

-Remedial grammar
1.1Articles & determiners.
1.2 Forms & functions of nouns, pronouns, prepositions.
1.3 Verbs,adverbs and adjectives
1.4 Tenses

Unit 2:
(7 Hours)
Functional grammar
2.1 Transformation of sentences
2.2 Figures of speech: - Simile, Metaphor, Irony, Personification, Hyperbole & Alliteration

Unit 3:
(8 Hours)
3.1 Introduction to Phonetics
3.2 Understanding sociolinguistics:-
Langue, parole, pidgin, creol and dialect

Unit 4:
(7 Hours)
Creative writing
4.1 Use of Idioms and phrases
4.2 Report writing
4.3 Formal letter & Application writing
4.4 Composing advertisements

Students are expected to practice effective oral and written communication

i. Paper reading session (presented by the students)
ii. Practice of face to face conversation
iii. Listening & summarizing (listening carefully to passage & summarizing the important points)

iv. Letter writing

Continuous assessment of the above mentioned assignment & one presentation on any given topic.

Reference:

1. Secrets of face to face communication -Peter urs Bender (Mecmillan Publications)
2 Learning to learn by Kenneth a Kiewra Nelson F. Dubros Publishers -Allyn & Bacon.
3 English for practical purpose - Z.N. Patil and B.S. Valke Ashok Thorat, Zeaneet Merchant (Macmillan Publications)
4 Teaching Material
5 Business communication - Dr. Urmila Rai
6 Professional Communication skills - A.K. Jain, S.R. Bhatia, A.M. Sheikh

Textile Science

Four Year (Eight Semester Degree Course)

Semester - I
ENVIRONMENTAL SCIENCE
VEC
BEV1 T01

Theory Marks	**: 100**	**Total Credits**	**: 2**
SEE	: 80	Theory	: 2
CIE	: 20		

Time Required: 30 Hours

Theory **(30 Hours)**

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto-cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr P.U. Meshram, Allied Publishers, New Delhi.
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Textile Science

Four Year (Eight Semester Degree Course)

Semester - I
Traditional Indian Textiles – I
IKS
BIK1 TO1

Theory Marks : 100		**Total Credits**	**: 2**
SEE	: 80	Theory	: 2
CIE	: 20		

Time Required: 30 Hours
Theory **(30 Hours)**

Objectives

1. To learn about traditional Indian Textiles
2. To understand various ornamentation techniques

Unit I: **(8 Hours)**

Evolution of Textile Design

1.1 History of Indian textile design
1.2 Importance of study of Textile Design
1.3 Journey of designing skills since ages
1.4 Influence of Religion, Art and Royalty on Textile Design
1.5 Influence of trade and media on textile design

Unit II: **(7 Hours)**

Textile design

2.1 Design -Definition & classification
2.2 Methods of creating design on fabric

- Structural ornamentation
- Surface ornamentation

Unit III: **(8 Hours)**

Textiles woven on pit loom

3.1 Meaning and introduction of sari weaving – parts of sari
3.2 Pit – loom weaving
3.2.1 Chanderi Sari (with reference to its motifs, techniques and color combination etc.)
3.2.2. Maheshwari Sari (with reference to its motifs, techniques and color combination etc.)
3.2.3 Mau sari
3.2.4 Shantipur Sari

Unit IV: **(7 Credit)**

Hand woven Textiles

4.1 Limitation and scope of hand loom weaving
4.1.1 Bhandara Karvat Kathi Sari
4.1.2 Nagpuri Sari
4.1.3 Jamdani Sari
4.1.4 Balrampuri Sari with refrence to its motif, technique, colour combination and products

References:

1. The sari styles – patterns – History – Techniques Linda Lynton
2. Textile Arts of India Kokyo Hatanaka
3 Indian Saris Traditions Perspectives, Design – Vijai Singh Katiyar
4 Decorative Design History In India Textiles & Costumes Parul Bhatnagar
5 Handcrafted Indian Textiles (Tradition And Beyond) Martand Singh Rta Kapur Chisti Rahul Jain
6 Traditional Textiles ShakeelaShaik
7 Costume, Textile and Jewellery of India Tradition in Rajasthan Vandana Bhandari
8 Traditional Indian Textiles John Gillow and Nicholas Barnard
9. Traditonal Indian Constumes& Textiles Parul Bhatnagar

Textile Science

Four Year (Eight Semester Degree Course)

Semester – I
Sports/ Cultural/ Yoga/ Music/ NSS/ NCC

CC
BCC1 PO1

Practical Marks: 100 **Total Credits : 2**

SEE : -- Practical : 2

CIE : 100

Time Required: 60 Hours

Practical: 60 Hours

As per university Rules

Textile Science
Four Year (Eight Semester Degree Course)
Semester – II
Colour Composition
DSC
BTS2 T03

Theory Marks	**: 100**	**Practical: 50**		**Total Credits**	**: 3**
SEE	: 80	SEE:--25		Theory	: 2
CIE	: 20	CIE: 25		Practical	: 1

Time Required: 60 Hours

Theory **(30 Hours)**

Objectives:

1 Students should know the basics of color theories& their role in designing.
2 To make students understand color combinations and textures.

Unit I : **(7 Hours)**

1.1 Definition of color
1.2 The meaning of color
1.3 Theories of color [light & pigment]
1.4 Chromatic circle
1.5 Complementary colors
1.6 After Image of colors

Unit II : **(8 Hours)**

2.1 Role of color in designing
2.2 Color modification
2.3 Value Scale
2.4 Qualities of color [Hue, Value, chrome]
2.5 Color Measurement

Unit III : **(7 Hours)**

3.1 Color Schemes
3.2 Basic Techniques for creating color schemes
3.3 Color Contrast

Unit IV : **(8 Hours)**

4.1 Psychological impact of color- style and colour
4.2 Role of color to create mood - Powerful, Romantic, Vital, Earthy, Friendly, Soft, Elegant, Trendy
4.3 Understanding of texture effects

Practical : **(30 Hours)**

Chromatic circle
Grey Scale
Colour Modification
Key System
Color Wheel
Colour Harmonies
Different Color Schemes
Prepare linear drawing with colored inks or poster colors
Prepare design related to 3 dimensional effects
Prepare different motifs with various tonal effects in different color media

Reference:

1. Color Harmony a Guide to creative color combinations-Bride M. Whelan
2. Designer guide to color-Volume - 1 - 5 -James Stockton
3. A Basic Study- Bhagwat Gajanan
4. Basic Design & Anthropometry-S.V. Bapat
5. Colour Harmony -A Guide to creative colour combinations by Hideaki Ghijirwa,
6. Fundamentals of designing for Textiles and other end uses – J.W.Parchure

Textile Science
FourYear(EightSemesterDegreeCourse)
Semester – II
Fundamentals of Textile – II
DSC
BTS2 T04

Theory Marks	**: 100**	**Practical**	**: 50**	**Total Credits**	**: 3**
SEE	: 80	SEE	:	Theory	: 2
CIE	: 20	CIE	: 50	Practical	: 1

Time Required: 60 Hours
Theory **(30 Hours)**

Objectives: Students should be able to
1. Differentiate between different types of fabrics.
2. Understand the process of weaving.
3. Understand Loom and its attachments.
4. Know the Relation between Design, Draft & lifting plan.
5. Develop the simple weaves on point paper.
6. To understand the classification of standard fabrics

Learning outcomes:
After undergoing the subject, the students will be able to deal with the different types of designs over variety of textile fabrics. Before going through the design aspect one must know about the different types of Machines used in fabric manufacture.

Unit I: **(7 Hours)**
Fabrics
1.1 Fabric - Definition
1.2 Definition of weaving, properties and end uses of woven fabrics
1.3 Definition of knitting, types of knitting, properties and end uses of knitted fabrics
1.4 Definition on non-woven, properties and end uses of non-woven.
1.5 Flowchart for manufacturing and input, output objectives and machinery used for
- Simple fabrics
- Striped fabrics
- Checks fabrics

Unit II: **(8 Hours)**
Weaving preparatory processes
2.1 Introduction to Winding - Passage of material
2.2 Introduction to Warping - passage of material through beam warping and sectional warping
2.3 Introduction to Sizing - passage of material through sizing machine
2.4 Introduction to Drawing - in & denting
2.5 Introduction to Tying - in

Unit III: **(7 Hours)**
Loom
3.1 Classification of loom
3.2 Passage material through loom
3.3 Motions of loom

Unit IV: **(8 Hours)**
4.1 Definition of design, draft and lifting plan
4.2 Weave representation methods
4.3Simple weaves, (Plain, Twill, and Satin)
4.4 Characteristics and end uses of simple weaves

Practical: **(30 Hours)**

1. Collection of standard fabrics such as muslin, poplin, organdie, cambric, mulmul,

   Crepe, georgette, satin, denim, flannel, felt, fur, woolen, worsted.
2. Collection of Woven, knitted and non-woven fabrics.
3. Collection of Simple, Stripes and Checks fabrics.
4. Collection of figured fabrics.
5. Preparation of simple weave samples (Plain, Twill, and Satin) using various materials.

References:

1. Textiles -Norma Hollen
2. Textile Science -E.P.G.Gohl - L.D. Vilensky
3. Weaving Mechanism - N. N. Banerjee
4. Weaving Mechanism- N. N. Banerjee
5. Watson's Textile Design and Colour-Z.Grosicki
6. Plain Weaving Motions - K. T. Aswani

Textile Science

Four Year (Eight Semester Degree Course)

Semester - II
Computer Application in Design
GE/OE
BGO2 TO3

Theory Marks	**:50**	**Practical**	**: 50**	**Total Credits**	**: 2**
SEE	:40	SEE	: 25	Theory	: 1
CIE	:10	CIE	: 25	Practical	: 1

Time Required: 45 Hours

Theroy **(15 Hours)**

Objectives

1. To help student to understand the fundamentals and principle of CAD
2. To explain the structure, features and concept of Hardware and software.
3. To help student to learn basic presentation skill
4. To help students to learn basic e mail and web use

Learning outcomes: Students will be able to understand the basic uses of MS Office and develop assignments by using the software effectively. Students will be able to understand the concept of E mail basics and handling.

Unit I: (3 Hours)

In Put Device

1.1 CAD – Definition
1.2 Digitizers
1.3 Image Scanners
1.4 Bar Code Reader, OMR & OCR,

Unit II : (4 Hours)

Out Put Device

2.1 Printers

2.2 Classification of Printers
2.3 Plotters

Unit III: (4 Hours)

Communication System

3.1 Basic elements of a communication system, Simplex
3.2 Half Duplex
3.3 Full Duplex
3.4 Types of communication Channels

Unit IV: (4 Hours)

Internet

4.1 Internet working tools: Bridge
4.2 Routers
4.3 Gateways
4.4 Introduction to 2G, 3G, 4G, Technology
4.4 Search Engines

Practical: (30 Hours)

1. Introduction to Excel, Spreadsheet & its Applications, Menus, Toolbars, Working with Spreadsheets, Converting files to different formats, Computing data, Formatting spreadsheets, Working with sheets, Sorting, Filtering, Validation, Consolidation, Subtotal
2. Introduction to presentation, Formatting a presentation, Adding style, Color, gradient fills, Arranging objects, Slide Background, Slide layout, Adding Graphics to the presentation, Inserting pictures, movies, tables, etc into the presentation, Drawing Pictures using Draw, Adding effects to the presentation, Setting Animation & transition effect, Adding audio and Video.
   Internet and web use, E-mail basics,

Reference:

1. Computer fundamentals-Sinha P.K.
2. Introduction to Computers-Peter Nartons
3. Computer for Beginners-Arora Pawan
4. Computer Network-Andrew Tanenbaum,
5. Fundamentals of Computer-V.rajaram

Textile Science

Four Year (Eight Semester Degree Course)

Semester - II
Chemical Processing – II
GE/OE
BGO2 TO4

Theory Marks : 100 **Total Credits : 2** SEE : 80 Theory : 2
CIE : 20

Time Required: 30Hours

Theory (30 Hours)

Objectives

1. To study the chemical processing of
2. To make students aware about Textile Chemistry

Unit I: **(8 Hours)**

1.1 Flow chart for manufacturing process of manmade fibre by

- Dry spinning – Acrylic
- Wet spinning – Viscose
- Melt spinning – Polyester and polypropylene
- Introduction and terms used in the POY, FDY and Texturing process

Unit II : **(7 Hours)**

Introduction to finishing of Fabric & Garment

2.1 Object of Finishing
2.2 Classification of Finishing
2.3 Mechanical Finishing

- Calendar Finishing
- Dimensional Stability Finishing

Unit III: **(7 Hours)**

3.1 Hot Air Stanter Finishing
3.2 Chemical Finishing

- Resin Finishing
- Water Repellent Finishing

Unit IV: **(8 Hours)**

Chemical Finishing

4.1 Fire Retardant Finishing
4.2 Enzyme Finishing
4.3 Back filling
4.4 Types of softner used in Finishing

References:

1. Technology of Textile Processing -Vol 1(Textile Fiber)-Dr. V.A. Shenoi
2. Technology of Textile Processing -Vol III (Technology of Bleaching)-V.A. Shenoi
3. Technology of Textile Processing -Vol IX (Fundamental Principal of Textile Processing) - V.A. Shenoi
4. Chemical technology of Fibre materials - F. Sadav
5. Textile scouring & Bleaching-E.R. Trotman

Textile Science

Four Year (Eight Semester Degree Course)

Semester - II
FABRIC CRAFT
VSC
BVS2 PO3

Theory Marks	**: --**	**Practical**	**: 100**	**Total Credits**	**: 2**
SEE	: --	SEE	: 50	Theory	: -
CIE	: --	CIE	: 50	Practical	: 2

Time Required: 60Hours

Practical (60Hours)

OBJECTIVES: To impart ability of creating art pieces made up of fabric.
To understand suitability of fabric for art pieces

UNIT I:

1.1 Understanding nature of fabric
1.2 Understanding Geometry of different art pieces- Estimation for bulk production
1.3 Designing of fabric art pieces
1.4 Appliques

UNIT II:

2.1 Flower
2.2 Buttons
2.3 Bows
2.4 Belts
2.5 Cords
2.6 Braids
2.7 Tassels

UNIT III:

3.1 Home Décor Items:
3.2 Table mats
3.3 Doormats
3.4 Wall Hangings
3.5 Wall Pieces
3.6 Lamp Shade
3.7 Cushion covers

UNIT IV:

4.1 Mask
4.2 Jewellery
4.3 Spects Cover
4.4 Wardrobe organiser
4.5 Bottle Covers
4.6 Shoe Cover
4.7 Saree Cover
4.8 Kitchens

References:

Complete Guide to Sewing- Readers Digest
Fabric Blooms Megan Hunt

Textile Science
Four Year (Eight Semester Degree Course)
Semester – II
Hand Painting II
SEC
BVS2 PO4

Theory Marks	**: --**	**Practical**	**: 100**	**Total Credits**	**: 2**
SEE	: --	SEE	: 50	Theory	: -
CIE	: --	CIE	: 50	Practical	: 2

Time Required: 60Hours

Practical (60Hours)

Objectives -

- Identify the appropriate different types of folk art of different states in India.
- Practice different techniques, mediums and styles of folk art.
- Develop the skills and aesthetic sense to appreciate folk art.
- Decorate their floors, walls, clothes, etc.

UNIT I

1.1 Introduction to folk and Tribal art
1.2 Forms of folk and tribal art
1.3 Medium, techniques and styles

UNIT II
2.1 Role of Proportion in drawing
2.2 Warli
2.3 Gond

UNIT III
3.1 Miniature painting
3.2 Madhubani art
3.3 Mandala art

UNIT IV
4.1 Floor painting (Chawk) festivals and ceremonies (different types of states)
4.2 Dhokra

Portfolio :
Fundamental painting techniques. Students need to get creating their own masterpiece.

Sketchbook-
Students will be responsible for keeping a sketchbook throughout the semester.

References:

Fundamentals of Visual art	Author: Muneesh Kumar
Art is Fundamental	Author: Eileen S. Prince.

Textile Science

Four Year (Eight Semester Degree Course)

Semester - II
English and Communication Skills
AEC
BAE2 T02

Theory Marks	**: 100**	**Total Credits**	**: 2**
SEE	: 80	Theory	: 2
CIE	: 20		

Time Required: 30 Hours
Theory **(30 Hours)**
Objectives
1. To improve Communication skills of students.
2. TIP: This subject should be taught in English only

UNIT I : **(8 Hours)**

Communication
1.1 Meaning and definition of communication
1.2 Process, elements, objectives and methods of communication
1.3 Principles of effective communication
1.4 Channels of Communication
1.5 Barriers of communication

Unit-II: **(7 Hours)**

2.1 Verbal vs non-verbal communication

- Oral Communication
- Conversation at a bank, at office, at a bus-stop and at a shop
- Telephonic Conversation: formal and informal
- Written Communication
- Content Writing: style and structure
- Resume writing

Unit III : **(8 Hours)**

Listening

3.1 Principles and Importance of Listening
3.2 Social etiquettes and manners
3.3 Areas of self development
3.4 Motivation

Unit IV: **(7 Hours)**

4.1Presentation skills : To acquire convincing presentation skills

- Leadership Skills
- Group Discussions
- Team work building
- Interview Technique

Reference :

1. Secrets of face to face communication - Peter Bender
2. Learning to learn by Kenneth a Kiewra Nelson F. Dubros
3. English for practical purpose by Z.N. Patil and B.S. Valke Ashok Thorat, Zeaneet Merchant
4. Teaching Material
5. Business Communication - Dr. Urmila Rai
6. Professional Communication Skills - A.K Jain, S.R. Bhatia
7. Managerial Communication – Urmila Rao, S.M.Rai – Himalaya Publishing House
8. Communication Skills – Mrs.Jaya Kulkarni Moholkar – Central Techno Publication

Textile Science

Four Year (Eight Semester Degree Course)

Semester - II
Constitution Of India
VEC
BEV2 T02

Theory Marks : 100
SEE : 80
CIE :20

Total Credits : 2
Theory : 2

Time Required: 30 Hours
Theory **(30 Hours)**

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Textile Science

Four Year (Eight Semester Degree Course)

Semester - II
Traditional Indian Textiles – II
IKS
BIK2 TO2

Theory Marks	**: 100**	**Total Credit**	**: 2**
SEE	: 80	Theory	: 2
CIE	: 20		

Time Required: 30 Hours

Theory **(30 Hours)**

Objectives

1. To learn about the traditional Indian textiles
2. To understand the culture of India pertaining to the different states

Unit I : **(8 Hours)**

Tribal Weaving

Study of following textiles with reference to region, raw material, techniques, motifs end use etc.

1.1 Backstrap loom weaving
1.2 Assam – Mekhala
1.3 Meghalaya Garo

Unit II : **(7 Hours)**

Tribal Weaving

Study of following textiles with reference to region, raw material, techniques, motifs end use etc.

2.1 Manipuri Phanek
2.2 Innaphi
2.3 Nagaland Blanket

Unit III : **(8 Hours)**

Shawls of India

Study of following textiles with reference to region, raw material, techniques, motifs end use etc.

3.1 Kullu Shawl
3.2 Kanikar
3.3 Gujarat Shawl
3.4 Do rukha

Unit IV : **(7 Hours)**

Floor Coverings

Study of following textiles with reference to region, raw material, techniques, motifs end use etc.

4.1 Namda
4.2 Dharri
4.3 Kashmiri Galicha

Reference:

1. The sari styles - patterns - History - Techniques Linda Lynton
2. Dhurrie Flat woven Rugs Of India Shyam Ahuja
3. Textiles and crafts of India (Arunachal Pradesh Assam. Manipur) Dr. Vardona Bhandari NIFT Pub. Division
4. Textile Arts of India KokyoHatanaka
5. Indian Sarees Traditions Perspectives, Design Vijai Singh Katiyar
6. Decorative Design History In India Textiles & Costumes PorulBhatnagar
7. (Tradition And Beyond) Handcrafted Indian Textiles Martand Singh RtaKapurChisti Rahul Jain

8. Traditional Textiles ShakeelaShaik
9. Costume, textile and Jewelry of India Tradition S/n Rajasthan Vandanabhandari
10. Traditional Indian Textiles John Gillow and Nicholas Bornard
11. Traditonal Indian Constumes& Textiles ParulBhatnagar

Textile Science

Four Year (Eight Semester Degree Course)

Semester - II
Sports/ Cultural/ Yoga/ Music/ NSS/ NCC

CC
BCC2 PO2

Practical Marks: 100
SEE : --
CIE : 100

Total Credits : 2
Practical : 2

Time Required: 30 Hours
Practical **(30 Hours)**

As per University rules

Annexure – III
Basket of Minor Courses

Faculty of Science and Technology

1. Basket for Minor Category Courses - BOTANY

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Algae, Fungi, Lichen &Plant Pathology	BBO1T01	BBO1P01
	Minor 2	Fossil Angiosperms &Angiosperm Taxonomy	BBO1T02	BBO1P02
IV	Minor 3	Genetics, Plant breeding, Biostatistics & Evolution	BBO2T03	BBO2P03
	Minor 4	Plant Development, Anatomy& Embryology	BBO2T04	BBO2P04
V	Minor 5	Biochemistry & Plant Physiology	BBO3T05	BBO3P05
	Minor 6	Economic botany, Ethnobotany & Phytogeography.	BBO3T06	BBO3P06
VI	Minor 7	Ecology & Laboratory Instrumentation	BBO4T07	BBO4P07

2. Basket for Minor Category Courses - BIOCHEMISTRY

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Biomolecules & Nutritional Biochemistry	BBC1T01	BBC1P01
	Minor 2	Microbial Biochemistry	BBC1T02	BBC1P02
IV	Minor 3	Human Physiology & Clinical Biochemistry	BBC2T03	BBC2P03
	Minor 4	Techniques in Biochemistry	BBC2T04	BBC2P04
V	Minor 5	Agriculture Biochemistry	BBC3T05	BBC3P05
	Minor 6	Enzymes and Enzyme Technology	BBC3T06	BBC3P06
VI	Minor 7	Metabolism	BBC4T07	BBC4P07

3. Basket for Minor Category Courses - BIOTECHNOLOGY

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Introductory Microbial Biotechnology	BBT1T01	BBT1P01
	Minor 2	Cellular Macromolecules	BBT1T02	BBT1P02
IV	Minor 3	Techniques in Biotechnology	BBT2T03	BBT2P03
	Minor 4	Enzyme Technology	BBT2T04	BBT2P04
V	Minor 5	Molecular Biology–I	BBT3T05	BBT3P05
	Minor 6	Molecular Biology-II	BBT3T06	BBT3P06
VI	Minor 7	Fundamentals of Genetic Engineering	BBT4T07	BBT4P07

4. Basket for Minor Category Courses - CHEMISTRY

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Inorganic Chemisty-1 (Atomic structure, bonding and main group elements)	BCH1T01	BCH1P01
	Minor 2	Organic Chemistry-1 (Fundamentals, stereochemistry and hydrocarbons)	BCH1T02	BCH1P02
IV	Minor 3	Organic Chemistry-2 (Functional group chemistry)	BCH2T03	BCH2P03
	Minor 4	Physical Chemistry-1 (Thermodynamics, gaseous and liquid state)	BCH2T04	BCH2P04
V	Minor 5	Physical Chemistry-2 (Surface chemistry, phase equilibria, electrochemistry and kinetics)	BCH3T05	BCH3P05
	Minor 6	Inorganic Chemistry-2 (Bonding, transition elements and solutions)	BCH3T06	BCH3P06
VI	Minor 7	Inorganic Chemistry-3 (Coordination chemistry, Redox reactions and Inorganic Polymers)	BCH4T07	BCH4P07

5. Basket for Minor Category Courses - COMPUTER SCIENCE

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Programming in 'C'	BCS1T01	BCS1P01
	Minor 2	Computer Fundamentals	BCS1T02	BCS1P02
IV	Minor 3	Object Oriented Programming using 'C ++'	BCS2T03	BCS2P03
	Minor 4	Operating Systems	BCS2T04	BCS2P04
V	Minor 5	Data Structures	BCS3T05	BCS3P05
	Minor 6	Linux Operating System	BCS3T06	BCS3P06
VI	Minor 7	Java Programming	BCS4T07	BCS4P07

6. Basket for Minor Category Courses - COMPUTER APPLICATION

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Programming in 'C'	BCA1T01	BCA1P01
	Minor 2	Computer Fundamentals	BCA1T02	BCA1P02
IV	Minor 3	Object Oriented Programming using 'C ++'	BCA2T03	BCA2P03
	Minor 4	Operating Systems and Linux	BCA2T04	BCA2P04
V	Minor 5	Data Structures	BCA3T05	BCA3P05
	Minor 6	Java Programming	BCA3T06	BCA3P06
VI	Minor 7	Advanced Java Programming	BCA4T07	BCA4P07

7. Basket for Minor Category Courses - DATA SCIENCE

Semester	Course Category	Name of Course	Course Code	
			Theory	**Practical**
III	**Minor 1**	Linear Algebra	BDS1T01	BDS1P01
	Minor 2	Programming with 'C++'	BDS1T02	BDS1P02
IV	**Minor 3**	Data Structure	BDS2T03	BDS2P03
	Minor 4	Probability and Statistics	BDS2T04	BDS2P04
V	**Minor 5**	JAVA Programming	BDS3T05	BDS3P05
	Minor 6	Digital Electronics and Microprocessor	BDS3T06	BDS3P06
VI	**Minor 7**	Operating System and Linux	BDS4T07	BDS4P07

8. Basket for Minor Category Courses – ELECTRONICS

Semester	Course Category	Name of Course	Course Code	
			Theory	**Practical**
III	**Minor 1**	Analog Electronic Circuits	BEN3T05	BEN3P05
	Minor 2	Micro-controller 8051 Family	BEN3T06	BEN3P06
IV	**Minor 3**	Linear Integrated Circuits	BEN4T07	BEN4P07
	Minor 4	Signals and Systems	BEN4T08	BEN4P08
V	**Minor 5**	Instrumentation system	BEN5T09	BEN5P09
	Minor 6	Communication System	BEN5T10	BEN5P10
VI	**Minor 7**	Industrial Instrumentation	BEN6T14	BEN6P14

9. Basket for Minor Category Courses - ENVIRONMENTAL SCIENCE

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Fundamentals of Environmental Science	BES1T01	BES1P01
	Minor 2	Environmental Biology	BES1T02	BES1P02
IV	Minor 3	Basics of Environmental Pollution	BES2T03	BES2P03
	Minor 4	Forest, Wildlife and Biodiversity and it's Conservation	BES2T04	BES2P04
V	Minor 5	Atmospheric Science, Meteorology and Climatology	BES3T05	BES3P05
	Minor 6	Natural Resources and Management	BES3T06	BES3P06
VI	Minor 7	Solid and Hazardous Waste management	BES4T07	BES4P07

10. Basket for Minor Category Courses - FORENSIC SCIENCE

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Forensic Science-I	BFS1T01	BFS1P01
	Minor 2	Digital & Cyber Forensic	BFS1T02	BFS1P02
IV	Minor 3	Forensic Chemistry	BFS2T03	BFS2P03
	Minor 4	Forensic Physics	BFS2T04	BFS2P04
V	Minor 5	Forensic Psychology	BFS3T05	BFS3P05
	Minor 6	Forensic Biology	BFS3T06	BFS3P06
VI	Minor 7	Forensic Science-II	BFS4T07	BFS4P07

11. Basket for Minor Category Courses - GEOLOGY

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Introduction to Geology	BGE1T01	BGE1P01
	Minor 2	Mineralogy	BGE1T02	BGE1P02
IV	Minor 3	Physical Geology and General Geology	BGE2T03	BGE2P03
	Minor 4	Optical Mineralogy and Crystallography	BGE2T04	BGE2P04
V	Minor 5	Igneous Petrology	BGE3T05	BGE3P05
	Minor 6	Sedimentary Petrology	BGE3T06	BGE3P06
VI	Minor 7	Metamorphic Petrology	BGE4T07	BGE4P07

12. Basket for Minor Category Courses - HOME SCIENCE

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Early Childhood Education	BHS1T01	BHS1P01
	Minor 2	Fabric Design	BHS1T02	BHS1P02
IV	Minor 3	Colour Scheme	BHS2T03	BHS2P03
	Minor 4	Community Nutrition	BHS2T04	BHS2P04
V	Minor 5	Public Health/ Nutritional Biochemistry	BHS3T05	BHS3P05
	Minor 6	Marriage and Family Relations	BHS3T06	BHS3P06
VI	Minor 7	Public Health/ Nutritional Biochemistry	BHS4T07	BHS4P07

13. Basket for Minor Category Courses - INFORMATION TECHNOLOGY

Semester	Course Category	Name of Course	Course Code	
			Theory	**Practical**
III	**Minor 1**	Programming in C	BIT1T01	BIT1P01
	Minor 2	IT Support Technologies	BIT1T02	BIT1P02
IV	**Minor 3**	Object Oriented Programming using C++	BIT2T03	BIT2P03
	Minor 4	Operating System and Linux	BIT2T04	BIT2P04
V	**Minor 5**	Data Structure	BIT3T05	BIT3P05
	Minor 6	Java Programming	BIT3T06	BIT3P06
VI	**Minor 7**	Advanced Java Programming	BIT4T07	BIT4P07

14. Basket for Minor Category Courses – MATHEMATICS

Semester	Course Category	Name of Course	Course Code	
			Theory	**Practical**
III	**Minor 1**	Algebra and Trigonometry	BMT1T01	BMT1P01
	Minor 2	Differential Calculus	BMT1T02	BMT1P02
IV	**Minor 3**	Integral Calculus and Ordinary Differential Equations	BMT2T03	BMT2P03
	Minor 4	Vector Analysis	BMT2T04	BMT2P04
V	**Minor 5**	Partial Differential Equations	BMT3T05	BMT3P05
	Minor 6	Analytical Solid Geometry	BMT3T06	BMT3P06
VI	**Minor 7**	Mathematical Methods	BMT4T07	BMT4P07

15. Basket for Minor Category Courses - MICROBIOLOGY

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Fundamentals of Microbiology	BMI1T01	BMI1P01
	Minor 2	Basic Techniques in Microbiology	BMI1T02	BMI1P02
IV	Minor 3	Microbial Diversity	BMI2T03	BMI2P03
	Minor 4	Chemistry of Biomolecules	BMI2T04	BMI2P04
V	Minor 5	Metabolism	BMI3T05	BMI3P05
	Minor 6	Environmental Microbiology	BMI3T06	BMI3P06
VI	Minor 7	Dairy Microbiology	BMI4T07	BMI4P07

16. Basket for Minor Category Courses - PHYSICS

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Measurement, Mechanics, and Properties of Matter	BPH1T01	BPH1P01
	Minor 2	Kinetic Theory of Gases and Thermodynamics	BPH1T02	BPH1P02
IV	Minor 3	Acoustics and Ultrasonics	BPH2T03	BPH2P03
	Minor 4	Oscillations and Blackbody radiations	BPH2T04	BPH2P04
V	Minor 5	Solid State Physics	BPH3T05	BPH3P05
	Minor 6	Optics	BPH3T06	BPH3P06
VI	Minor 7	Lasers and Optical Fibres	BPH4T07	BPH4P07

17. Basket for Minor Category Courses - STATISTICS

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Probability Theory	BST3T01	BST3P01
	Minor 2	Descriptive Statistics	BST3T02	BST3P02
IV	Minor 3	Probability distributions	BST4T03	BST4P03
	Minor 4	Economic Statistics	BST4T04	BST4P04
V	Minor 5	Statistical Methods	BST5T05	BST5P05
	Minor 6	Applied Statistics	BST5T06	BST5P06
VI	Minor 7	Statistical Inference	BST6T07	BST6P07

18. Basket for Minor Category Courses - ZOOLOGY

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Life and Diversity of Animals- Nonchordates (Protozoa to Annelida)	BZO1T01	BZO1P01
	Minor 2	Cell Biology and Genetics	BZO1T02	BZO1P02
IV	Minor 3	Life and Diversity of Animals- Nonchordates (Arthropoda to Hemichordata)	BZO2T03	BZO2P03
	Minor 4	Developmental Biology	BZO2T04	BZO2P04
V	Minor 5	Chordata	BZO3T05	BZO3P05
	Minor 6	General Mammalian Physiology	BZO3T06	BZO3P06
VI	Minor 7	Applied Zoology	BZO4T07	BZO4P07

19. Basket for Minor Category Courses– APPLIED ELECTRONICS & SOFTWARE TECHNOLOGY

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
I	Minor 1	Applied Physics	BET1T03	BET1P03
	Minor 2	Applied Chemistry	BET1T04	BET1P04
II	Minor 3	Applied Physics	BET2T03	BET2P03
	Minor 4	Applied Chemistry	BET2T04	BET2P04
III	Minor 5	Electron Devices & Circuits	BET3T03	BET3P03
	Minor 6	Linear Network Analysis	BET3T04	BET3P04

20. Basket for Minor Category Courses - COSMETIC TECHNOLOGY

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Cosmetic Engineering	BCT3T03	BCT3P03
	Minor 2	Instrumental Methods of Analysis	BCT3T04	BCT3P04
IV	Minor 3	Cosmetic Engineering	BCT4T03	BCT4P03
	Minor 4	Instrumental Methods of Analysis	BCT4T04	BCT4P04
V	Minor 5	Cosmetic Engineering	BCT5T04	BCT5P04
	Minor 6	Instrumental Methods of Analysis	BCT5T05	BCT5P05
VI	Minor 7	Drug & Cosmetic Laws	BCT6T05	BCT6P05

21. Basket for Minor Category Courses - INTERIOR DESIGN

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Furniture Design I	BHD3T03	BHD3P03
	Minor 2	GRAPHICS III	BHD3T04	BHD3P04
IV	Minor 3	Furniture Design II	BHD4T03	BHD4P03
	Minor 4	GRAPHICS IV	BHD4T04	BHD4P04
V	Minor 5	Furniture Design III	BHD5T05	BHD5P05
	Minor 6	INTERIOR SERVICES I	BHD5T06	BHD5P06
VI	Minor 7	Furniture Design IV	BHD6T05	BHD6P05

22. Basket for Minor category courses – FASHION DESIGN

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Study of Indian Costumes		
	Minor 2	Draping Techniques-I		
IV	Minor 3	Study of Western Costumes		
	Minor 4	Draping Techniques-II		
V	Minor 5	Marketing		
	Minor 6	Entrepreneurship Development		
VI	Minor 7	Merchandising		

23. Basket for Minor category courses – TEXTILE SCIENCE

Semester	Course Category	Name of Course	Course Code	
			Theory	Practical
III	Minor 1	Fundamentals of Knitting-I		
	Minor 2	Dyeing Technology-I		
IV	Minor 3	Fundamentals of Knitting-II		
	Minor 4	Dyeing Technology-II		
V	Minor 5	Marketing		
	Minor 6	Entrepreneurship Development		
VI	Minor 7	Merchandising		

Annexure – IV
Basket of Open Electives (OE)

GE/OE Basket Semester I
Faculty of Science and Technology

Semester	Course Category		Name of Course	BoS	Course code
I	**GE/OE**	1	Bio fertilisers, bio-pesticides and compositing	Botany	**BGO1 T01**
		2	Food Biochemistry	Biochemistry	
		3	Biotechnology and Human Welfare	Biotechnology	
		4	Computer fundamentals	Computer Science	
		5	Basic Electronics Components & Instruments	Electronics	
		6	Environmental Conservation Movements	Environmental Science	
		7	A. Introduction to Sports Forensics / B. Toxicology in Everyday Life / C. Optics and Optical Instruments / D. General Instruments in Forensic Biology / E. Psychology of Health & Well Being-I (Psychology)/ F. Computer Fundamentals/ G. Crime and Criminal Behaviour (Law)	Forensic Science	
		8	Topographic Map Reading	Geology	
		9	Basic Physics and Basic Computer -I	Home Science	
		10	Quantitative aptitude	Mathematics	
		11	Introduction and scope of Microbiology	Microbiology	
		12	Space Science	Physics	
		13	Elementary Descriptive Statistics	Statistics	
		14	Human anatomy and physiology	Zoology	
			Indian birds	Zoology	
		15	Physical Chemistry	Cosmetic Technology	
		16	Computer Basics	Fashion Design	
		17	Computer Basics	Textile Science	

B. Sc. Semester-I
GE / OE-1 Botany (BGO1T01)
Bio-fertilizers, Bio-pesticides and Composting

GE/OE-I Theory	Hours: 2 Hours/Week	Marks: 80+20=100	Credit: 2

Unit-I	
1. **Biofertilizers:** Definition, scope and importance 2. Classification of Biofertilizers on basis of organisms 3. Biological Nitrogen Fixation 4. Plant Growth Promoting Rhizobacteria (PGPR)	7.5 Hrs.
Unit-II	
1. **Microbes:** Various microbes used as Biofertilizers *2.* Commercial production of Biofertilizers: *Rhizobium*, *Azotobactor*, *Nostoc* and, *Azolla* *3.* Phosphate Solubilizer Bacteria (PSB), e.g. *Bacillus polymyxa* *4.* Phosphate Solubilizer Fungi (PSF), e.g. *Aspergillus awamori*	7.5 Hrs.
Unit-III	
1. **Biopesticides:** History and concept, Definitions, scope and importance 2. Classification of Biopesticides 3. Role of Biopesticides in Ecofriendly agriculture and Organic farming. 4. Production of Biopesticides (Microorganism and Plant based) 5. Methods of applications of Biopesticides	7.5 Hrs.
Unit-IV	
1. **Composting:** Definition, scope and importance 2. Science of composting, Classification of composting 3. Methods for composting: Indore method; 4. Methods to improve process of Composting. 5. Vermicomposting 6. Agricultural waste composting 7. Uses of Weed in composting	7.5 Hrs.

Suggested Readings:

1. Maheshwari D.K. (2012) Bacteria in Agrobiology: Plant Probiotics; Springer Berlin, Heidelberg, New York.
2. Rai M.K. (2006) Handbook of Microbial Biofertilizers; Food Product Press, An Inprint of the Haworth Press, Inc. New York.
3. Reddy Shankara, R. (2012) Biofertilizer Technology; Akhand Publishing House Sadatpur, Dehli.

4. Sharma A.K. (2007) Biofertilizers for Sustainable Agriculture; Agrobios, Jodhpur.
5. Siddiqui, Zaki & Anwar (2012) PGPR: Biocontrol and Biofertilization; Springer Heidelberg,New York.
6. Tivedi P.C. (2008) Biofertilizer; Pointer Publishers Jaipur
7. Leo, M.L. Nollet, Hamirsingh Rathore (2015). Bio Pesticide Handbook. CRC Press Tayler &Francis group, New York. 1-29.
8. Md. Arshad Anwer (2017). Bio Pesticides and Bio Agents e book CRC Press Taylor & Francisgroup New York. 1-365.
9. Dwijendra Singh. (2014), Advances in Plant Bio Pesticides. Publisher Springer 1-401.
10. Vaishali Kandpal 2014. Bio Pesticides. International Journal of Environmental Research and Development. 4(2), 191-196.
11. Jamie Mc Sweeney (2019), Community Scale Composting systems: A Comprehensive Practical Guide for closing the Food system Loop solving our waste crisis Chelsea Green Publishing, USA.
12. Grace Gershuny (1992), The Rodale Book of Composting, Rodale Press, Penssylvania.
13. Michelle Balz and Anna Stockton (2017), Composting for a New Generation: Latest Techniques for the Bin and Beyond, Cool Springs Press.

GE/OE Basket (Biochemistry) Semester-I

FOOD BIOCHEMISTRY

Course Objectives:The specific objectives of the course are:

- This course will help you to enrich your knowledge on how energy generates from foods, namely carbohydrate, proteins and fat molecules, in human body
- How molecules breakdown or rebuild in your body, what other molecules (like, enzymes, minerals, vitamins) needed for the utilization of these molecules.
- You will also be able to get a detail picture of formation DNA, RNA and hormones and their functions in living organisms.
- You will be able to describe methods for food processing and underlying safety aspects.

PREREQUISITES : *Basic Training in Chemical and Biological Concepts at the level of Higher Secondary.*

Unit 1

Biochemical Changes in Carbohydrates in Food Systems, Changes in Carbohydrates during Seed Germination, Basics of Metabolism of Carbohydrates; Biochemical Changes of Proteins and Amino Acids in Foods, Proteolysis in Animal Tissues, Proteolysis in Geminating Seeds;

Unit 2

Biochemical Changes of Lipids in Foods, Changes in Lipids in Food Systems, Changes in Lipids during Cheese Fermentation, Lipid Degradation in Seed Germination, Biochemical Degradation and Biosynthesis of Plant Pigments, Degradation of Chlorophyll in Fruit Maturation

Unit 3

Foundations of Food Processing: Transglutaminase Activity in Seafood Processing, Proteolysis during Cheese Fermentation ,Removal of Glucose in Egg Powder Production, Production of Starch Sugars and Syrups; Proteases in Chill-Haze Reduction in Beer Production; Biogeneration of Fresh-Fish Odor, Biochemically Induced Food Flavors

Unit 4

Selected Biochemical Changes Important in the Handling and Processing of Foods, Production of Ammonia and Formaldehyde from Trimethylamine and Its N-Oxide, Production of Biogenic Amines, Production of Ammonia from Urea, Adenosine Triphosphate Degradation, Polyphenol Oxidase Browning, Ethylene Production in Fruit Ripening, Reduction of Phytate in Cereals.

Text Books and References:

1. Ashie IA, Lanier TC. 2000. Transglutaminases in seafood processing. In: NF Haard, BK Simpson, editors, Seafood Enzymes. New York: Marcel Dekker, Inc. Pp. 147–166.
2. Berger M. 1994. Flour aging. In: B Godon, C Willm, editors. Primary Cereal Processing. New York: VCH Publishers, Inc. Pp. 439–452.
3. Bewley JD. 1997. Seed germination and dormancy. Plant Cell 9:1055–1066.
4. Bewley JD, Black M. 1994. Physiology of Development and Germination, 2nd ed. New York: Plenum Press. Pp. 293–344.
5. Bryce JH, Hill SA. 1999. Energy production and plant cells. In: PJ Lea, RC Leegood, editors, Plant Biochemistry and Molecular Biology Chichester: John Wiley and Sons. Pp. 1–28.
6. Cadwallader KR. 2000. Enzymes and flavor biogenesis. In: NF Haard, BK Simpson, editors, Seafood Enzymes. New York: Marcel Dekker, Inc. Pp. 365–383.
7. Chin HW, Lindsay RC. 1994. Modulation of volatile surfur compounds in cruciferous vegtebles. In: CJ Mussinan, ME Keelan, editors, Sulfur Compounds in Foods. Washington, DC: American Chemical Society. Pp. 90–104.
8. Croteau R, Kutchan TM, Lewis NG. 2000. Natural products (secondary metabolites). In: BB Buchenan, W Grussem, RL Jones, editors, Biochemistry and Molecular Biology of Plants. Rockwell, Maryland: American Society of Plant Physiologists. Pp. 1250–1318.
9. Gill T. 2000. Nucleotide-degrading enzymes. In: NF Haard, BK Simpson, editors, Seafood Enzymes. New York: Marcel Dekker, Inc. Pp. 37–68.
10. Gopakumar K. 2000. Enzymes and enzyme products as quality indices. In: NF Haard, BK Simpson, editors, Seafood Enzymes. New York: Marcel Dekker, Inc. Pp. 337–363.
11. Grappin R, Rank TC, Olson NF. 1985. Primary proteolysis of cheese proteins during ripening. J. Dairy Science 68:531–540.
12. Greaser M. 2001. Postmortem muscle Chemistry. In: YH Hui, WK Nip, RW Rogers, OA Young, editors, Meat Science and Applications. New York: Marcel Dekker, Inc. Pp. 21–37.
13. Gripon JC. 1987. Mould-ripened cheeses. In: PF Fox, editor, Cheese: Chemistry, Physics and Microbiology. London: Elsevier Applied Science. Pp. 121– 149.
14. Haard CE, Flick GJ, Martin RE. 1982. Occurrence and significance of trimethylamine oxide and its derivatives in fish and shellfish. In: RE Martin, GJ Flick, CE Haard, DR Ward, editors, Chemistry and Biochemistry of Marine Food Products, Westport, Connecticut: AVI Publishing Company. Pp. 149– 304.
15. Haard NF. 1990. Biochemical reactions in fish muscle during frozen storage. In: EG Bligh, editor, Seafood Science and Technology. London: Fishing News Books (Blackwell Scientific Publications, Ltd.) Pp. 176–209.

Open Elective Courses

SEMESTER – I

BIOTECHNOLOGY FOR HUMAN WELFARE

Course Code: BGO1T01 **Total Contact Hours: 30**

Course Outcomes:
After successful completion of this Course, students will be able to:
CO 1. Understand the biotechnological applications in the industry
CO 2. Appreciate application of biotechnology in environmental management
CO 3. Describe application of biotechnology to forensic science
CO 4. Comprehend contributions of biotechnology to biomedical fields, such as diagnostics, genomics and therapeutics
CO 5. Understand the biotechnological applications in the agriculture and livestock management

Unit I **8 hrs**
Environment: Application of biotechnology in environmental aspects: Degradation of organic pollutants – chlorinated and non-chlorinated compounds; degradation of hydrocarbons and agricultural wastes; Biodegradable plastics & Biofuels- production and its futuristic applications; Bioremediation, Biomining

Unit II **7 hrs**
Industry: Important enzymes used in Industries, Biotechnological intervention in enzyme engineering; Industrial production of alcoholic beverages (wine), antibiotics (Penicillin), enzymes (lipase), food supplements (Single Cell Protein), Vitamin (B12). Food processing- Production of cheese and yoghurt

Unit III **8 hrs**
Forensic science: Application of biotechnology in forensic science: Solving crimes of murder and rape; solving claims of paternity and theft by using DNA finger printing techniques

Health: Application of biotechnology in health: Genetically engineered insulin, recombinant vaccines, gene therapy, molecular diagnostics using ELISA, PCR; monoclonal antibodies and their use in cancer; human genome project.

Unit IV **7 hrs**
Agriculture: N_2 fixation: transfer of pest resistance genes to plants; interaction between plants and microbes; biofertilizers & biopesticides.

Livestock: Transgenic animals, animal vaccine production, increased milk production, artificial insemination- poultry, fisheries

References:

• Bhasin M.K. and Nath, S. (2002). Role of Forensic Science in the New Millennium, University of Delhi, Delhi

• Crueger W. and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd Ed., Panima Publishing Co. New Delhi.

• Eckert W.G. (1997) Introduction to Forensic Sciences, 2nd Ed., CRC Press, Boca Raton

• James S.H. and Nordby, J.J. (2005). Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton

• Mohapatra, P.K. (2006) Textbook of Environmental Biotechnology, I.K. International Publishing House Pvt. Ltd., New Delhi

• Patel A.H. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited.

• Stanbury P.F, Whitaker A and Hall S.J. (2006). Principles of Fermentation Technology. 2nd Ed., Elsevier Science Ltd.

• Nanda B.B. and Tiwari R.K. (2001). Forensic Science in India: A Vision for the Twenty First Century, Select Publishers, New Delhi

• Joerdening H.-J. and Winter J. (2005). Environmental Biotechnology – Concepts and Applications

B.Sc. Sem-I (Computer Science)
BGO1T01
COMPUTER FUNDAMENTALS

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1.To understand the basic digital components of computer.
2.To understand the working of peripheral devices.
3.To understand the number systems and logical gates.
4.To understand the network topologies.

Course Outcomes :

After completing this course satisfactorily, a student will be able to:

1.Confidently operate computers to carry out computational tasks
2.Understand working of Hardware and Software and the importance of operating systems
3.Understand number systems, peripheral devices, networking, multimedia and internet concepts

UNIT I

Basic Components of Digital Computers: Block Diagram**.**
CPU: Functions of Each Unit: Primary Memory, ALU and CU: Fetch and Execution cycle, Execution of Instructions in Single Address CPU.
Memory: RAM, ROM, PROM, EPROM, EEPROM and Cache. CISC and RISC Technology
Bus: Data, Control and Address Bus, Bus Organization.
Language Evolution: Generation of Languages: Machine, Assembly, High Level Languages. Characteristics of Good Language
Translators: Compiler, Interpreter and Assembler. Source and Object Program.

UNIT II

Storage Devices: Hard Disk and Optical Disk. Pen Drive, SD Card, Cloud as storage.
Input Devices: Keyboard, Mouse, Light Pen, Touch Screen, Voice Input, MICR, OCR, OMR, Barcode Reader and Flatbed Scanner. **Output Devices**: VDU, Printers: Dot Matrix, Laser and Inkjet. Plotters: Drum, Flat-Bed and Inkjet.

UNIT III

Number Systems: Binary, Octal, Decimal, Hexa-Decimal, Their Conversions, Binary Arithmetic. ASCII, BCD, EBCDIC**.**
Logic Gates: Truth table, properties and symbolic representation of NOT, AND, OR, NOR, NAND, EXOR, EXNOR gates. NOR and NAND gates as a universal gates.
Binary Arithmetic: Binary addition, binary subtraction using 1's and 2's compliment.

UNIT IV

Network: Network terminology, Topologies: Linear, Circular, Tree and Mesh. Types of Networks: LAN, WAN, MAN.Networking Devices: Repeaters, Bridges, Routers and Gateway. Modem for Communication between pc's, wi-fi network, Introduction of Bluetooth and Infrared devices. Network Architecture: Peer-to-Peer, Client/Server

Internet Protocols: TCP/IP, FTP, HTTP, HTTPS, Internet Addressing: IP Address, Domain Name, URL.

Books

1. Information Technology Concepts by Dr. Madhulika Jain, Shashank & Satish Jain, [BPB Publication, New Delhi.]
2. Fundamentals of Information Technology By Alexis And Mathews Leon [Leon Press, Chennai &Vikas Publishing House Pvt. Ltd, New Delhi]
3. Fundamental of Micropocessor by B Ram

Electronics BoS : Semester – 1: OE1:

Basic Electronic Components and Instruments (BGO1T01)

Course outcome:

At the end of this course students will have ability to

1. Identify various electronic components understand their role
2. Make series and parallel combinations of components.
3. Understand working & replacement

Syllabus

1. Electrical Signal and parameters Current Voltage Wattage AC DC Components Identification: Resistor, Capacitor, Inductor, Transformer, Switches, Semiconductors
2. Serial and parallel connection of Resistor, capacitor, inductor, Lead & Lag Concepts.
3. Study of Voltmeter & Ammeter, concept of Range, Resolution, Impedance, Loading effect, Multi-meter.
4. Visualization of electrical signal, Introduction to Oscilloscope, Application in general

Books:

1. Charles Platt, Make: Electronics, O'Reilly Publications
2. Paul Scherz, Practical Electronics for Invertors, McGraw-Hills Publications
3. J. M. Hughes, Practical Electronics, O'Reilly Publications
4. B. L. Theraja, Basic Electronics (Solid State): S. Chand & Company

GE/OE-1: Environmental Conservation Movements (BGO1T01)

Unit-I: Civilization and Environmental Pollution:

Environment: Definition, role of environment in shaping civilizations. Inter-relation between civilization and environment- Ecological economic and socio-cultural.

Industrialization revolution and environmental pollution, Globalization and environmental pollution, Modern agriculture and environmental degradation.

Unit-II: Development and Environment:

Development: Definition, population growth and its impact on natural resources, modernization and population, causes for industrialization, impact of industrialization on quality of human life, negative impact of industrialization and urbanization.

Environmental Management: Definition, objectives, components, principle and importance of Environmental management; **Development and Environment:** Types of development, sustainable development- need and relevance in contemporary society.

Unit-III: Sustainable Development:

Sustainable Development: Definition, concept, principle and planning for sustainable development, Environmental issues and crises, Preventive Environmental Policy (PEP), desertification, invasive species, wildlife depletion and social insecurity.

United Nation Sustainable Development Goals, Strategies for implementing eco-development programmes, sustainable development through- trade, economic growth, carrying capacity and public participation.

Unit-IV: Environmental Movements:

Environmental Movements: Concept of environmental movements, the local grassroots movement level, United Nations Conference on Environment,1972-'Limits to Growth'. The Brundtland Commission, 1987-'Our Common Future'. The United Nations Conference on Environment and Development, 1972.

Environmental Movements in India: Bishnoi Movements, The Chipko Movements, Appiko Movements, Silent Valley Movements, Narmada Bachao Andolan, Beej Bachao Andolan and Tehri Dam Conflicts,

References:

1. Bindra, P.S.(2017). The Vanishing: India's Wildlife Crisis. Penguin Random HouseIndia.
2. Climate Change: Science and Politics.(2021). Centre Science and Environment, New Delhi.
3. Edwards, Andres R. (2005). The Sustainability Revolution: Portrait of a Paradigm Shift. New Society Publishers.
4. Flanders, L. (1997). The United Nations Department for Policy Co-ordination and Sustainable Development (DPCSD), Global Environmental Change, 7 (4), 391-394.
5. McNeill, John R. (2000). Something New Under the Sun: An Environmental History of the Twentieth Century.
6. Nagendra, H., and Mundoli, S. (2009). Cities and canopies: Trees in Indian cities,Penguin Random House India Private Limited.
7. Nepal, Padam. (2009). Environmental Movements in India: Politics of Dynamism and Transformation, Author Press, Delhi.
8. Rachel Carson. (2002). Silent Spring. Houghton Mifflin Harcourt.
9. Rajit Sengupta and Kiran Pandey. (2021). State of India's Environment 2021: In Figures. Centres Science and Environment.
10. Sustainable Development in India: Stocktaking in the run up to Rio + 20. (2011) TERI for MoEF and CC.

Semester I

GE/OE (Forensic Science)

GE 1 (BGO1T01): Introduction to Sports Forensics

Learning Outcomes: By the end of this Course, the learners will be able to:

1. Recall and identify the concept of sports forensic, sports doping its history n prevalence along with its forensic investigation.
2. Evaluate and analyze different anti-doping organizations and the acts related to it, and also understand the concept of e-doping and e-sporting.
3. Understand the concepts of doping of drugs in sports their classification and effects on human body.
4. Apply the knowledge of analytical chemistry to use preliminary and confirmatory analytical techniques for drug testing in sport.
5. By the end of the course students will have knowledge and understanding about detection of drugs of abuse in sports and its role in forensic science.

Unit-I Basics of Sports Forensics

Introduction to Sports Forensics, History and Prevalence, Sports doping, why do athletes' resort to doping, investigation of deaths in sports, Forensic investigation in sport malpractices, case studies related to sports forensics.

Unit II Legal Provisions for Drugs Abuse in Sports

Anti-doping organization; World Anti-Doping Organizations (WADA) and NADA. National Anti-Doping Act 2022. Concept of e-sports and e-doping. Understanding E-doping and need for fair competition in E-Sports.

Unit-III Drug doping in sports

Drug doping in sports, Classification of prohibited substances in sports: Stimulants, Amphetamines, Cocaine, Sympathomimetic Amines, Narcotic Analgesic, Anabolic steroids. Notable abused drugs in sports-performance enhancing drugs; effects of drugs on the human body;

Unit IV Analytical techniques for drug testing

Use of preliminary and confirmatory analytical techniques for drug testing in sports: Gas Chromatography- Mass Spectrometry, Liquid Chromatography- Mass Spectrometry, HPLC- UV Immuno- Assays. Detection of drugs of abuse: Steroids, Narcotics, Stimulants, Masking agents, contaminants of other dietary supplements and other substances on WADA prohibited list. Detection of doping in sports and role of forensic science.

Semester I

GE/OE (Forensic Chemistry)

GE 1 (BGO1T01): Toxicology in Everyday Life

Course Outcomes: By the end of this Course, the learners will be able to:

1. Recall and identify the key terms and concepts related to poisons, fatal dose and fatal period, classification of poison, types of poisoning, mode of action, sources of poison, signs and symptoms of poison along with their antidotes.
2. Understand the classification of cometic products and certain poisonous substances present in them along with their side effects and precautions.
3. Analyze some common poisonous agents present in household cleaning agents along with their classification, side effects and precautions.
4. Evaluate the effects of some commonly used insecticides and pesticides along with their precautions.

Unit I: Introduction to Toxicology

Introduction, definition of poison, classification of poisons, modes of action of poisons, types of poisoning, fatal dose and fatal period, signs and symptoms of common poisoning and their antidotes. Sources of poisons in everyday life.

Unit II: Cosmetic Products

Introduction, Classification, common poisonous substances found in cosmetics products like – lipsticks, fairness creams, facewash, lotions, nail paints, hair colours and hair care products, talcum powders, deodorants, etc. their side effects and precautions related to use of cosmetics.

Unit III: Household Cleaning Agents

Introduction, Classification, common poisonous substances found in household cleaning agents like – Floor cleaners, toilet and bathroom cleaners, electronic gadgets cleaners, sanitizers, soaps, detergents, etc. their side effects and precautions related to use of cleaning agents.

Unit IV: Pesticides and Insecticides

Introduction, classification, commonly used pesticides and insecticides in house like – mosquito and cockroach repellents, rat kills, termiticides, fungicides, herbicides, agrochemicals, safety measure and precautions related to use of Pesticides and Insecticides.

Semester I

GE/OE (Forensic Physics)

GE 1 (BGO1T01): Optics and Optical Instruments

Course Outcomes: By the end of this Course, the learners will be able to:

1. Understand the introduction of lenses, equations of lenses, and formulae of optical systems.
2. Understand the types and their reduction of chromatic and achromatic aberration.
3. Analyze the working principles of microscope telescope eyepiece spectrometer interferometer.
4. Remember the working concept of optical and advanced microscope.

Unit I: Geometric Optics

Introduction, Thin and Thick Lenses, Lens Equation, Lens Maker's Formula, Cardinal Points of an Optical System, Combination of Two Thin Lenses (Equivalent Lenses) (Including Derivation for Focal Length and Cardinal Points).

Unit II: Aberrations

Achromatic and Chromatic Aberration, Types of Achromatic Aberration and their Reduction: Spherical Aberration, Coma, Astigmatism, Curvature of Field, Distortion, Types of Chromatic Aberration: Achromatism (Lenses in Contact and Separated by Finite Distance).

Unit III: Optical Instruments

Simple Microscope and Compound Microscope, Telescopes, Reflection and Transmission Type of Telescope, Eyepieces: Huygens's Eyepiece, Ramsden's Eyepiece, Gauss's Eyepiece, Constant Deviation Spectrometer, Michelson Interferometer, Resolving Power and Magnifying Power of Microscope and Telescope.

Unit IV: Microscopes

Optical Microscopes: Stereomicroscope, Polarizing Microscope, Phase Contrast Microscope and Comparison Microscope.

Advanced Microscopes: Scanning Electron Microscopes (SEM), Transmission Electron Microscope (TEM), X-Ray Diffraction (XRD), X-Ray Fluorescence (XRF).

Semester I

GE/OE (Forensic Biology)

GE 1 (BGO1T01): General Instrumentation in Forensic Biology

Course Outcome: By the end of this Course, the learners will be able to:

1. Analyze the function of pH and buffer along with its mechanism and action relevant to forensic science.
2. Understand and examine the titration curve of weak acids and amino acids.
3. To gain hands-on experience in various laboratory techniques and immunoassay methods.
4. Understand the principles, working mechanism and forensic application of certain techniques and assay related to forensic biology.

Unit-I : pH and Buffer

pH and Buffer- Biochemical buffers, measurement of pH; Mechanism of buffer action; Henderson-Hasselbalch equation; Isoelectric pH, Titration curve of weak acids; Titration curve of amino acids.

Unit-II: Spectroscopy

Spectroscopy- Principle of spectroscopy, Concepts of electromagnetic radiation, Concept of chromophores; Beer- Lambert's law and deviations, Extinction coefficient; Principle and working of Spectrophotometer (UV-Visible); Applications of spectrophotometry in forensic biology.

Unit-III: Chromatography

Chromatography- Types of chromatography, Principle and working of Planar chromatography (Paper and Thin layer); Column chromatography (Preparation of column, Sample loading, Elution, and Detection); Ion exchange chromatography (Principle, working and applications); Applications of chromatography in forensic biology.

Unit-IV: Electrophoresis

Electrophoresis- Theory of electrophoresis, Methods of electrophoresis; Principle, working and applications of (Agarose gel electrophoresis, Polyacrylamide gel electrophoresis, Immunoelectrophoretic) with reference to forensic biology.

B.Sc. Sem-I (Forensic Science - Major)

Semester I

GE/OE (Psychology)

GE 1 (BGO1T01): Psychology of Health and Wellbeing-I

Course Outcomes: By the end of this Course, the learners will be able to:

1. Understand the spectrum of health and illness for better health management
2. Identify stresses in one's life and how to manage them
3. Understand a variety of health announcing health protective and health compromising behaviour and to be able to know their application in illness management

Unit I: Illness, Health, and Wellbeing

Illness, Health and Wellbeing, Health continuum; models of health and illness: Medical, Bio psychosocial; Holistic Health.

Unit II: Stress and Coping:

Nature and Sources of Stress; Personal and Social Mediators of Stress; Effects of Stress on Physical and Mental Health; Coping and Stress management.

Unit III: Health Management

Health enhancing behaviours: Exercise, Nutrition, Meditation, Yoga; Health compromising behaviours (alcoholism, smoking, internet addiction); Health Protective behaviours, Illness Management.

Unit IV: Promoting Human Strengths and Life Enhancing virtues

Strength: Meaning; Realizing strength; Maximizing Unrealized Strength. Weakness – meaning, measures towards identifying & overcoming weaknesses. Strategies for improving hope and optimism.

Semester I

GE/OE (Digital and Cyber Forensics)
GE 1 (BGO1T01): Computer Fundamentals

Course Outcomes: By the end of this Course, the learners will be able to:

1. Understand the meaning of basic components of digital computers and remembering the different types of storage devices, translators etc used in digital computers.
2. Understand how data is stored and retrieved from different types of storage media.
3. Understand the conversion process between different number systems (e.g., binary to decimal, decimal to hexadecimal, etc.).
4. Remember the basic properties of each number system, including their base values and corresponding digit symbols and the logical operations performed by basic logic gates.
5. Apply knowledge of networking protocols to analyze network traffic and identify potential security threats or anomalies.

Unit I: Basic Components of Digital Computers

Basic Components of Digital Computers: Block Diagram. CPU: Functions of Each Unit: Primary Memory, ALU and CU: Fetch and Execution cycle, Execution of Instructions in Single Address CPU. Memory: RAM, ROM, PROM, EPROM, EEPROM and Cache. CISC and RISC Technology. Bus: Data, Control and Address Bus, Bus Organization. Language Evolution: Generation of Languages: Machine, Assembly, High Level Languages. Characteristics of Good Language. Translators: Compiler, Interpreter and Assembler, Source and Object Program.

Unit II: Storage, Input and Output Devices

Storage Devices: Hard Disk, Optical Disk, Pen Drive, SD Card, and Cloud as storage. Input Devices: Keyboard, Mouse, Light Pen, Touch Screen, Voice Input, MICR, OCR, OMR, Barcode Reader and Flatbed Scanner. Output Devices: VDU, Printers: Dot Matrix, Laser and Inkjet, Plotters: Drum, Flat-Bed and Inkjet.

Unit III: Number Systems, Logic Gates and Binary Arithmetic

Number Systems: Binary, Octal, Decimal, Hexadecimal, Their Conversions, Binary Arithmetic. ASCII, BCD, EBCDIC. Logic Gates: Truth table, properties and symbolic representation of NOT, AND, OR, NOR, NAND, EXOR, EXNOR gates. NOR and NAND gates as a universal gate. Binary Arithmetic: Binary addition, binary subtraction using 1's and 2's compliment.

Unit IV: Network Topology and Internet Protocols

Network: Network terminology, Topologies: Linear, Circular, Tree and Mesh. Types of Networks: LAN, WAN and MAN, Networking Devices: Repeaters, Bridges, Routers and Gateway. Modem for Communication between PC's, Wi-Fi network, Introduction of Bluetooth and Infrared devices. Network Architecture: Peer-to-Peer, Client/Server. Internet Protocols: TCP/IP, FTP, HTTP, HTTPS, and Internet Addressing: IP Address, Domain Name, URL.

B.Sc. Sem-I (Forensic Science - Major)

Semester I

GE/OE (Law)

GE 1 (BGO1T01): Crime and Criminal Behaviour

Learning Outcomes: By the end of this Course, the learners will be able to:

1. Demonstrate knowledge and understanding of the basic concepts, theories, and terminology related to crime, criminal behaviour, and the criminal justice system in India.
2. Apply their knowledge and understanding of crime and criminal behaviour to practical scenarios.
3. Develop the ability to analyze crime-related information, including crime scenes, criminal profiles, and legal documents.
4. Develop critical thinking skills to evaluate the effectiveness and fairness of the criminal justice system in India. They will assess the application of forensic techniques, legal procedures, and ethical considerations in the investigation and punishment of crimes.

Unit I: Introduction to Crime

Nature and Concept of crime, Essential elements of crime, Types of crime, Causes of crime: Social Causes of Crime, Economic Causes of Crime, Physical and Psychological causes of crime, Geographical Causes of Crime. Organized Crimes, Environmental Crimes, Crime and Politics, Economic Crimes, White Collar Crimes, Juvenile Delinquency and Female Delinquency, Terrorism, Cyber Crimes.

Unit II: Crime and Criminal Behaviour

Definition, Scope and Nature of Criminology. Interrelationship between Criminology, Penology and Criminal Law. Schools of Criminology. Pre-Classical, Classical and Neo-Classical Schools. Lombroso Theory/Positive School. Typological School. Sociological School. Psychological School.

Unit III: Crime and Punishment

Introduction and History**,** Theories of Punishment**,** Kinds of Punishment**.** Historical development from punishment to Correction and Reformation**.** Prevention and control mechanism**.** Prison system: Traditional prison, Open air prison, Pennsylvanian system etc. Prison Reforms in India**.** Correctional Administration**.** Probation and Parole.

Unit IV: Criminal Justice System in India

History and evolution of the criminal justice system. Overview of Indian Criminal Justice System. Wings of Criminal Justice System. Police: History, Structure and Functions. Accountability of Police towards Law Enforcement Agencies and Society. Role of Investigating Officer in crime investigation. Other Specialized Agencies in India: CBI, CID, RAW, ED, NCB etc. Police Reforms in India. International Investigation Agencies: FBI, INTERPOL etc. Introduction of Prison Administration.

BACHELOR OF SCIENCE (HONORS/RESEARCH)

(Geology - Major) 2023-24

SYLLABUS (GE/OE)

SEMESTER - I

Paper I: Topographic Map Reading (BGO1T01)

Unit I

History of cartography; modern cartography; introduction to toposheets and aerial photography; maps and globe; map projections - conical, cylindrical, azimuthal; general information on regional maps - (physical, political thematic) - India, Asia, Europe, Africa, North America, South Ameriaca, Oceans and Antarctica.

Unit II

Types of geological maps; toposheet numbering- national and international; quadrants in toposheets; scale of toposheet - representative fraction, written statement scale, graphical scale; topographic maps and their numbering by Survey of India; types of maps- large scale map, small scale maps; general purpose maps- physical maps

Unit III

Objectives of geological mapping - institutional interest, government mandate, academic purpose; precision required in geological mapping; base maps for geological mapping; outcrop maps and sections; geological symbols in maps; contours and landforms - conical hills, plateau, spur and valley, col and pass, gorge, cliff, knoll, convex slope, concave slope.

Unit IV

General principles of geological mapping; mapping methods in sedimentary, igneous and metamorphic terrains; maps of India - political maps, physical map, rainfall trends, wind maps, drainage maps, soil and land-use maps, mineral deposits, food – crop maps, irrigation maps, agro-climatic zone maps, road and inland maps, railway maps, population maps, natural hazard maps.

Books Recommended:

1. Macmillan Publishers India Private Limited (2021)
2. Survey of India toposheets
3. Compton, R.R. (1962) Manual of Field Geology, John Wiley and Sons, Inc.
4. Forrester, J.D. (1957) Principles of Field Geology and Mining Geology, John Wiley.
5. Lahi, F.H. (1987) Field Geology, CBS Publishers.
6. Mathur, S.M. (2001) Guide to Field Geology, Prentice-Hall, New Delhi

SEMESTER I

1. QUANTITATIVE APTITUDE

Course Outcomes: This course will enable the students to

1. Have a strong base in the fundamental mathematical concepts.
2. Grasp the approaches and strategies to solve problems with speed and accuracy
3. Gain appropriate skills to succeed in preliminary selection process for recruitment

UNITS	TOPICS	HOURS
Unit 1	Number System • H.C.F. and L.C.M. of Numbers • Decimal Fractions • Simplification • Square Roots and Cube Roots • Average • Problems on Numbers • Problems on Ages • Surds and Indices • Logarithms	**8**
Unit 2	Percentage • Profit and Loss • Ratio and Proportion • Partnership • Chain Rule • Pipes and Cisterns • Time and Work • Time and Distance • Boats and Streams • Problems on Trains • Alligation or Mixture • Simple Interest • Compound Interest	**8**
Unit 3	Area • Volume and Surface Area • Races and Games of Skill • Calendar • Clocks • Stocks and Shares • Permutations and Combinations • Heights and Distances	**7**
Unit 4	Data Interpretation • Tabulation • Bar Graphs • Pie Chart • Line Graphs	**7**
	TOTAL	**30 HRS**

Recommended Books:

1. R.S. Aggarwal, "Quantitative Aptitude for Competitive Examinations", Revised Edition, S. Chand and Co. Ltd, New Delhi, 2018.
2. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.
3. Quantitative Aptitude : Numerical Ability (Fully Solved) Objective Questions, Kiran Prakashan, Pratogitaprakasan, Kic X, Kiran Prakasan publishers.
4. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc Graw hill publications.

INTRODUCTION AND SCOPE OF MICROBIOLOGY **Course Code: BGO1T01**			
GE / OE	**Hours: 2 Hours/Week**	**Marks: 80+20=100**	**Credit: 2**
Unit-I			
Bacteria	Discovery of Microorganism, Differences between prokaryotes and eukaryotes cell Bacteria: General characteristics of different groups. Important archaeal and eubacterial groups. Bacterial Cell size, shape and arrangement, Typical bacterial cell structure & their function		**7.5 Hrs**
Unit-II			
Fungi	General characteristics of fungi including habit, habitat, nutritional requirements, thallus organization and aggregation, Asexual reproduction, sexual reproduction, heterokaryosis and parasexual mechanism. Slide culture techniques.		**7.5 Hrs**
Unit III			
Algae	General characters and industrially important algal cells, Asexual & sexual reproduction Cyanobacteria: occurence and structure of the following: Spirulinaand Anabaena. Application of Algae		**7.5 Hrs**
Unit IV			
Scope of Microbiology	a] Medical microbiology, b] Biotechnology, c] Agriculture microbiology d] Environmental microbiology e] Geomicrobiology,		**7.5 Hrs**

Reference books -

1. Atlas RM. (1997).Principles of Microbiology.2nd edition.WM.T.BrownPublishers.
2. Black JG. (2008). Microbiology: Principles and Explorations. 7th edition.PrenticeHall
3. Madigan MT, and Martinko JM.(2014). Brock Biology of Micro-organisms.14th edition.Parker J. Prentice Hall International,Inc.
4. PelczarJr MJ, Chan ECS, and Krieg NR.(2004). Microbiology.5th edition Tata McGrawHill.
5. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005). General Microbiology. 5th edition. McMillan.

COURSE OUTCOMES

After this course the students will be able to

Sr. No.	Course outcome
1.	Students will be able to understand diversity of microorganisms
2.	Students will be aware of prokaryotic & eukaryotic cellular organization
3.	Justify various scopes of microbiology.

FYUGP Semester-I Generic Elective / Open Elective Course (GE/OE-1) (BGO1T01) **(Space Science)**			
GE/OE-1 THEORY	**Hours: 04 Hours /Week**	**Marks: 80 + 2- = 100**	**Credit: 02**
Unit-I			
Solar system and measurements	Solar System, Kepler's Laws, Earth-Moon System, Solar and Lunar eclipses, Exploration of Solar System by Telescopes, Rockets and Satellites. Exploration of Mars and Moon. Measurement of terrestrial distances, distance of moon, distance of planets, Astronomical unit, light year and parsec.		**7.5 Hrs**
Unit-II			
Telescopes and their principles	Optical telescopes, (Refractor, Galilean, Newtonian or Dobsonian, Cassegrainian & Hubble Space Telescope), Magnifying power & Resolving power of telescopes, UV, X-ray, IR, Radio & Gravitational Astronomy, Spectroscope.		**7.5 Hrs**
Unit III			
Observational and Experimental Tools for Space Science	Rockets and Satellite Payloads. Rocket principle and types. Detectors for optical and infrared regions, Application of CCD's and CMOS to stellar imaging, Techniques of observations of astronomical sources.		**7.5 Hrs**
Unit IV			
Fundamental Particles and Basic Forces	Particles originated from space, cosmic rays, Protons, Electrons, Neutrons, Neutrinos, Mesons, leptons, and quarks. The concept of Basic forces viz., strong, weak, electromagnetic, and gravitational forces. Basic ideas about galaxy, black hole, neutron star, red giant, black matter and pulsars, nebula, white dwarfs etc.		**7.5 Hrs**

Reference Books:

1. Ionospheric Radio Propagation by Kenneth Davis. National Bureau of Standards Monograph 80 (1965), US Government Printing office, Washington D.C.
2. Physics of the Upper Atmosphere edited by J, A. Ratcliffe, Cavendish Laboratory, University of Cambridge. Academic Press New York and London (1960)
3. Research in Geophysics: Vol.1- Sun, Upper Atmosphere and space edited by Hugh Odishaw, National Academy of Sciences. Washington D.C.
4. Source book on the Space Sciences - Samuel Glasstone, Princeton, New Jersey.
5. The Upper Atmosphere - S K Mitra

Course outcomes

After the completion of this course students will be able to

Sr. No.	Course Outcome
1.	Get acquainted with the space related events
2.	Get knowledge about solar system and planets
3.	Determine the average distance and sizes of heavenly bodies
4.	Understand the concept of black hole and other giants
5.	Know the measurement related to large distance
6.	Understand the communication time requirement for longer distances

Generic Elective Courses/ Open Elective Courses (GE/OE)

For Statistics major

	Semester I (GE/OE)
	Name of the Paper - Elementary Descriptive Statistics
	Paper code – (BGO1T0I) 2 Credits (2 hrs Theory per week)
	Total 30 Hrs
	OBJECTIVES
	Students acquire knowledge about how to classify and tabulate data . They also learn various methods of graphical and diagrammatic representations of data.
	OUTCOMES
	Students acquire knowledge about: Construction of tables with many factors of classification. They also learn analysis of categorical data.
	Unit-I (15 Hrs)
(A)	**Types of data**: Concepts of a statistical population and sample from a population; qualitative and quantitative data; nominal and ordinal data; cross sectional and time series data; discrete and continuous data; frequency and non-frequency data.
(B)	**Different types of scales**— nominal, ordinal, ratio and interval. Primary data and Secondary data, Methods of data collection: Interview method, Questionnaire method, Personal Observation method, designing a questionnaire and a schedule; checking their consistency, Pilot survey Instruction
(C)	**Controlled experiments**: Observational studies and Scrutiny of data for internal consistency and detection of errors of recording.
(D)	**Sample surveys and Population Census**: methods of conducting population census with special reference to Census in India. Analysis of Categorical data: Consistency of categorical data. Independence and association of attributes. Various measures of association for two- way classification, Odds ratio.
	Unit-II (15 Hrs)
(A)	**Presentation of data**: Construction of tables with one or more factors of classification,
(B)	**Classification:** Geographical, chronological, qualitative and quantitative. Formation of frequency distribution of discrete and continuous type, relative frequency, frequency density and cumulative frequencies. Construction of Stem and leaf chart
(C)	**Diagrammatic representation of data:** Construction of Simple bar diagram, multiple bar diagram, subdivided bar diagram, percentage bar diagram, pie- diagram and pictogram.
(D)	**Graphical representation of grouped data:** Construction of Frequency bar diagram, frequency polygon, histogram, cumulative frequency diagrams and ogives
	REFERENCES
1	Bhat B.R,Srivenkataramana T And RaoMadhava K.S(1997): STATISTICS: A BEGINNER'S TEXT,VOL I,NEW AGE INTERNATIONAL (P) LTD.
2	Goon A. M,Gupta M. K, Das Gupta,B (1999): FUNDAMENTALS OF STATISTICS, VOL I, WORLD PRESS, CALCUTTA.
3	CroxtonF.E,Cowden D.J And Kelin S(1973): APPLIED GENERAL STATISTICS, PRENTICE HALL OF INDIA
4	Agrawal B. L: BASIC STATISTICS (New Age International Publishers)
5	SudhaPurohit, GoreS.D., Deshmukh S. R.: Statistics Using R (Narosa)
6	Christian S. Albright, Wayne L. Winston, Zappe Christopher J. : Decision Making using Microsoft

General Elective (GE)/ Open Elective (OE) for FYUGP

GE/OE for B.Sc. I Human anatomy and Physiology (BGO1T01)

Credit: 2

Course outcomes: After completion of the course, students will able to-

- Learn, describe and explain structure and histology of human digestive system.
- Learn, describe and explain structure and physiology of excretion and muscles.
- Learn, describe and explain structure and physiology of respiration and circulation.
- Learn, describe and explain structure and physiology of nervous system.

UNIT-I

1.1 Digestion – Structure and function of digestive system.

1.2 Histology stomach, Intestine, pancreas, liver, large intestine.

1.3 Digestion of carbohydrates, proteins and lipids.

1.4 Composition and function of Saliva, Gastric juice, Bile juice, Pancreatic juice, Intestinal juice.

UNI T-II

2.1 Excretory system –Excretory organs, structure of kidney.

2.2 Juxtaglomerular apparatus, formation of urine.

2.3 Muscles – E.M. structure of muscles, contraction of muscle.

2.4 Single muscle twitch, tetanus, summation, fatigue, tonus.

UNIT-III

3.1Respiratory system- Structure of respiratory system, mechanism of respiration (breathing).

3.2 Histology of lungs and trachea, Transport of O_2 and CO_2 through alveoli

3.3 Circulatory system – Structure of heart, cardiac cycle, Composition of blood

3.4 Mechanism of clotting of blood.

UNIT-IV

4.1 Nervous system – structure of brain.

4.2 Structure and histology of spinal cord.

4.3 Structure and types of neuron.

4.4 Transmission of impulse through neuromuscular junction.

Suggested reading:

Garg K, Joshi M, Kundu S (2022). Human anatomy and physiology theory and practical 2 edition. CBS Publishers and Distributors Pvt. Ltd. pp. 352.

Murugesh N. (2021). Human anatomy and physiology. Sathya publishers, pp. 286.

GE/OE for B.Sc. I Indian Birds (BGO1T01)

Credit: 2

Course outcomes: After completion of the course, students will able to-

- Understand, describe and explain importance of birds.
- Learn how to record and study the birds.
- Identify and recognized certain Indian birds.

Unit - I

1.1 Methods of identification of birds.
1.2 Terms used in the description of birds plumage and body parts.
1.3 Bird study techniques: eqpuipments, field data recording, Bird sanctuaries in India.
1.4 Role of birds in ecosystem: pollination, seed dispersal, insect control.

Unit- II

2.1 Morphological features, distribution, feeding habit and habitat of Sarus crane (*Grus antigone*); purple moorhen (*Porphyrio* porphyrio); black Ibis (*Pseudibis papillosa*); Indian coot (*Fulica atra*).

2.2 Morphological features, distribution, feeding habit and habitat of Indian spot billed duck (*Anas poecilorhyncha*); Lesser whistling teal (*Dendrocygna javanica*); ruddy *shelduck* (*Tadorna ferruginea*); bronze-winged jacana (*Metopidius indicus*).

2.3 Morphological features, distribution, feeding habit and habitat of black-winged kite or oriental honey buzzard (*Elanus caeruleus*); black kite (*Milvus migrans*); shikra (*Accipiter badius*); Indian white backed vulture (*Gyps bengalensis*).

2.4 Morphological features, distribution, feeding habit and habitat of peacock (*Pavo cristatus*); common quail (*Coturnix coturnix*);grey jungle fowl (*Gallus sonneratii*); black patridge *(Francolinus francolinus*).

Unit- III

3.1 Morphological features, distribution, feeding habit and habitat of red-wattled lapwing (*Vanellus indicus*); common sandpiper (*Tringa hypoleucos*); little ringed plover (Charadrius dubius); *black-winged stilt* (*Himantopus himantopus*).

3.2 Morphological features, distribution, feeding habit and habitat of common green pigeon (*Treon phoenicoptera*); rock pigeon (*Columbia livia*); spotted dove (*Streptopelia chinensis*); red turtle dove (*Streptopelia tranquebarica*).

3.3. Morphological features, distribution, feeding habit and habitat of koyal (*Eudynamys scolopacea*); Coucal (*Centropus sinensis*); spotted owlet (*Athene brama*); house swift (*Apus affinis*).

3.4 Morphological features, distribution, feeding habit and habitat of little blue kingfisher (*Alcedo atthis*); pied kingfisher (*Ceryle rudis*); green bee eater (*Meropsorientalis*); hopoe (*Upupa epops*).

Unit- IV

4.1 Morphological features, distribution, feeding habit and habitat of roller (*Coracias benghalensis*); Indian grey hornbill (*Ocyceros birostris*); coppersmith barbet (*Psilopogon haemacephalus*); black drongo (*Dicrurus adsimilis*).

4.2 Morphological features, distribution, feeding habit and habitat of jungle babber (*Argya striata*); pied bushchat (*Saxicola caprata*); oriental magpie robin (*Copsychus saularis*); scarlet minivet (*Pericrocotus speciosus*).

4.3 Morphological features, distribution, feeding habit and habitat of tree pie (*Dendrocitta vagabunda*); redvented bulbul (*Pycnonotus cafer*); paradise flycatcher (*Terpsiphone paradise*); tailor bird (*Orthotomus sutorius*).

4.4 Morphological features, distribution, feeding habit and habitat of *ashy* wren-*warbler* (*Prinia socialis*); *grey wagtail* (*Motacilla cinerea*); baya or common weaver bird (*Ploceus philippinus*); purple sunbird (*Nectarinia asiatica*).

Suggested reading:

Salim Ali and Futehally L. (1968). Common Indian Birds: A picture album. National Book Trust, India, pp. 51.

Salim Ali (2003). The book of Indian birds. 13th edition, Oxford publication, pp. 326.

Grewal B, Sen S, Singh S, Devasar N and Bhatia G. (2016). Birds of India - A Pictorial Field Guide. Om Books International, pp. 792.

GE/OE Basket Semester I
Faculty of Science and Technology

Semester	Course Category		Name of Course	BoS	Course code
I	**GE/OE**	1	Indoor gardening and landscaping	Botany	**BGO1T02**
		2	Health & Wellness	Biochemistry	
		3	Fermented Foods	Biotechnology	
		4	Office Automation	Computer Science	
		5	Communication & Broadcasting	Electronics	
		6	Environmental and Public Health	Environmental Science	
		7	A. Introduction to Forensic Journalism/ B. Basic Analytical Chemistry/ C. Basic Analog and Digital Electronics / D. Basics of Enzymology / E. Psychology of Health & Well Being-II (Psychology)/ F. Programming with C /	Forensic Science	
		8	Geostatistics in Geology	Geology	
		9	Basic Chemistry- I	Home Science	
		10	Basic Statistics	Mathematics	
		11	Statistics for Competitive examinations	Statistics	
		12	Reproductive biology	Zoology	
			Attractive insects	Zoology	
		13	Organic Chemistry	Cosmetic Technology	
		14	Chemical Processing-I	Fashion Design	
		15	Chemical Processing-I	Textile Science	

B. Sc. Semester-I
GE / OE-2 Botany (BGO1T02)
Indoor Gardening and Landscaping

GE/OE-II Theory	Hours: 2 Hours/Week	Marks: 80+20=100	Credit: 2

Unit-I

1. **Indoor Gardening:** Introduction, objectives, and scope.
2. Essential Factors to grow indoor plants.
3. Establishment of the indoor garden.
4. Decoration of conference hall, living room & dining hall by indoor plants.
5. Common problems of indoor plants and their management.

7.5 Hrs.

Unit-II

1. **Selection of indoor plants:** Potted plants, hanging baskets, bonsai, bromeliad tree terrarium, bottle garden and dish garden.
2. **Importance as popular indoor plants:**
   a) **Foliage plants:** *Begonia* sp., *Coleus* sp.
   b) **Ferns:** *Adiantum* sp., *Nephrolepis* sp.
   c) **Flowering plants***:* *Anthurium* sp., *Bromeliads*
   d) **Orchids:** *Miltoniopsis* sp., *Dendrobium* Sp.
   e) **Palms***:* *Areca palm, Ravenea rivularis*

7.5 Hrs.

Unit-III

3. **Landscaping:** Introduction, objectives, and scope.
   a) Landscape architecture
   b) Tools and equipment used
   c) Lawn and lawn maintenance
   d) Fertilizing, weed control, pruning & disease and insect pest control for plants used in landscaping.

7.5 Hrs.

Unit-IV

4. Landscape management and conservation.
   a) Heritage and cultural landscape, Urban open space systems, Rural landscape
   b) Different elements used in construction and designing of landscape
   c) Landscaping elements in residential, commercial, bungalow, public area, hotel educational institute and religious places.
   d) Selection of plants for landscaping
   e) Computer applications in landscaping.

7.5 Hrs.

Note: Field visits are compulsory.

SUGGESTED READINGS

1. Agarwal, V. K. and Bhargava P. (2017), Home Gardening, Pustak Mahal, Allahabad (India)
2. Bose T. K. and Mukharjee D. (1977) Gardening in India. Oxford & IBH Publishing Co. Pvt. Ltd.,Calcutta.
3. Gopal Swamy Iyengar (1990). Complete Gardening in India, IBH, India.
4. Grewall H. S. and Singh P. (2014), Landscape designing and ornamental plants, KalyaniPublication, New Delhi
5. Nambison, K.M.P. (1992). Design elements of landscape gardening. Oxford and IBHPublications, New Delhi.
6. Randhawa G. S. (1973). Ornamental Horticulture in India, Today and Tomorrow's printers and Publishers, New Delhi.
7. Vishnu Swarup (1993), Publication and information-Division ICAR, New Delhi
8. Vishnu Swarup (2002). Indoor Gardening, ICAR, New Delhi.
9. Walker D. T. (1983). Planting Designs, PDA Publishers Corporation, USA.

WEBSITES:

1. www.dgt.gov.in
2. www.baratskills.gov.in
3. www.andhrauniversity.edu.in
4. www.sevenmentor.com
5. www.jsscacs.edu.in

GE/OE Basket (BOS Biochemistry Major)

Health and Wellness (BG01T02)

Course Outcomes:

1. Students will know about importance of healthy lifestyle.
2. Students will know about physical and mental health.
3. Students will aware about various lifestyle diseases and how to modulate them.
4. Students will aware about stress management techniques.
5. Students will know about importance of yoga and pranayama.

Unit -I: General awareness.

Definition of health and wellness. Factors affecting health and wellness (Social, economic, emotional, occupational, intellectual, physical). Types of Physical Fitness and its Health benefits. Sedentary lifestyle and its risk of disease. Modern lifestyle and hypo-kinetic diseases; prevention and management. Benefits of exercise in adulthoods. Use of Health Management Information System (HMIS) in hospitals.

Unit -II: Physiological aspects.

Brief idea about different parts of kidney, heart, brain. Structure and function of Hemoglobin. LDL in plaque formation. Importance of HDL. International classification of adults underweight, overweight and obesity according to BMI. Parts of respiratory system. Breathing pattern. Stages of breathing in yoga pranayama. Health benefits of Kapalbhati and Anuloma Viloma pranayama.

Unit -III: Mental aspects.

What is mental health? Types of mental health disorders. Factors affecting mental health. What is anxiety? Types, causes, symptoms and treatment of anxiety. What is depression? Symptoms, factors affecting, and treatment of depression. Causes and treatment of migraine. Brief idea about stress and it's management. Identification of suicidal tendencies.

Unit- IV: Nutritional aspects.

Diet and nutrition for health & wellness. Essential components of balanced diet (carbohydrates, proteins, fats, vitamins & minerals) for healthy lifestyle. Malnutrition, under nutrition and over nutrition. Healthy foods for prevention and progression of Obesity, Diabetes, Polycystic Ovarian Syndrome, Cancer, Cardiovascular diseases and Hypertension. WHO recommendations of healthy diet for adults, infants and young children.

Reference Books:

1. Jesse Peoring Williams “The Principles of Physical Education” Published by College Book House, Shivaji Road, Meerut.
2. William D McArdle, Frank I Katch and Vitor I Katch, Essential of Exercise Physiology, Second edition, New York: LipincoffWelliams and wilkins, 2000.
3. Scott K. Powers and Stephen L. Dodd. Total Fitness: Exercise, Nutrition and wellness, Boston: Allyn and Bacon, 1999.
4. P Sembulingam, K Sembulingam. Essentials of medical physiology. 8 th edition. Jaypee Brothers Medical Publishers.
5. Vladimir Gordin. Nutrition and diet The Triangle of health: Chemical components Book 2). Gordin Medical Centre publication.
6. Arvind Upadhyay. Mental health problems. 2nd edition. Notion press publication.
7. James Hewitt. The Complete Yoga Book: The Yoga of Breathing, Posture and Meditation. Ebury Publication.

Open Elective Courses

SEMESTER – I

FERMENTED FOODS

Course Code:BGO1T02 **Total Contact Hours: 30**

Course Outcomes:

After successful completion of this Course, students will be able to:

CO 1. Understand the importance of fermented foods, probiotics, prebiotics and nutraceuticals.
CO 2. Make the students aware of the different types of beverages.
CO 3. Understand the importance of fermented meat and fish products.
CO 4. Understand the importance of fermented dairy and vegetable products.

Unit I **7 Hours**

History of food fermentations; Types of fermented foods, Nutritional Values, Advantages and Health Benefits; Prebiotics- Sources of prebiotics, Probiotics- Characteristic features, Sources and Microorganisms used as Probiotics; Synbiotics and Nutraceutical Foods; Oriental fermented foods-Soy sauce, Miso, Tempeh, Tofu, Natto; Traditional fermented foods – Idli, Dosa, Khaman

Unit – II **8 Hours**

Beverages- Introduction, Health Importance of Beverages; Ingredients of beverages: Water, fruit pulps, juices, concentrates, sweeteners and preservatives; Alcoholic Beverages- Undistilled Alcoholic Beverages, Beer- commercial production of beer, Elements of brewing process; Types of beer; Wines- commercial production, Types of wine, Distilled alcoholic beverages- Whisky, Rum, Gin, Brandy, Vodka, Non-Alcoholic Beverages- Coffee, Tea, Carbonated beverages, Mocktails, Quality- control in beverage industry

Unit III **7 Hours**

Fermented Meat product Sausages- History of fermented meats industry, Meat composition, Fermentation principles, Meat starter cultures, Manufacture of fermented sausage- Cutting and mixing, Stuffing, Casing materials, Fermentation, Cooking, drying, and smoking, Mold-ripening, Flavour of fermented meats, Defects and spoilage of fermented meats. Fermented fish products- Fish sauces, Fish paste- Manufacturing steps, Storage and Shelf-life of products.

Unit IV *8 Hours*

Fermented Dairy products- Introduction, Cultured dairy products- Yogurt, Cultured buttermilk, Sour cream, Kefir, Other cultured dairy products. Cheese-Introduction, Manufacturing principles, General steps in cheese making, Types of cheese, Cheese ripening, Recent technological advances in cultured dairy products technology. Fermented Vegetable products-Introduction, Production principles, Manufacture of Sauerkraut, Principles of pickle production, fermented olives, Kimchi and Fermented vegetables.

References:

- Hutkins, Robert W. *Microbiology and technology of fermented foods*. John Wiley & Sons, 2008.
- Joshi, V. K. "Biotechnology Food Fermentation" Volume 1. Educational Publishers &Distributors, 2004.
- Hui Y. H "Handbook of Food and Beverage Fermentation Technology". Marcel Dekker, 2004.
- Wood, Brian J. B. "Microbiology of Fermented Foods" Volume 1 and 2. II Edition. BlackieAcademic and Professional, 1998.
- Ramesh C. Ray and Didier Montet, "Fermented Foods, Part- II Technological Interventions",CRC Press, 2017.
- Kosikowski, F.V. 1997. Cheese and fermented milk foods. Frank Kosikowski and Vikram Mistry, Brooktondale, N. Y.
- Feiner, G. 2006. Meat products handbook. ISBN 978-1-84569-050-2
- Industrial Fermentations- Leland, N. Y. Chemical Publishers.
- Prescott and Dunn's- Industrial Microbiology, 4 th, ed.
- Bamforth, C.W. 2004. Beer: Health and Nutrition. Blackwell Science Ltd., Oxford, United Kingdom.

B.Sc. Sem-I (Computer Science)

BGO1T02

OFFICE AUTOMATION

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1.To understand functionality of Operating Systems and its applications.

2.To understand the working with the user interface.

3.To understand Word Processing, their usage, details of word processing screen, Opening, saving and printing a document

4.To understand Worksheet creation, inserting and editing data in cells.

Course Outcomes :

After completing this course satisfactorily, a student will be able to:

1. understand functionality of Operating Systems and its applications.
2. Working with the user interface.
3. prepare documents, letters and do necessary formatting of the document.
4. Worksheet creation, inserting and editing data in cells.
5. Opening/saving a presentation and printing of slides and handouts.

UNIT I

Introduction to windows Operating System

Advantages of windows operating system, using different windows applications simultaneously, operating with windows, GUI, use of help features, starting an application, essential accessories, creating shortcuts, windows explorer, control panel, my computer, my documents, recycle bin, finding folders and files, changing system settings, system tools, use of run command, setting peripherals, drivers, editing graphics in windows, new features in windows XP/Vista versions.

UNIT II

Introduction, basics, starting Word, creating document, parts of Word window, mouse and keyboard operations, designing a document; Formatting- selection, cut, copy, paste; Toolbars, operating on text; Printing, saving, opening, closing of document; Creating a template; Tables, borders, pictures, text box operations; Mail Merge.

UNIT III

Introduction to MS EXCEL, navigating, Excel toolbars and operations, Formatting; copying data between worksheets; entering formula, chart creation; data forms, data sort; Functions in ExcelROUND( ), SQRT ( ), MAX( ), MIN( ), AVERAGE( ), COUNT( ), SUMIF( ), SUMIF( ), ABS( ), ROMAN( ), UPPER( ), LOWER( ), CELL( ), TODAY( ), NOW( ).

UNIT IV

Introduction to MS POWER POINT Working with Power Point Window, Standard Tool Bar, Formatting tool bar, Drawing tool Bar, Moving the Frame, Inserting Clip Art, Picture, Slide, Text Styling, Send to back, Entering data to graph, Organization Chart, Table,Design template, Master Slide, Animation Setting, Saving and Presentation , auto Content Wizard.

Books:

1. MS Office XP for Everyone By Sanjay Saxena (Vikas Publi, Noida)
2. MS-Office 2000(for Windows) By Steve Sagman
3. A First Course in Computers – Sanjay Saxena

Semester – 1; OE2: Communication & Broad Casting (BGO1TO2)

Course outcome:

At the end of this course students will have ability to

1. Historical understanding about evolution of Electronics CommunicationTechnology
2. Appreciate transformation and Geo-reach concept in Broad casting
3. Define purpose of present day communication & Broad Cast Technology, Entertainment, information Education, Alerts, Agricultural
4. Conversant with modern digital systems

Syllabus

1. Concept of Communication, One-one, One to Many, One way, Two way Distance & media wise, communication applications
2. Global & National History about evolution & growth, Akashwani, Vividh Bharti, FM service, HAM radio web based Radio, Doordarshan, Gyan Vani & other.
3. Contemporise Communication & Broad Casting system, working features, Sub module of communication system, Regulatory bodies, Law, Standards
4. Advances in Communication & Broad Casting Human-Machine communication, Machine-Machine communication, Integration of AI

GE/OE-2: Environment and Public Health (BGO1TO2)

Unit-I:

Environment and Public Health: Definition of health and diseases, Perspective on individual health: Nutritional, Socio-cultural and developmental aspects, Dietary diversity for good health; Human developmental indices for public health, Effect of quality of air, water and soil on human health.

Diseases in Contemporary Society: Need for good health – factors affecting health, Types of diseases – deficiency, infection, pollution diseases – allergies, respiratory, cardio-vascular and cancer, Personal hygiene: food- balanced diet, Health effects of smoking, drugs and alcohol consumption.

Unit-II:

Malnutrition: Vitamin deficiency diseases and Mineral deficiency diseases, Folic acid requirement during pregnancy; Food safety- adulterants and preservatives, pesticides toxicity, endosulfan and DDT, genetically modified food.

Non-communicable diseases and life style diseases: Diabetes and Hypertension; Communicable diseases: Definition, mode of transmission- pandemic, epidemic and endemic diseases.

Unit-III:

Vector Borne Diseases : Plauge and Malaria, emerging diseases: Dengue, Chikungunia. Ebola, Zika, Swine flu, Bird flu, Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS), Zoonosis-Leptospirosis.

Water and Air Borne Diseases: Water borne diseases (Cholera, diarrhea. Typhoid, ameobiasis, hepatitis, gastroenteritis and giardiasis. Air borne diseases (Pneumonia, tuberculosis, Anthrax, COVID-19 and Acute Flaccid Myelitis (AFM).

Unit-IV:

Occupational Health: Sick building Syndrome, Noise and Radiation; Ergonomoics – Stress and fatigue, Carpal Tunnel Syndrome (CTS), Methyl mercury and cerebral palsy, Synergistic effect, Irritable bowel syndrome, Crohn’s diseases.

Environmental Sanitation and Hygiene : Safe disposal of human excreta, solid waste disposal, sanitation value chain. Drug safeties – Thalidomide Tragedy, Antibiotic stewardship, New Delhi Antibiotic – Resistant superbug.

References:

1. Aktar, R. (Ed.). (2019). Extreme weather events and human health: International casestudies. Springer Nature.
2. Bedi and Yashpal. (1971). Handbook of Hygienic and Public Health. Atma Ram & Sons,Delhi.
3. Kessel, A. (2006). Air, the environment and public health. Cambridge University Press.
4. Lopez, R.P. (2012). The built environment and public health (Vol.16). John Wiley &Sons.
5. Nandini N. (2018). Environment and public Health. Sapna Book House, Bengaluru,
6. Q'Carroll, P.W., Yansnoff, W.A., Ward, M.E., Ripp, L.H., & MartinE.L. (Eds.).(2003). Public health informatics and information systems.
7. Park, K (2009). Park's Textbook and Preventive and Social Medicine, 20th Edition. Misc Publication
8. Rajit Sengupta and Kiran Pandey. (2021). State of India's Environment 2021: In Figures. Centre Science and Environment, New Delhi.
9. Van den Bosch, M., & Bird, W. (Eds.). (2018). Oxford textbook of nature and public health: The role of nature in improving the health of a population. Oxford University Press.
10. Walton, M (2017). One planet, One Health. Sydney University Press.

GE/OE (Forensic Science)

GE 2(BGO1T02): Introduction to Forensic Journalism

Course Outcome: By the end of this Course, the learners will be able to:

1. Recall and identify the key terms and concepts related to forensic journalism, including investigative reporting, forensic journalist, types of news reporting, news editing, and ethical practices.
2. Understand the principles, practices, and challenges of forensic journalism in contemporary society.
3. Apply the techniques, methods, and skills required for effective forensic journalism, including researching, reporting, writing, and editing.
4. Analyze the role and impact of forensic journalism in uncovering the truth, promoting justice, and addressing social issues, as well as the challenges and limitations of forensic journalism.
5. Evaluate the effectiveness and ethics of forensic journalism in different contexts, including reporting on crime, human rights abuses, disasters, and crises, as well as assessing the future directions and innovations in forensic journalism.

Unit-I Writing and Editing of News

Introduction to News, Types of News, Sources of News, Writing News, The Leads, Types of Leads, Method of Writing Leads, Tips for Writing News, Function of News, News Editing, Nature and Need for Editing, Editors, Method of Editing, Proof Reading, Preparation of Copy for Press.

Unit-II: Introduction to Forensic Journalism

Definition of forensic journalism and its importance: What is forensic journalism and how is it different from regular journalism? The importance of forensic journalism in uncovering the truth and promoting justice, The origins of forensic journalism in investigative reporting. Ethics and best practices in forensic journalism: The importance of accuracy, fairness, and balance in forensic journalism

Unit-III: Basics of Forensic Journalism

Forensic Journalism, Investigative Journalism, Forensic Journalist, Scope and Need of Forensic Journalist. 5W1H, Reporting, Reporter, Type of News Reporting such as Straight News Report, Beat Reporting, Investigative News Reports, Role and Responsibilities of Forensic Journalist, Research methods and tools for investigative reporting, Ten Golden Rules for Forensic Journalist, Qualities of Good Forensic Journalist.

Unit IV: Applications of Forensic Journalism

Covering crime and courts. Investigating human rights abuses and social justice issues. Reporting on disasters and crises. The challenges and limitations of reporting on disasters and crises. Challenges and limitations of forensic journalism. The potential future directions and innovations in forensic journalism.

GE/OE (Forensic Chemistry)

GE 2(BGO1T02): Basic Analytical Chemistry

Learning Outcomes: By the end of this Course, the learners will be able to:

1. Recall and identify the key terms and concepts related to SI units, methods of expressing concentrations, calculations, solutions and their concentration.
2. Understand the principles, descriptions, handling, calibration and use common laboratory apparatus.
3. Apply the knowledge and skills of volumetric analysis to classify different volumetric methods and understand the concept of different types of titrations.
4. Analyze the principles, theory, types of gravimetric analysis their application and limitations.

Unit I: SI Units

Definitions of the Seven Basic Units (Mass, Length, Time, Temperature, Amount of substance, Electrical current and Luminous intensity). Methods of expressing concentrations - Mole, molar mass, Molarity, Calculations in grams and moles, Solutions and their concentrations, Molar concentration b) Percent concentration, Parts per million/billion (ppm, ppb)

Unit II: Description and use of common laboratory apparatus

Volumetric flasks, burettes, pipettes, meniscus readers, weighing bottles, different types of funnels chromatographic columns, chromatographic jars, desiccators, drying ovens, filter crucibles, rubber policeman. Calibration and use of volumetric glassware.

Unit III: Volumetric Analysis A

Definitions: Volumetric Titration, Gravimetric Titration, Coulometric Titration. B. The equivalence point, the end point; Classification of volumetric methods, theory of indicators and buffers Equilibria Principles-Aqueous and non-aqueous acid-base titration- Redox titrations-Complexometric titrations – Precipitation titrations

Unit IV: Volumetric Analysis B

Principle, theory and types of Gravimetric analysis, properties of precipitates and precipitating agents, application and limitations of gravimetric methods

GE/OE (Forensic Physics)

GE 2(BGO1T02): Basic Analog and Digital Electronics

Course Outcome: By the end of this Course, the learners will be able to:

1. Recall and identify the key terms and concepts related to basic electronics, including active and passive components, identification techniques of components, and rectifier circuits.
2. Understand the principles, practices, and challenges of analog and digital electronics, including the working principle of oscillators and waveform generators, and the applications of logic gates, flip-flops, and shift registers.
3. Apply the knowledge and skills required to properly design and analyze analog and digital electronic circuits, including the use of filters, waveform generators, and signal converters.
4. Analyze the characteristics and properties of electronic components, including resistors, capacitors, inductors, diodes, and transistors, and their applications in electronic circuits.
5. Evaluate the performance and limitations of electronic circuits, including waveform shaping circuits and signal processing techniques, and the ethical considerations surrounding the use of electronic devices.

Unit I: Basic Electronics

Active and Passive Components (Resistors, Capacitors, Inductors, Diodes, Transistors), Field Effect Transistors, IC's and IC packages, Identification Techniques of Components, Rectifier Circuits, Introduction to OPAMP (Inverting & Non-inverting Amplifier) and Applications.

Unit II: Analog Electronics

LR, CR, LCR Circuits, Timer Circuits (using IC 555 &UJT). Active Filters: Low Pass, High Pass, Band Pass. Waveform Generators: Working Principle of Oscillators, Waveform Generators; Sine (Phase-shift, Wien Bridge, Colpitts and Hartley), Square, Triangular, Sawtooth.

Unit III: Digital Electronics

Logic Gates and Their Applications, Flip Flops, Shift Registers and Counters (Asynchronous, Synchronous and Decade).

Unit IV: Signal Processing

Signal Converters: Analog to Digital Converters (Dual Slope &Successive Approximation), Digital to Analog Converters (Weighted Resistors &R-2R Ladder). Wave Shaping Circuits: Wave Clipping, Clamping Circuits.

GE/OE (Forensic Biology)

GE 2(BGO1T02): Basics of Enzymology

Course Outcome: By the end of this Course, the learners will be able to:

1. Recall and identify key terms, historical developments, and classification of enzymes.
2. Understand the specificity of enzyme action, mechanisms of enzyme catalysis, and the role of regulatory enzymes.
3. Apply knowledge of enzyme mechanisms to predict and explain enzyme-substrate interactions.
4. Analyze enzyme kinetics, including the measurement of initial velocities and interpretation of graphs.
5. Evaluate the effects of enzyme concentration, temperature, and pH on enzyme activity.

Unit-I: Fundamentals of Enzymology and Enzyme Catalysis

History and Terminology; Classification & nomenclature of enzymes; Specificity of enzyme action (Lock & key model & Induced fit model); Introduction to Enzyme catalysis: Proximity and Orientation effect; covalent catalysis; acid-base catalysis; metal ion catalysis; Introduction to regulatory enzymes.

Unit-II: Enzyme Mechanisms, Coenzymes, and Factors Affecting Enzyme Activity

Mechanism of action of Chymotrypsin; Role of vitamins as coenzyme precursors (Niacin, Biotin); Effect of enzyme concentration; Effect of temperature on enzyme activity & temperature quotient.

Unit-III: Enzyme Kinetics

Enzyme kinetics: Importance of measuring initial velocities; Michaelis-Menten equation; Single & double reciprocal plots; Graphical representation of various inhibitors (Competitive, Non-competitive & Uncompetitive) on Lineweaver-Burke plots.

Unit-IV: Advanced Enzyme Kinetics and Assay Techniques

Definition and importance of Kcat / Km; Introduction to Bisubstrate reactions, sequential and ping-pong mechanisms with examples; Effect of pH, General pH profile diagram; Concept of enzyme assay & its importance, Enzyme activity units (Katal & Specific activity).

GE/OE (Psychology)

GE 2(BGO1T02): Psychology of Health and Wellbeing-II

Learning Outcomes: By the end of this Course, the learners will be able to:

1. Understand the spectrum of health and illness for better health management
2. Identify stresses in one's life and how to manage them
3. Understand a variety of health announcing health protective and health compromising behaviours and to be able to know their application in illness management.

Unit I: Aptitude

Concept of Aptitude, Aptitude Tests: DAT, GATB. Concept of Interest; Interest Tests: The strong Campbell Interest Inventories, Kuder preference Record. Application: Use of Psychological tests in career selection.

Unit II: Emotions

Theories of emotions: James-Lange's theory, Cannon-Bard's theory, Schachter-Singer's theory, cognitive appraisal theory. Application to everyday life: use of incentives to motivate the employees to work hard.

Unit III: Personality

Assessment of Personality- Behavioural assessment (Observation, Rating scales), Personality inventories (16 PF, MMPI, NEO-PI). Projective techniques: TAT, Rorschach Ink Blot Test, Sentence Completion Test. Applying psychology to everyday life: Parents as a role model for children and film stars as role models for adolescents.

Unit IV: Intelligence

Theories of Intelligence: Spearman, Gardner, and Sternberg. Individual Differences in Intelligence: mental retardation, and giftedness. Application: Early childhood intervention: towards boosting intelligence.

GE/OE (Digital and Cyber Forensics)

GE 2(BGO1T02): Programming with C

Course Outcomes: By the end of this Course, the learners will be able to:

1. Understand programming structures like Sequence, Selection, Iteration and Modular.
2. Understand development tools such as algorithm, flowchart and pseudo code for any problem to solve them programmatically.
3. Understand basic concepts of programming in C such as character set, Operators, Functions, arrays, strings, functions, structures, unions and pointers.
4. Understand the file handling, sequential access and random access programmatically.
5. Apply their knowledge to solve programming problems using C language.

Unit I: Programming Fundamentals

Programming Structure: Sequence, Selection, Iteration and Modular, Problem-Solving Techniques and Development Tools: Algorithm, Flowcharts and Pseudo code (Definition and its characteristics), Developing Algorithm and Drawing flowcharts

Unit II: Introduction to C Programming

C Character set, Tokens, Identifier, Keywords, Variables, Data types, Qualifiers. Operators and Expressions: Arithmetic, Relational, Logical, Bit-Wise, Increment, Decrement, Conditional and Special operators. typedef, Type Conversion, Constants, Declaring Symbolic Constants, Character Strings, Enumerated Data Types, Operator Precedence and Associativity. Library functions: Maths, string handling Functions. Control Structure: Compound Statement, Selection Statement: if, if-else, Nested if, switch. Iteration statement: for, while, do...while, Nested loops, jump statements: break, continue, goto (Special emphasis on problem solving)

Unit III: Arrays, Strings, and Functions in C Programming

Arrays: Need, Types: Single and Two-Dimensional Array. Strings: Strings Manipulation, Arrays of Strings, Evaluation order. Function: Function Components, Return Data type, Parameter Passing, Return by Reference, Default Arguments, Recursive Functions, Arrays with Functions, Storage Classes. (Special emphasis on problem Solving)

Unit IV: Structures, Unions, Pointers, and File Handling in C Programming

Structure: Declaration, Definition, Accessing structure members, Initialization, Nesting of Structures. Union: Unions, Differences between Structure and Union. Pointer: Introduction, Address Operator (&), Pointer variables, void pointers, Pointer Arithmetic, Pointers to Pointers. File handling: Hierarchy of File Stream Classes, Opening & closing a file, Testing for errors, File Modes, File pointers and their manipulations, Sequential Access, Random Access, Command Line arguments.

Paper II: Grain Size and Geostatistics in Geology (BGO1T02)

Unit I

Concept of grain size of minerals-grains; very coarse-grained, medium-grained, fine-grained, glassy material; grain-size distribution of acidic, intermediate, basic and ultrabasic igneous rocks with textures of rocks; glassy acidic and basic igneous rock types.

Unit II

Surface processes leading to rock breakdown- physical, chemical and biological; weathering; resistance of rocks to weathering; factors influencing weathering; Processes of sediment transport; grain size variation from river, marine, deltaic and glacial sediments.

Unit III

Wentoworth's scale of grain sizes of sediments; grain sizes of sediments and sedimentary rock types; grain angularity and roundness, conversion of millimeter to phi scale of grain size.

Unit IV

Arithmatic mean, mode, median, range, variance, frequency, skewness, kurtosis, standard deviation of grain sizes; identification of depositional environment based on grain size distribution; CM plot, depositional environment based on grain size distribution from probability ordinate paper.

Books Recommended:

1. Blatt, H., Middleton, G.V. and Murray, R.C. (1980) Origin of Sedimentary Rocks, Prentice-Hall Inc.
2. Hota, R.N. (2011) Practical Approach to Petrology, CBS Publisher and Distributors Pvt Ltd., New Delhi
3. Reineck, H.E. and Singh, I.B. (1973) Depositional Sedimentary Environments, Springer-Verlag.
4. Isaaks, E.A. and Srivastava, R.M. (1990) An Introduction to Geostatistics, Oxford University Press.
5. Morrison, D.F. (1967) Multivariate statistical methods, McGraw-Hill.
6. Tucker, M.E. (1981) Sedimentary Petrology: An Introduction, Wiley and Sons, New York.

SEMESTER 1: BASIC STATISTICS

Course Outcomes:

1. To discuss the interpretations of Statistics in numerical data.
2. To give overview of Statistics in various sectors & disciplines
3. To apply & use of Statistics Methods in various diverse fields

UNITS	TOPICS	HOURS
Unit 1	Concept of Sample Space - Events - Definition of Probability - Addition and Multiplication laws of Probability - Conditional Probability - Baye's Theorem - Simple Problems.	**8**
Unit 2	Random Variables - Distribution Function - Expectation and Moments - Moment Generating Function - Probability Generating Function - Simple Problems.	**8**
Unit 3	Concept of Bivariate Distribution - Correlation - Karl Pearson's Coefficient of Correlation - Rank Correlation - Linear Regression.	**7**
Unit 4	Standard distributions: Discrete distributions - Binomial, Poisson, Hyper Geometric and Negative Binomial Distributions - Continuous Distributions Normal, Uniform, Exponential.	**7**
	TOTAL	**30 HRS**

Recommended books:

1. S.C. Gupta & V.K. Kapoor : Fundamentals of Mathematical Statistics, Sultan & sons
2. Hoel, P.G (1971): Introduction to Mathematical Statistics, Wiley.
3. Wilks S.S. Elementary Statistical Analysis, Oxford and IBH
4. Hogg, R.V. &Craig.A.T.(1998) : Introduction to Mathematical Statistics, Macmillan
5. Statistical Methods, Gupta S. P.: Sultan Chand and Sons, New Delhi.

	Semester I (GE/OE)
	Name of the Paper - Statistics for Competitive examinations
	Paper code – (BGO1T02) 2 Credits (2 hrs Theory per week)
	Course Objectives
	To train the students to solve the problems of statistics that appear in most of the competitive exams conducted by Banking, State and Central Governments and other agencies.
	Course Outcomes (CO)
	After the successful completion of the course, the students will be able to develop the data analysis skills required for Competitive Examinations.
	CONTENTS
	Unit 1 (15 Hrs)
(A)	**Collection Classification and Presentation of Statistical Data** Primary and Secondary data, Methods of data collection; Tabulation of data; Graphs and charts; Frequency distributions; Diagrammatic presentation of frequency distributions.
(B)	**Measures of Central Tendency** Meaning of central tendency and essentials of a good measure of central tendency. Types of measures of central tendency, Arithmetic mean, Median, Mode, Geometric mean and Harmonic mean - definition, merits and demerits. Properties of arithmetic mean. Empirical relation between mean median and mode. Problems on both grouped and ungrouped data for all the measures. Partition values-definition and types of partition values: quartiles, deciles and percentiles. Problems on Quartiles for grouped ungrouped data only
	Unit 2 (15 Hrs)
(A)	**Measures of Dispersion** Meaning and objectives of measures of dispersion. Essentials of a good measure of dispersion, absolute and relative measures of dispersion. Types of measures of dispersion- Range, Quartile deviation, Mean deviation and standard deviation with relative measures – definition, merits and demerits. Properties of Standard deviation, simple problems on ungrouped and grouped data.
(B)	**Introduction to Probability** Introduction to probability, Basic concepts: Random experiment, Sample space, Mutually exclusive, exhaustive, equally likely events, complimentary events, classical, statistical and axiomatic definition of probability, properties, Addition theorem of Probability and Definition of independent, dependent events, Conditional probability, Multiplication theorem of Probability without proof. Simple numerical problems.
	References
1	Freedman, D., Pisani, R. and Purves, R. (2014), Statistics, 4th Edition, W. W. Norton & Company.
2	Gupta S. C. Fundamentals of Statistics, Himalaya Publishing House, Bombay.
3	Gani S. G., Sankhyshastra and Ganakayantra. Udaya Ravi Publications, Bijapur

GE/OE for B.Sc. I Reproductive Biology (BGO1T02)

Credit: 2

Course outcomes: After completion of the course, students will able to-

- Understand, describe and explain the male reproductive system.
- Understand, describe and explain the female reproductive system.
- Understand, describe and explain menstrual cycle.
- Understand, describe and explain spermatogenesis, oogenesis and fertilization.

Unit- I

1. Female reproductive organs.
2. Function of Sertoli cells and Leydig cells.
3. Structure of Sperm.
4. Sperm transportation in male tract.

Unit -II

1. Female reproductive organs.
2. The anatomy, histology and function of uterus, cervix, vagina, fallopian tubes and mammary gland.
3. Structure of Ovary.
4. Sperm transport in female tract.

Unit- III

1. Menstrual cycle- different phases of menstrual cycle, menarche and menopause.
2. Hormonal control of menstrual cycle.
3. Male reproductive hormone and their function.
4. Female reproductive hormone and their function.

Unit- IV

1. Spermatogenesis, spermiogenesis and spermiation
2. Oogenesis, Folliculogenesis, Ovogenesis, Ovulation
3. Oocyte maturation – Primary follicle to Graffian follicle
4. Fertilization- Sperm egg recognition, Acrosome reaction and species barriers

Suggested Reading:

Tortora GJ and Derrickson BH (2009). Principles of Anatomy and Physiology, XII Edition, john Wiley and Sons, Inc., pp. 1281.

Widmaier EP, Raff H and Strang KT (2008). Vander's Human physiology. 11th Edition. McGraw Hill, pp. 770.

Khurana I (2018). Medical Physiology for undergraduate students.2nd edition, Elsevier, pp. 938.

GE/OE for B.Sc. I Attractive Insects BGO1T02

Credit: 2

Course outcomes: After completion of the course, students will able to-

- Understand, describe and explain the general characters of insects.
- Understand, describe and explain suborders of Odonata .
- Identify, recognized, describe and explain certain damselflies.
- Understand, describe and explain ecological significance of dragonflies.
- Identify, recognized, describe and explain certain dragonflies.
- Identify, recognized, describe and explain certain butterflies.
- Identify, recognized, describe and explain certain beetles.

Unit -I

1.1 Introduction to class Insecta: Systematic position of class Insecta, General Characters of class Insecta .

1.2 Introduction to order Odonata: General characters of odonata, suborders and families of order Odonata.

1.3 General characters of suborder Zygoptera, morphological difference between dragonflies and damselflies.

1.4 General characters, distribution of Coromandel marsh dart, *Ceriagrion coromandelianum* (Fabricius, 1798) and golden dartlet, *Ischnura aurora* (Brauer, 1865)

Unit- II

2.1 General characters of suborder Anisoptera, Ecological importance of dragonflies.

2.2 General Characters of Family Libellulidae; general characters, morphological features and distribution of green marsh hawk, *Orthetrum sabina* (Drury,1770)*;* ground skimmer, *Diplocodes trivalis* (Rambur, 1842).

2.3 General characters, morphological features and distribution of the granite ghost, *Bradinopyga geminata* (Rambur, 1842), ditch jewel, *Brachythemis contaminata* (Fabricius, 1793).

2.4 General characters, morphological features and distribution of the scarlet skimmer, *Crocothemis servilia* (Drury, 1770); pied paddy skimmer, *Neurothemis tullia* (Drury, 1773).

Unit- III

3.1 General characters of family Aeshnidae; Morphological features, distribution of pale spotted emperor, *Anax guttatus* (Burmeister, 1839).

3.2 General characters of family Gomphidae; Morphological features, distribution of common clubtail, *Ictinogomphus rapax* (Rambur, 1842).

3.3 Introduction to Coleoptera: General characters, distribution and habitat of beetles.

3.4 Morphological features, distribution and habitat of Indian glow worm, *Lamprophorus tenebrosus* (Walker, 1858); seven spotted ladybird beetle, *Coccinella septumpunctata* (Linnaeus, 1758); *six-spotted zigzag ladybird***,** *Cheilomenes sexmaculata* ((Fabricius, 1781).

Unit- IV

4.1 General characters, distribution and habitat of butterflies; morphological features of Nymphalidae, Papillionidae and Pieridae.

4.2. Morphological features, distribution and habitat of the common core, *Euploea core* (Cramer, 1780); the blue pansy, *Junonia orithya* (Linnaeus, 1758); *Danaus chrysippus* (Linnaeus, 1758)

4.3 Morphological features, distribution and habitat of lemon butterfly, *Papilio demoleus* (Linnaeus, 1758); the crimson rose, *Pachliopta hector* (Linnaeus, 1758); the tailed jay, *Graphium agamemnon* (Linnaeus, 1758).

4.4 Morphological features, distribution and habitat of common jezebel, *Delias eucharis* (Drury, 1773); common grass yellow, *Eurema hecabe* (Linnaeus, 1758); common emigrant, *Catopsilia pomona* (Fabricius, 1775).

Suggested Reading

Marshal SA (2018). Beetles: The natural history and diversity of Coleoptera. Boston Mils Press, pp. 800.

Smetacek P (2016). A naturalists guide to the butterflies of India. Prakash Books India Private Limited, pp. 176.

Andrew R.J., Subramanian K.A., Tiple A.D. (2008). Common odonates of Central India. e- book for " the 18th International Symposium of Odonatology, Hislop College, Nagpur", pp. 56.

Subramanian K.A. (2005). Dragonflies and damselflies of peninsular India: A field guide. Project report of Centre for Ecological Science, Indian Institute of Science, Banglore and Indian Academy of Science, Banglore, pp. 35.

GE/OE Basket Semester II
Faculty of Science and Technology

Semester	Course Category		Name of Course	BoS	Course code
II	**GE/OE**	1	Sustainable agriculture	Botany	**BGO2T03**
		2	Bioethics	Biochemistry	
		3	Applications of Biotechnology in Agriculture	Biotechnology	
		4	Programming in C	Computer Science	
		5	PC Assembly & Maintenance	Electronics	
		6	Introduction to Climate Crises	Environmental Science	
		7	A. Introduction to Forensic Auditing & Fraud Assessment / B. Chemistry of Natural & Synthetic Molecules / C. Instrumentation Aids/ D. Basics of Microbial Forensics/ E. Basics of Clinical Psychology (Psychology)/ F. Office Automation/ G. Criminal Law-I (Law)	Forensic Science	
		8	Introduction to Landforms	Geology	
		9	Basic Physics and Basic Computer -II	Home Science	
		10	Business statistics I	Mathematics	
		11	Introduction to Microscopy and staining	Microbiology	
		12	Energy sources	Physics	
		13	Statistical methods and psychological testing	Statistics	
		14	Industrial entomology	Zoology	
		15	Physical Chemistry	Cosmetic Technology	
		16	Computer Application in Design	Fashion Design	
		17	Computer Application in Designing	Textile Science	

B. Sc. Semester-II
GE / OE-3 Botany (BGO2T03)
Sustainable Agriculture

GE/OE-III Theory	Hours: 2 Hours/Week	Marks: 80+20=100	Credit: 2

Unit-I

Introduction — 7.5 Hrs.

1. Concept and importance of sustainable agriculture
2. General principles and goals of sustainable agriculture
3. History and policy for sustainable agriculture in India
4. Barriers or problems in adoption of sustainable agriculture
5. Farming system: Scope and types

Unit-II

Sustainable agriculture system: Objectives, Characteristics and advantages of following practices — 7.5 Hrs.

1. Organic farming.
2. Natural farming.
3. Biodynamic of agriculture.
4. Conservation agriculture.
5. Integrated farming system.
6. Precision farming.
7. Crop rotation and inter cropping
8. Vertical farming

Unit-III

Sustainable agriculture system: Objectives, Characteristics and advantages of following practices — 7.5 Hrs.

1. Permaculture.
2. Agroforestry.
3. Integrated pest management
4. Rain water harvesting- artificial ground water recharge.
5. Floating farming.
6. Mulching.
7. Vermi-composting.
8. Soil solarization.

Unit-IV

Factors affecting: sustainability of agricultural resources and control measures — 7.5 Hrs.

1. Land or soil related problems.
2. Irrigation related problems.
3. Indiscriminate use of agrochemicals.
4. Environmental pollution.
5. Erosion of genetic biodiversity.

Note: Field visits are compulsory.

Suggested readings

1. Gopal Chandra De. 1980., Fundamentals of Agronomy. Oxford and IBH Publishing Co. Ltd., Bangalore. 3) Hand book of Agriculture, ICAR Publication.
2. Panda, S.C., 2006. Agronomy Agribios Publication, New Delhi.
3. Reddy, S.R. Principles of Agronomy Kalyani Publishers, Ludhiana, India.
4. Sankaran, S and Subbiah Mudliyar, V.T., 1991. Principles of Agronomy. The Bangalore Printing and Publishing Co. Ltd., Bangalore.
5. Lampkin, N (1990) Organic Farming. Farming Press, Ipswich (ISBN 0 85236 191 2)
6. Kristensen, P., Taji, A. and Reganold, J. (2006). Organic Agriculture: A Global Perspective. CSIRO Press, Victoria, Australia.
7. Palsnnipsn S. P., Cropping systems in tropics- Principles and practices
8. Altieri, M. A. 1995, Agroecology: The Science and Sustainable Agriculture. 2nd EdnWestvies Press, Colorado.
9. A. Zaman. 2002 Watershed Management for Sustainable Agriculture in Indian Perspectives. 12th ISCO Conference
10. Chadha G. K. Sen S. and Sharma H. R. 2004. State of Indian Farmer: A Millenium Study, Vol.2: Land resources, Ministry of Agriculture, Govt of India.
11. Niti Gupta, Shanal Pradhan, Abhishek Jain and Nahya Patel (2021); Sustainable Agriculturein India: What we know and how to scale up. New Delhi. CEEW Report April 2021
12. Deb, D. L. 1994. Natural Resources Management for Sustainable Agriculture and Environment. Angkor Publishers Ltd., New Delhi.
13. Saroja Raman. 2006. Agricultural Sustainability- Principles, Processes and Prospects. Food products Press, New York.
14. Subramaniyan, S. 2004. Globalization of Sustainable Agriculture. Kalyani Publishers, Ludhiyana.

General Elective Paper (Biochemistry-Major)

Semester 2 : BIOETHICS (BGO2T03)

COURSE OUTCOMES:

This course is designed to provide:

1. To Understand the terms ‘ethics’ and ‘bioethics’;

2. To Demonstrate understanding of the biosciences and ethical considerations associated with a current advance in biotechnology, modern biomedicine, agriculture and in the utilization of natural resources.

3.Integrate the use of scientific facts and ethical principles and argumentation in discussing cases involving moral dilemmas;

4. Use and critically evaluate information gathered from a variety of sources; a Recognize the diversity of informed ethical opinions regarding the development of current advancements in biology and biomedicine;

5. Develop scientific attitudes, reflective processes and decision making skills; a Develop a sense of moral obligation and responsibility both in their relationship with nature and in their future professional activity.

UNIT I: Theoretical background to bioethics

The nature of bioethics (defining bioethics, history and philosophy, modern science, a new history of biology, the scientific method, bioscience and biotechnology, importance of bioethics for the biosciences); theories of ethics (introduction to ethics, ethics and morality, moral reasoning and major ethical theories)

UNIT: II. Environmental ethics

Interactions of humans with the natural world (the place of humans in nature, environmental values, origin and emergence of environmental ethics, ideas of stewardship and Gaia); current themes in environmental ethics (anthropogenic impact on the biosphere and precautionary principles, environmental sustainability); current issues in environmental ethics (terrestrial and aquatic pollution, global climate change, environmental degradation and loss of biodiversity, ecotourism and ethics); humans and non-humans animals (animal welfare and animal rights, human use of nonhuman animals, ethics of animal research, legislation for, and alternatives to animal experimentation).

UNIT: III Ethics of biotechnology

Genetic modification (general ethical issues related to genetic modification, application of genetic modification – pharmaceuticals, GM food and crops, genetic modification of animals, research use of genetic modification, GM and less-developed countries; GM microorganisms as bacteriological warfare; conception of risk, assessment, management, communication and

standards of risk; interpreting the precautionary principles);Introduction to the Human Genome Project.

UNIT: IV Biomedical ethics

Cloning and stem cells (ethics of human cloning, reproductive cloning and therapeutic cloning, embryonic stem cells and the status of the early human embryo, experiments on embryonic stem cells, legislation and therapeutic cloning); ethical aspects of the assisted reproductive technologies (artificial insemination and donor insemination, in vitro fertilization, surrogate mothering, designer babies etc. in brief)

Refrences:

1. Bryant J., Baggott la Velle L., Searle S. (2006) Introduction to Bioethics, John Wiley & Sons, Chichester.
2. Downie R., Clarkeburn H. (2005) Bioscience Education,
3. Encyclopedia of Bioethics (2004) 3rd Edition (Stephen G. Post, Ed.), Thomson Gale, p. xi.
4. Greenwell P. and McCulley M. (2007) Molecular therapeutics: 21st Century Medicine. John Wiley & Sons,Chichester.
5. Hristova S. (2009). Ethics in the world of biotechnology, Faber, Sofia. (in Bulgarian);.
6. Jonsen A. (1998) The Birth of Bioethics, Oxford University Press, Oxford.

SEMESTER – II

APPLICATIONS OF BIOTECHNOLOGY IN AGRICULTURE

Course Code: BGO2T03 **Total Contact Hours: 30**

Course Outcomes:
After successful completion of this Course, students will be able to:

CO 1. Understand the biotechnological applications in agriculture
CO 2. Comprehend the pros and cons of GM crops and their plant products
CO 3. Appreciate the biotechnological applications for effective pest control and crop improvements
CO 4. Understand the importance of molecular markers in agriculture

Unit I **8 hours**

Agricultural Biotechnology: Concept and scope of biotechnology in Agriculture; Plant tissue culture, micro propagation; entrepreneurship in commercial plant tissue culture; Banana tissue culture – primary and secondary commercial setups, Small scale bio enterprises: Mushroom cultivation

Unit II **7 hours**

Transgenic plants: The GM crop debate – safety, ethics, perception and acceptance of GM crops; GM crops case study: Bt cotton, Bt brinjal; Plants as biofactories for molecular pharming; edible vaccines, plantibodies, nutraceuticals.

Unit III **8 hours**

Pest control and crop improvement: Baculovirus pesticides, Mycopesticides; Post-harvest Protection: Antisense RNA technology for extending shelf life of fruits and shelf life of flowers; Genetic engineering for quality improvement: Golden rice, Seed storage proteins, Flavours– capsaicin, vanillin

Unit IV **7 hours**

Molecular marker aided breeding: RFLP maps, linkage analysis, RAPD markers, STS, microsatellite, SCAR (sequence characterized amplified regions), SSCP (single strand conformational polymorphism), QTL, map based cloning, molecular marker assisted selection

References:

• Chrispeels M.J. and Sadava D.E. (1994) Plants, Genes and Crop Biotechnology, 2nd Ed., Jones and Bartlett Publishers, Boston.

• Gamborg O.L. and Philips G.C. (1998) Plant cell, tissue and organ culture, 2nd Ed., Narosa Publishing House. New Delhi.

• Gistou, P. and Klu, H. (2004). Handbook of Plant Biotechnology (Vol. I & II). John Publication.

• Hammond J., McGarvy P. and Yusibov.V. (2000). Plant Biotechnology, Springer Publ.

• Heldt. H.-W. (1997). Plant Biochemistry and Molecular Biology. Oxford and IBH Publishing Co. Pvt. Ltd. Delhi.

• Kyte, L., Kleyn, J., Scoggins, H., and Bridgen M. (2003) Plants from test tubes. An introduction to micropropagation, 4th Ed., Timber Press, Portland.

• Murray D.R. (1996) Advanced methods in plant breeding and biotechnology. Panima Publishing Corporation.

• Nickoloff, J.A. (1995). Methods in molecular biology, Plant cell electroporation and electrofusion protocols-Humana Press Incorp, USA.

• Sawahel, W.A. (1997). Plant genetic transformation technology. Daya Publishing House, Delhi.

B.Sc. Sem-II (Computer Science)
BGO2T03

PROGRAMMING IN 'C'

Credits : 2 **Duration : 30 Hours**

Course Objectives:

1.To formulate simple algorithms for arithmetic and logical problems.
2.To translate the algorithms to programs (in C language).
3.To test and execute the programs and correct syntax and logical errors.
4.To implement conditional branching, iteration and recursion.
5. To implement operations on arrays, strings , structures, unions , functions and file handling.

Course Outcomes :

After completing this course satisfactorily, a student will be able to:
1. Write simple algorithms for arithmetic and logical problems.
2. Write the C code for a given problem
3. Perform input and output operations using programs in C
4. Write programs that perform operations on arrays, strings , structures, unions , functions and file handling.

UNIT I

Programming Structure: Sequence, Selection, Iteration and Modular. Problem Solving techniques: Development Tools: Algorithm, Flowcharts and Pseudo code (Definition and its characteristics) Developing Algorithm and Drawing flowcharts

UNIT II

C Character set, Tokens, Identifier, Keywords, Variables, Data types, Qualifiers. Operators and Expressions: Arithmetic, Relational, Logical, Bit-Wise, Increment, Decrement, Conditional and Special operators. typedef, Type Conversion, Constants, Declaring Symbolic Constants, Character Strings, Enumerated Data Types, Operator Precedence and Associativity. Library functions: Maths, string handling Functions. Control Structure: Compound Statement, Selection Statement: if, if-else, Nested if, switch. Iteration statement: for, while, do...while, Nested loops, Jump statements: break, continue, goto (Special emphasis on problem solving)

UNIT III

Arrays: Need, Types: Single and Two Dimensional Array.
Strings: Strings Manipulation, Arrays of Strings, Evaluation order
Function: Function Components, Return Data type, Parameter Passing, Return by Reference, Default Arguments, Recursive Functions, Arrays with Functions, Storage Classes. (Special emphasis on problem Solving)

UNIT IV

Structure: Declaration, Definition, Accessing structure members, Initialization, Nesting of Structures.

Union: Unions, Differences between Structure and Union
Pointer: Introduction, Address Operator (&), Pointer variables, void pointers, Pointer Arithmetic, Pointers to Pointers.
File handling: Hierarchy of File Stream Classes, Opening & closing a file, Testing for errors, File Modes, File pointers and their manipulations, Sequential Access, Random Access, Command Line arguments.

Books

1. The Art of programming through flowcharts & algorithm by Anil B. Chaudhari Firewall Media, Laxmi publication, New Publication.
2. Programming in C by E. Balagurusamy TMH Publications.
3. C Programming – KernighenRitche
4. Programming with C – Y. Kanetkar.
5. C Programming – Holzner, PHI Publication.
6. Programming in C – Ravichandran.

Semester – 2; OE1: PC ASSEMBLY & MAINTENANCE (BG02T03)

Course outcome:

At the end of this course students will have ability to

1. Identify basic terms, concepts, functions, and operations of personal computer (PC) system components.

2. Complete installations of memory modules, system boards, processors, power supplies, adapter boards, storage devices, and multimedia devices. 3 Analyse common symptoms and problems associated with PC components and provide solutions to troubleshoot and isolate the problems. Identify the purpose of various types of preventive maintenance products and procedures.

Syllabus :

1. Introduction to PC Hardware: Study of basic I/O systems, Types of Memories- Static RAM and Dynamic RAM, ROM, PROM, EPROM, EEPROM, CPU (Central Processing Unit)- ALU and control unit.
2. Motherboard and Processor: Study of different types of Motherboards, Motherboard Configuration, Identifying Internal and External connectors, Types of data cables, Types of Processors- Intel Celeron, P4 family, Xeon dual core, quad core, core2 duo, i3, i5, i7 and AMD.
3. BIOS Configuration: Study of BIOS Set-up- Advance set-up, Boot configuration, Boot Menu. Installation of OS (Operating Software) Windows installation. Hard Disk: Formatting of Hard disk, Partitioning of Hard disk in different logical drives, Disk defragmentation, Disk clean up, Scan disk etc.
4. Troubleshooting: Motherboard drivers, LAN, Audio, and Video. Configuration of External devices: Printers, Scanner set-up, Webcam, Bluetooth device, Memory card reader etc. Diagnostic and troubleshooting of PC: POST (Power on Self-Test), identifying problems by Beep codes errors, checking power supply using Multi-meter, Replacement of components etc. Antivirus and Application Software

Books:

1. Troubleshooting, Maintaining and Repairing PCs by Stephen J. Bigelow
2. The Complete PC Upgrade and Maintenance Guide by Mark Minasi.

OE/GE-3 : Introduction to Climate Crises

Unit-I:

Climate Change: Definition, scope and facts of climate change, Composition and thermal structure of atmosphere, weather and climate. Meteorological parameters – temperature, pressure, precipitation, humidity, wind speed and direction.

Monsoons: Definition, Indian monsoons – seasons: cold weather season (winter), the hot weather season (summer), season of advancing monsoon (rainy season) and season of retreating monsoon (the transition season), cyclones of the Indian region; El-Nino and La-Nina and their impacts.

Unit-II:

Air Pollution: types of air pollution. Air pollutants, Co-relation between air pollution and climate crisis. Impact of air pollution, Mitigation methods. Case studies of air pollution disasters. **Acid rain**: chemistry of acid rain, impacts of acid rain, mitigation measures of acid rain.

Greenhouse effect and global warming: Definition, impacts, major greenhouse gases, sources and sinks of greenhouse gases, global dimming and global warming potential, black carbon and carbon footprint.

Unit-III:

Impact of climate change: Influence on agriculture, climate change and food security, water stress and water insecurity, rise in sea levels, loss of biodiversity and extinction of species, vectorborne/zoonotic diseases, increase in floods and drought incidences.

Mitigation strategies of climate change: Carbon sequestration, carbon sink, carbon credit, carbon offsetting, carbon tax, geo-engineering.

Unit-IV:

Climate change and policy frameworks: United Nation Framework Convention on Climate Change (UNFCCC), The United Nation Conference on Environment and Development, Inter-governmental Panel on Climate Change (IPCC), The Kyoto Protocol, Paris Agreement.

India and Climate Change: Ministry of Environment, Forest and Climate Change (MoEF and CC), India's National Plan on Climate Change, The National Mission on Strategic Knowledge for Climate Change (NMSKCC), National Mission for Sustainable Agriculture (NMSA), National Bio-Energy Mission.

References :

1. Abhishek Tiwary and Jerem Colls.(2020). Air Pollution: Measurement, Modelling andMitigation.III Edition, Routledge Publication.
2. Agarwal.K.M, Sikdar P.K and Deb S.C. (2002). A Text book of Environment MacMillerIndia Ltd., Culcutta.
3. Climate Change: Science and Politics. (2021). Centre Science and Environment, NewDelhi.
4. Donald Ahrens. C. (2008). Essential of Meteorology: An Invitation to the Atmosphere.Cengage Learning Publication.
5. Howard J. Critchfield.(1983). General Climatology (4th Edition), Phi Learning Pvt Ltd.
6. IPCC. (2006). Guidelines for National Green house gas Inventories. Published by the Institute for Global Environmental Strategies (IGES), Hayama, Japan on Behalf of the IPC.
7. John E. Oliver, John J Hidore. (2002). Climatology: An Atmosphere Science, SecondEdition. Printice Hall Publication.
8. John T. Hardy. (2003). Climate Change: Causes, Effects and Solution. John Wiley andSons Publication.
9. Mann, M.E. (2021 The New Climate War: The Fight to take back our planet, HachetteUK.
10. Nicholas Stern.(2008). The Economics of Climate Change: The Stern Review. Cambridge University Press, Great Britain.
11. Rajit Sengupta and Kiran Pandey, (2021). State of India's Enironment 2021: In Figures.Centre Science and Environment, New Delhi.
12. Roger G. Barry and Richard J. Chorley. (2007). Atmosphere, Weather and Climate, 8th Edition, Routledge Publication.
13. Shankar IAS Academy (2016). Environment 4th Edition. Chennai (India).

Semester II

GE/OE (Forensic Science)

GE 1 (BGO2T03): Introduction to Forensic Auditing, Forensic Accounting and Fraud Assessment

Learning Outcomes: By the end of this Course, the learners will be able to:

1. Apply the principles of forensic auditing and understand the fundamental concepts of forensic auditing and its role in investigating financial irregularities.
2. Understand the different types of fraud, including financial statement fraud, employee embezzlement, and corruption schemes.
3. Utilize forensic accounting techniques, including data analysis, financial statement reconstruction, asset tracing, and forensic interviews.
4. Develop strong written and verbal communication skills to present their forensic audit findings and fraud assessment reports.
5. Collaborate effectively with other professionals, to gather evidence, analyze complex financial transactions, and build strong legal cases.

Unit-I: Basics of Forensic Auditing

Introduction to Forensic Auditing, the difference between a general audit and Forensic Audit, Legal and Regulatory Framework, Understanding the legal and ethical considerations in forensic auditing, Fraud Examination Techniques, Introduction to data analytics in forensic auditing, Investigative Procedures and Evidence Gathering, Fraudulent Financial Reporting, Case Studies and Real-World Applications, Ethical Considerations in Forensic Auditing

Unit-II: Basic of Forensic Accounting

Forensic Accounting, basics of Forensic Accounting, the difference between general and Forensic accounting, principles of Forensic Accounting and fraud examination, Roles of a forensic accountant, forensic accounting services, forensic accounting skills; critical thinking, reasoning and communication.

Unit-III: Fraud Assessment I

Introduction to fraud; definition of fraud, Role of fraud assessment in forensic auditing, Importance of proactive fraud risk management different types of frauds such as insurance frauds, management fraud, financial statement fraud (revenue and inventory related frauds), disclosure frauds (consumer fraud, identity theft, scams, money laundering), tax fraud, fraud in e-commerce.

Unit-IV: Fraud Assessment II

Nature of fraud, fraud cycle, fraud schemes and red flags. Fraud prevention and fraud detection, recognizing symptoms of fraud, fraud investigation, fraud risk assessment. Emerging Trends and Technologies in Fraud Assessment, Introduction to technological advancements in fraud assessment, Use of artificial intelligence, machine learning, and data mining in fraud detection Future challenges and opportunities in fraud assessment

GE/OE (Forensic Chemistry)

GE 1 (BGO2T03): Chemistry of Natural and Synthetic Molecules

Course Outcomes: By the end of this Course, the learners will be able to:

1. Examine the classification, structure, properties and biological importance of synthetic sugar and natural sugars and its significance in forensic science.
2. Recall and understand the fundamentals of dyes and paints along with their nature, classification, composition use and significance in forensic science.
3. Understand the nature, structure and physical properties of fats and oils.
4. Understand the structure, types, properties, preparation, and application of polymers and its significance in forensic science.

Unit I: Sugars

Introduction, Classification, Properties and Biological importance. Natural and synthetic sugars, structures of glucose, reducing and non-reducing sugars, significance in forensic science

Unit II: Dyes and Paints

Dyes & Paints: Introduction, Nature, classification, composition, uses. Paints. Components of paint: binders, pigments, solvents, additives; Role and properties of each component in paint formulation; Common types of paints and their distinguishing features. Forensic significance of Dyes and Paints.

Unit III: Oils and fats

Introduction, Structures of Fats and Oils, Physical Properties of Fats and Oils, Physical Properties of Fats and Oils, Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils. Analytical constants: Acid value, Saponification value, Iodine value, significance and principle involved in their determination.

Unit IV: Polymers

Introduction, General idea of structures, types of polymerization processes, properties of polymers, Structure, preparation and applications of Polyethylene, Teflon, PVC, Polystyrene, etc. Significance in Forensic Science

GE/OE (Forensic Physics)

GE 1 (BGO2T03): Instrumentation Aids

Course Outcomes: By the end of this Course, the learners will be able to:

1. Remember the basic principles of electromagnetic radiation and its properties.
2. Apply the appropriate electromagnetic radiation sources such as UV, visible and IR rays etc. for specific forensic analysis.
3. Understand the basic structure and basic concept of optical fiber and remembering different types of optical fibers used in forensic physics.
4. Understanding the working mechanisms of various transducers and their applications.
5. Understand the principles of detection and signal processing and the working mechanisms of different detectors and their applications.

Unit I: Electromagnetic Radiation Sources

Conventional Sources for UV, Visible and Infrared Rays, Sources of Radiations for X-Rays, Laser (Ruby, He-Ne, CO_2, Dye Laser, Semi-Conductor Laser).

Unit II: Optical Fibres

Importance of Optical Fiber, Propagation of Light Waves in Optical Fiber, Basic Structure, Stepped Index Monomode Fiber, Graded Index Fiber, Acceptance Angle and Acceptance Cone, Numerical Aperture, Fiber Losses and their Units (Basic Concept), Electrical and Optical Band Width, Bandwidth Length Product, Dispersion in Optical Fiber.

Unit III: Transducers

Strain Gauge, Resistance Thermometer, Thermocouple, Thermistors and its Applications, Microphone & Loudspeaker, Photo-Electric Transducers, LVDT

Unit IV: Detectors

Photographic Detectors, Thermal Detectors, Photoelectric Detectors, PMT and Semiconductor Detectors. Construction and Working Principle of Ionization Chamber, Proportional Counter, Geiger Muller Counter, Scintillation Counter, Solid State Detectors.

GE/OE (Forensic Biology)

GE 1 (BGO2T03): Basics in Microbial Forensics

Course Outcomes: By the end of this Course, the learners will be able to:

1. Understand the concept of microbiology, bioterrorism, bio-surveillance, biodefence, biotoxin and their aspect in forensic science.
2. Recall and understand the structure of bacteria and viruses along with their different culturing techniques.
3. Gain a comprehensive understanding of the functioning of Recombinant DNA technology and its significance in forensic science, Polymerase Chain Reaction, its history and development, different types of vectors and restriction enzymes.
4. Examine the growth curve of bacteria and analyze concepts such as reproduction of bacteria, control of bacteria and different staining technique.

Unit-I: Introduction to Microbiology

Introduction of Microbiology, History, and Development of Microbiology; Whittaker Classification system; General structure of Bacteria and Viruses; Types of culture media (basal, selective, differential, enriched, enrichment); Culturing techniques of microorganisms (Streak plate and pour plate method).

Unit-II: Bacterial Reproduction, Control, and Culture Techniques

Reproduction of bacteria; Control of microorganisms (Chemical and Physical); Growth curve of bacteria; continuous culture and synchronous culture of bacteria; Staining of bacterial cells (Simple and differential).

Unit-III: Recombinant DNA Technology and Forensic Applications

Introduction to Recombinant DNA technology (RDT): History and development; Types of vectors (Plasmid, Cosmid, YAC, BAC); Restriction enzymes; Joining of DNA molecules; Introduction to PCR; Forensic significance of RDT.

Unit-IV: Microbial Forensics, Bioterrorism, and Biological Toxins

Introduction to microbial forensics, the critical elements, the sample collection methods and guidelines, the various detection methods and the result interpretation. Bioterrorism; Types of biological agents (Category-A, B, C); Bio surveillance; Biodefence; Forensic aspects of biological toxins (Ricin, Botulin).

B.Sc. Sem-II (Forensic Science - Major)

GE/OE (Psychology)

GE 1 (BGO2T03): Basics of Clinical Psychology

Course Outcomes: By the end of this Course, the learners will be able to:

1. Understand the fundamentals and characteristics of clinical psychology
2. Explore the activities of clinical psychologists, such as assessment, treatment, research, teaching, consultation, and administration.
3. Evaluate the scope and advancements in clinical psychology, including evidence-based practice, training, and different models of treatment delivery in the healthcare environment.
4. Analyze the ethical standards in clinical psychology, including principles of honesty, lack of bias, responsible caring, professional competence, and integrity in professional relationships.

Unit-I Basics of Clinical Psychology

Introduction and definition of clinical psychology, Historical overview of clinical psychology, characteristics of clinical psychology, Role of clinical psychologist, Legal, Educational, and Ethical Requirements to Be a Clinical Psychologist, Clinical Psychology and the Related Mental Health Professions. Qualification for clinical psychologist.

Unit-II: Clinical Psychologists at Work

Activities of Clinical Psychologists (Assessment, Treatment, Research, Teaching, Consultation, Administration, Employment Settings of Clinical Psychologists. Working with children and Family, working with adult, Working with people having disability and serious health issues and working with person of dementia.

Unit-III: Clinical Psychology in the 21st Century

Scope of clinical psychology, Evidence based practice, Clinical Psychology Training, Eclecticism and Integration, The Health Care Environment, Managed Care, Managed Care, Models of Treatment Delivery.

Unit-IV: Ethics in Clinical psychology

Ethical standards in clinical psychology, General principle, Value statement, honesty, lack of Bias, Responsible caring, professional competence and responsibility/ honesty and integrity in professional relationships.

GE/OE (Digital & Cyber Forensics)

GE 1 (BGO2T03): Office Automation

Course Outcomes: By the end of this Course, the learners will be able to:

1. Remember the basic functions of word processing software, such as creating, editing, and formatting documents.
2. Understand the basic features of MS Word, MS office, MS excel, MS power point and Open Office Writer, calc., base, and impress respectively. for collaboration and version control.
3. Apply the MS PowerPoint and OpenOffice Impress to create visually engaging presentations of forensic findings.
4. Evaluate the effectiveness of different document formats for preserving metadata and maintaining data integrity in forensic analysis.
5. Create the design and templates for forensic reports, data analysis, or presentation purposes using MS Word, MS Excel, MS PowerPoint, or OpenOffice applications.

Unit I: Introduction to MS Office - MS Word and Open Office – Writer

MS Word - Working with Documents -Opening & Saving files, Editing text documents, Inserting, Deleting, Cut, Copy, Paste, Undo, Redo, Find, Search, Replace, Formatting page & setting Margins, Converting files to different formats, Importing & Exporting documents, Sending files to others, Using Tool bars, Ruler, Using Icons, using help, **Formatting Documents** - Setting Font styles, Font selection- style, size, colour etc, Type face - Bold, Italic, Underline, Case settings, Highlighting, Special symbols, Setting Paragraph style, Alignments, Indents, Line Space, Margins, Bullets & Numbering. **Setting Page style -** Formatting Page, Page tab, Margins, Layout settings, Paper tray, Border & Shading, Columns, Header & footer, Setting Footnotes & end notes – Shortcut Keys; Inserting manual page break, Column break and line break, Creating sections & frames, Anchoring & Wrapping, Setting Document styles, Table of Contents, Index, Page Numbering, date & Time, Author etc., Creating Master Documents, Web page. **Creating Tables**- Table settings, Borders, Alignments, Insertion, deletion, Merging, Splitting, Sorting, and Formula, **Drawing -** Inserting Clip Arts, Pictures/Files etc., **Tools –** Word Completion, Spell Checks, Mail merge, Templates, Creating contents for books, Creating Letter/Faxes, Creating Web pages, Using Wizards, Tracking Changes, Security, Digital Signature. **Printing Documents–** Shortcut keys.

Free Open Source Software: OPEN OFFICE - WRITER: Introduction to Open Office Suite - Selecting the application package, working with Documents- Formatting Documents - Setting Page style- Creating Tables - Drawing- Tools - Printing Documents - Operating with MS Word documents.

Unit II: Introduction to MS Office – MS Excel and Open Office – Calc

MS Excel: Spread Sheet & its Applications, Opening Spreadsheet, Menus - main menu, Formula Editing, Formatting, Toolbars, Using Icons, Using help, Shortcuts, Spreadsheet types. Working with Spreadsheets- opening, Saving files, setting Margins, Converting files to different formats (importing, exporting, sending files to others), Spread sheet addressing - Rows, Columns & Cells, Referring Cells & Selecting Cells – Shortcut Keys. **Entering &**

Deleting Data- Entering data, Cut, Copy, Paste, Undo, Redo, Filling Continuous rows, columns, Highlighting values, Find, Search & replace, Inserting Data, Insert Cells, Column, rows & sheets, Symbols, Data from external files, Frames, Clipart, Pictures, Files etc, Inserting Functions, Manual breaks, **Setting Formula -** finding total in a column or row, Mathematical operations (Addition, Subtraction, Multiplication, Division, Exponentiation), Using other Formulae. **Formatting Spreadsheets-** Labelling columns & rows, Formatting- Cell, row, column & Sheet, Category - Alignment, Font, Border & Shading, Hiding/ Locking Cells, Anchoring objects, Formatting layout for Graphics, Clipart etc., Worksheet Row & Column Headers, Sheet Name, Row height & Column width, Visibility - Row, Column, Sheet, Security, Sheet Formatting & style, Sheet background, Colour etc, Borders & Shading – Shortcut keys. **Working with sheets** – Sorting, Filtering, Validation, Consolidation, and Subtotal**. Creating Charts -** Drawing. **Printing. Using Tools –** Error checking, Spell Checks, Formula Auditing, Creating & Using Templates, Pivot Tables, Tracking Changes, Security, Customization.
OpenOffice-Calc - Introduction – Introduction to Spreadsheets, Overview of a Worksheet, Creating Worksheet & Workbooks, Organizing files, Managing files & workbooks, Functions & Formulas, Working with Multiple sheets, Creating Charts & Printing Charts – Operating with MS Excel documents, which are already created and saved in MS Excel.

Unit III: Introduction to MS Office-MS Access and Open Office-Base

MS Access: Introduction, Planning a Database, Starting Access, Access Screen, Creating a New Database, Creating Tables, Working with Forms, Creating queries, Finding Information in Databases, Creating Reports, Types of Reports, Printing & Print Preview – Importing data from other databases viz**.** MS Excel etc.
OpenOffice-Base – Introduction- Database Concepts – Creating a New Database, Creating Tables, Working with Forms, creating queries, Finding Information in Databases, Creating Reports, Types of Reports, Printing and Printing preview – Operating with other databases i.e. MS Access etc.

Unit IV: Introduction to MS Office-MS Power Point and Open Office-Impress

MS Power point: Introduction to presentation – Opening new presentation, Different presentation templates, setting backgrounds, selecting presentation layouts. **Creating a presentation** – Setting Presentation style, Adding text to the Presentation. **Formatting a Presentation** - Adding style, Colour, gradient fills, arranging objects, Adding Header & Footer, Slide Background, Slide layout. Adding Graphics to the Presentation- Inserting pictures, movies, tables etc into presentation, Drawing Pictures using Draw. **Adding Effects to the Presentation-** Setting Animation & transition effect**. Printing Handouts,** Generating Standalone Presentation viewer.
OpenOffice-Impress - Introduction – Creating Presentation, Saving Presentation Files, Master Templates & Re-usability, Slide Transition, Making Presentation CDs, Printing Handouts – Operating with MS Power Point files / slides.

B.Sc. Sem-II (Forensic Science - Major)

GE/OE (Law)

GE 1 (BGO2T03): Criminal Law I

Learning Outcomes: By the end of this Course, the learners will be able to:

1. Understand the criminal law by interpreting and explaining the provisions of IPC 1860 related to offenses affecting the human body, offenses against property, and offenses relating to coins and government stamps.
2. Apply their knowledge of criminal law to practical scenarios.
3. Analyze legal provisions and case laws related to offenses affecting the human body, offenses against property, and offenses relating to coins and government stamps.
4. Synthesize their knowledge and skills to propose legal strategies and solutions in criminal law cases.
5. Evaluate the ethical considerations, legal principles, and forensic evidence in the investigation, prosecution, and adjudication of these offenses.

Unit I: Introduction to Indian Penal Code, 1860

Historical background**,** Jurisdiction under the Code**,** Definitions**,** Punishments**,** General Exceptions.

Unit II: Offences affecting the Human Body

Culpable homicide and Punishment for culpable homicide not amounting to murder. Murder and Punishment for murder. When culpable homicide is not murder. Punishment for murder by life-convict. Causing death by negligence. Dowry death. Abetment of suicide. Attempt to murder. Hurt and Grievous hurt. Sexual offences, Unnatural Sexual offences.

Unit III: Offences against Property

Theft, Extortion, Robbery and Dacoity. Criminal Misappropriation of Property. Criminal Breach of Trust. Receiving of Stolen Property. Cheating. Fraudulent Deeds and Dispositions of Property.

Unit IV: Offences relating to Coins, Government Stamps, etc.

Counterfeiting of coin, Government Stamps. Offences relating to Weights And Measures. Offences relating to Documents. Offences relating to Property Marks and other marks. Offences relating to Currency-Notes and Bank-Notes.

SEMESTER - II

Paper I: Introduction to Landforms (BGO2T03)

Unit I

From of Earth; atmosphere; hydrosphere; biosphere; weathering and erosion; differential weathering; products of weathering

Unit II

Concept of diastrophism; types of diastrophism – epeirogenic movements (continental building movements), orogenic movements (mountain building movements); sudden movements, slow and secular movments; evidences for upliftment of land; evidences for subsidence of land

Unit III

Development of (drainage) rivers system; identification and naming of streams; concept of drainage area, altitude, volume, slope, profiles of the land and drainage basin characteristics; stream order, stream length, mean stream length, stream length ratio.

Unit IV

River profiles; sea profiles; types of coast lines; coral reafs; ice sheets; glaciers; desertic lands.

Recommended Books

1. Arthur Holmes (1978) Principles of Physical Geology
2. Emmons, Thiel, Staffer and Allison: Geology principles and Processes.
3. Hamblin, Kenneth: The Earths' Dynamic System.
4. Sawkins, Chase, Darby and Rapp: The Evolving Earth: A Text Book in Physical Geology.
5. Mallory and Cargo: Physical Geology.
6. Judson Kauffman and Leet: Physical Geology.
7. Skinner and Porter: The Dynamic Earth: An introduction to Physical Geology.
8. Tarbuck and Lutgens: The Earth: An introduction to Physical Geology.
9. Manroe and Wicander: Physical Geology: Exploring the Earth

SEMESTER II

2. BUSINESS STATISTICS –I

Course Outcomes: This course will enable the students to

1. Translate the real word problems through appropriate statistical modellling.
2. Explain the concepts and use equations, formulae and statistical expression and relationship in a variety of context.
3. Analyze and demonstrate the statistical skill require in intensive areas in economics and business.

UNITS	TOPICS	HOURS
Unit 1	Permutations and combinations, Set theory, Logarithm, Binomial theorem, Compound interest, Annuities	**8**
Unit 2	Charts & Diagrams, Collection, Classification & Presentation of business statistical data	**8**
Unit 3	Frequency Distribution, Frequency Curve and Analysis of data	**7**
Unit 4	Measure of central tendency and Measure of dispersion	**7**
	TOTAL	**30 HRS**

Recommended Books:

1. Fundamental of Mathematical Statistics, B L Agarwal, S. Chand
2. Business mathematics of Statistics., N.G. Das, J. K. Das, Mc Graw Hill
3. Statistical Methods, Gupta S. P.: Sultan Chand and Sons, New Delhi.
4. Fundamental of Mathematical Statistics, S.C. Gupta, V. K. Kapoor, Sultan Chand & Sons

INTRODUCTION TO MICROSCOPY & STAINING Course Code: BGO2T03			
GE/OE	**Hours: 2 Hours/Week**	**Marks: 80+20=100**	**Credit: 2**
Unit-I			
Microscopy I	1. Discovery of Microscope 2. Properties of Light 3. Simple Microscope 4. Compound microscope—Bright field Microscopy, 5. Principle, applications and ray diagram Dark field Microscopy,		**7.5 Hrs**
Unit-II			
Microscopy II	**Principle, applications and ray diagram:** 1. Transmission Electron microscopy 2. Scanning Electron microscopy 3. Phase-contrast microscopy, 4. Fluorescent microscopy		**7.5 Hrs**
Unit III			
Staining Techniques I	1. Stains & dyes, chromophore, auxochrome & chromogenes 2. Types of stains 2. Theories of staining 3. Staining techniques : Simple, negative staining, 4. Differential staining- Gram staining		**7.5 Hrs**
Unit IV			
Staining Techniques II	Special staining Technique 1. Acid-fast staining 2. Flagella staining 3. Endospores staining 4. capsule staining 5. Inclusion bodies staining		**7.5 Hrs**

Reference books -

1. Introduction to Microbial Techniques by Gunasekaran
2. Microbiology: Fundamentals and Applications by Ronald M. Atlas, New York: Macmillan Publication
3. Powar C. B. and Daginawala H. I. (2005). General microbiology Volume I. Himalaya Publishing House Private Limited, Pune, India.
4. Powar C. B. and Daginawala H. I. (2005). General microbiology Volume II. Himalaya Publishing House, Private Limited, Pune, India
5. Debnath M., Prasad G. B. and Bisen P. S. (2012). Microbes: Concepts and Applications. Germany: Wiley.
6. Pelczar M. J. Jr., Chan E.C.S. and Krieg N. R. (2010). Microbiology: An Application based Approach. McGraw-Hill Education (India) Private Limited, New Delhi, India.
7. Pierce B. E. and Leboffe M. J. (2019). Microbiology: Laboratory Theory and Application: Essentials. United States: Morton Publishing

COURSE OUTCOMES

After this course the students will be able to

Sr. No.	Course outcome
1.	Students will be able to understand the needs and basics of techniques used in observing microbes.
2.	Students will be aware of applications of basic techniques.
3.	Handling and use of microscopes for the study of microorganisms which are among the basic knowledge expected from a practicing microbiologist.

FYUGP Semester-II
Generic Elective / Open Elective Course (GE/OE-2) (BGO2T02)
(Energy Sources)

GE/OE-2 THEORY	**Hours: 04 Hours /Week**	**Marks: 80 + 20 = 100**	**Credit: 02**
Unit-I			
Conventional and Non-conventional energy Sources, Solar Energy	Conventional and Non-conventional energy Sources: Fossil fuels and Nuclear Energy, their limitation, need of renewable energy, Solar Energy: Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems. Solar energy utilization by Solar roof panels.		**7.5 Hrs**
Unit-II			
Ocean Energy, Tidal energy, Geothermal Energy	Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. Tidal energy, Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power. Geothermal Energy: Geothermal Resources, Geothermal Technologies. (02 L)		**7.5 Hrs**
Unit -III			
Hydro Energy, Biomass energy, Wind Energy	Hydropower resources, hydropower technologies, environmental impact of hydro power sources. Biomass, biochemical conversion, biogas generation, Ocean biomass Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies		**7.5 Hrs**
Unit -IV			
Piezoelectric Energy, Electromagnetic Energy	Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power Linear generators, physics mathematical models, recent applications, Carbon captured technologies, cell, batteries, power consumption Environmental issues and sustainability of renewable energy sources.		**7.5 Hrs**

Reference Books:

1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
2. Solar energy - M P Agarwal - S Chand and Co. Ltd.
3. Solar energy - Suhas P Sukhatme Tata McGraw - Hill Publishing Company Ltd.
4. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University.
5. Solar Energy: Dr. P Jayakumar, Resource Assesment Handbook, 2009
6. Photovoltaics, J.Balfour, M.Shaw and S. Jarosek, Lawrence J Goodrich (USA).

Course outcomes

After the completion of this course students will be able

Sr. No	Course outcome
1.	To impart knowledge of basic concepts of Conventional and Non-conventional Energy Sources.
2.	To get the knowledge and methodology necessary for Solar, Ocean, geothermal, Hydro and Biomass energy resources.
3.	To learn the efficiency of the technology available for using source of energy and the environmental impact of using that source.
4.	To apply the knowledge of Energy Sources to real life problems.
5.	To create scientific temperament related to Energy Sources.

	Semester II (GE/OE)
	Name of the Paper - Statistical Methods And Psychological Testing
	Paper code – (BGO2T03) 2 Credits (2 hrs Theory per week)
	Course Objectives
	To introduce basic statistical methods, psychological testing and qualitative methods and their uses.
	Course Outcomes (CO)
	Statistical methods play a critical role in the field of psychology by helping researchers to draw meaningful conclusions from their data. It is important for psychologists to have a solid understanding of statistical methods so that they can design effective studies and accurately interpret their findings. After the successful completion of the course, the students will have knowledge of different psychological testing and qualitative methods and their uses.
	CONTENTS
	Unit 1 (15 Hrs)
(A)	**Data:** Ungrouped and grouped, frequency distribution. Graphical representation of data: Histogram and Frequency Polygon. Primary and Secondary data,; Tabulation of data; Graphs and charts; Frequency distributions;
(B)	**Application:** Diagrammatic presentation of data ,Graphical representation
(C)	**Data analysis** **Measures of central tendency**: Mean, Median, Mode (Properties and Computation of grouped & ungrouped data) **Application**: Computation of statistical problems.
(D)	**Measures of Dispersion** Meaning and objectives of measures of dispersion. Essentials of a good measure of dispersion, absolute and relative measures of dispersion. Types of measures of dispersion- Range, Quartile deviation, Mean deviation and standard deviation with relative measures – definition, merits and demerits. Properties of Standard deviation, simple problems on ungrouped and grouped data. Computation of standard deviation
(E)	**Correlation**: Meaning & types: Spearman's Rank Correlation
	Pearson's Product Moment correlation , Normal Probability Curve (NPC): Properties
	Unit II (15 Hrs)
(A)	**Test of Significance**: All applications of Chi Square test , All applications of 't' test.
(B)	**Psychological Testing**: Introduction to psychological testing, characteristics of Psychological test, Reliability, Validity, Norms and standardization. Types of tests.
(C)	**Qualitative methods:** Methods of data collection - Interview, observation, case study.
(D)	**Application:** Use of psychological test in day to day life
	References
1	Chadha, N. K. (1991): Statistics for Behavioral and Social Sciences. Reliance Pub. House: New Delhi.
2	Garrett, H. E. & Woodworth, R. S. (1987): Statistics in Psychology and Education. Mumbai, Vakils, Feffer & Simons Pvt. Ltd.
3	Gregory, R. J. (2006): Psychological Testing: History, Principles, and Applications (4th Ed.) New Delhi: Pearson Education
4	King, B. M. & Minium, E. W, (2007): Statistical Reasoning in the behavioral Sciences USA: John Wiley & Sons

GE/OE for B.Sc. II Industrial Entomology BGO2T03

Credit: 2

Course outcomes: After completion of the course, students will able to-

- Understand, describe and explain the Mulberry sericulture
- Understand, describe and explain Tasar sericulture.
- Understand, describe and explain Eri sericulture
- Understand, describe and explain lac culture.
- Understand, describe and explain agricultural and medical pests.
- Understand, describe and explain apiculture.

Unit 1- Mulberry sericulture

1.1 Mulberry sericulture:- life history and rearing.

1.2 Silk gland of mulberry silkworm:- structure and silk synthesis.

1.3 Cocoon formation, cocoon harvesting and reeling.

1.4 Mulberry plantation and silkworm rearing house.

Unit 2- Tasar sericulture

2.1 Tasar silkworm biology and life cycle.

2.2 Mature tasar larvae, silk gland and silk proteins.

2.3 Hammock and cocoon formation, cocoon harvesting.

2.4 Natural host plants and predators of tasar silkworm.

Unit 3- Eri, lac culture , agricultural and medical pests

3.1 Eri silkworm biology and life cycle.

3.2 Lac insect- biology, lac cultivation and economic importance.

3.3 Agricultural pest: pest of paddy, pest of vegetables, pest of stored grain

3.4 Insect vectors spreading diseases in human (Malaria, Filarial, Kala- Azar).

Unit 4- Apiculture

4.1 Types of honey bees, *Apis dorsata, A. indica and A. melifera*.

4.2 Colony formation and Apiary products.

4.3 Beekeeping techniques: moveable frame hive and bee rearing management.

4.4 Economic importance honey, wax and other apiary products.

Suggested reading:

K.K. Nayar, T. N. Ananthkrishan and B.V. Davis. General and Applied Entomology, Tata McGraw -Hill Co.Ltd., pp. 589.

D. B. Tembhare. Modern Entomology(Second edition):, Himalaya Publication House.

C. L. Metcalf, W. P. Flint and R. I. Metcalf . Destruction and Useful Insect, Their Hanits and Control, , Mc Grow I Ill Co. New York.

H. S. Dennis. Agriculture Entomology, , Timber Press Inc.

Alford V. David. Text Book of Agriculture Entomology, Blackwell Science.

Textile Science

Four Year (Eight Semester Degree Course)

Semester - II
GE/OE - Computer Application in Design (BGO2T03)

Theory Marks	**:50**	**Practical**	**: 50**	**Total Credits**	**: 2**
SEE	:40	SEE	: 25	Theory	: 1
CIE	:10	CIE	: 25	Practical	: 1

Time Required: 45 Hours

Theroy **(15 Hours)**

Objectives

1. To help student to understand the fundamentals and principle of CAD
2. To explain the structure, features and concept of Hardware and software.
3. To help student to learn basic presentation skill
4. To help students to learn basic e mail and web use

Learning outcomes: Students will be able to understand the basic uses of MS Office and develop assignments by using the software effectively. Students will be able to understand the concept of E mail basics and handling.

Unit I: **(3 Hours)**

In Put Device

1.1 CAD – Definition
1.2 Digitizers
1.3 Image Scanners
1.4 Bar Code Reader, OMR & OCR,

Unit II : **(4 Hours)**

Out Put Device

2.1 Printers
2.2 Classification of Printers
2.3 Plotters

Unit III: **(4 Hours)**

Communication System

3.1 Basic elements of a communication system, Simplex
3.2 Half Duplex
3.3 Full Duplex
3.4 Types of communication Channels

Unit IV: **(4 Hours)**

Internet

4.1 Internet working tools: Bridge
4.2 Routers
4.3 Gateways
4.4 Introduction to 2G, 3G, 4G, Technology
4.4 Search Engines

Practical: **(30 Hours)**

1. Introduction to Excel, Spreadsheet & its Applications, Menus, Toolbars, Working with Spreadsheets, Converting files to different formats, Computing data, Formatting spreadsheets, Working with sheets, Sorting, Filtering, Validation, Consolidation, Subtotal
2. Introduction to presentation, Formatting a presentation, Adding style, Color, gradient fills, Arranging objects, Slide Background, Slide layout, Adding Graphics to the presentation, Inserting pictures, movies, tables, etc into the presentation, Drawing Pictures using Draw, Adding effects to the presentation, Setting Animation & transition effect, Adding audio and Video. Internet and web use, E-mail basics,

Reference:

1. Computer fundamentals-Sinha P.K.
2. Introduction to Computers-Peter Nartons
3. Computer for Beginners-Arora Pawan
4. Computer Network-Andrew Tanenbaum,
5. Fundamentals of Computer-V.rajaram

GE/OE Basket Semester II
Faculty of Science and Technology

Semester	Course Category		Name of Course	BoS	Course code
II	**GE/OE**	1	Hydroponics and Plant Growth Regulators	Botany	**BGO2T04**
		2	Antimicrobial Resistance	Biochemistry	
		3	Bioethics and Biosafety in Biotechnology	Biotechnology	
		4	Web Technologies	Computer Science	
		5	Home Automation	Electronics	
		6	Environmental Disaster and Management	Environmental Science	
		7	A. Forensic Gemology / B. Chemistry of Drugs / C. Introduction to Forensic Ballistics / D. Basics of Biostatistics and Bioinformatics/ E. Basics of Psychology (Psychology)/ F. Internet & Web Development/	Forensic Science	
		8	Tools and Techniques in Geology	Geology	
		9	Basic Chemistry- II	Home Science	
		10	Business statistics II	Mathematics	
		11	Statistics for Economics	Statistics	
		12	Fish farming	Zoology	
		13	Organic Chemistry	Cosmetic Technology	
		14	Chemical Processing-II	Fashion Design	
		15	Chemical Processing-II	Textile Science	

B. Sc. Semester-II
GE / OE-4 Botany (BGO2T04)
Hydroponics & Plant Growth regulators.

GE/OE-IV Theory	Hours: 2 Hours/Week	Marks: 80+20=100	Credit: 2

Unit-I	
1. **Hydroponics:** Introduction, Scope and Importance of Hydroponics, Differenttypes of hydroponic systems, NFT and DWC 2. Methods of hydroponic farming in tomato, spinach and cucumber. 3. Commercial Aspects of Hydroponics- Concept and importance of post-harvest management including cooling, cleaning, sorting, grading and packaging 4. Advantages and disadvantages of Hydroponics.	7.5 Hrs.
Unit-II	
1. Mineral nutrition –sources and types (Macro and Micronutrients) 2. Role and deficiency symptoms of Macronutrients – Nitrogen, Phosphorus, Potassium and Calcium. 3. Role and deficiency symptoms of Micro nutrients – Iron, Manganese, Boron and Zinc. 4. Government Schemes for hydroponics	7.5 Hrs.
Unit-III	
1. Plant growth regulators (Phyto-hormones) – i. Definition, Natural and synthetic, Auxins- Discovery, occurrence, Distribution,Structure. ii. Synthetic auxins – IPA, IBA, NAA, 2,4-D, 2,4,5-T iii. Effect of auxins on plant growth and development. (cell elongation and cell division, apical dominance, phototropism, geotropism and sex expression) iv. Uses of auxin in rooting, seedless production, promotion of flowering and tissue culture. 2. Gibberellins – History, types, structure, GAs, regulation by environment and its role in seed development and other physiological functions.	7.5 Hrs.
Unit-IV	
1. **Cytokinins-** History, structure, function, mode of action and uses. 2. **Ethylene -** History, structure, properties, function, properties and production. 3. **Abscisic acid (ABA) –** Discovery, structure, function, location and timing ofbiosynthesis, effect.	7.5 Hrs.

Suggested Readings:

1. How to Hydroponics 4th Edition by Keith Roberto
2. Hydroponic Grower Books Varieties
3. Hydroponics for the Home Grower by Howard M. Resh
4. Hydroponic Tomatoes by Howard M. Resh
5. Commercial Hydroponics by John Mason
6. Plant Factory: An Indoor Vertical Farming System for Efficient Quality Food Production byOyokiKozai
7. The Hydroponics Gardening Guide to Growing Your Own Vegetables, Fruits and HerbsRiley Brown
8. The Ultimate Beginner's Guide to Container Gardening in Urban Settings. Roger Grant
9. Plant Growth Regulators Signaling Under Stress Conditions (Hb 2021) by Aftab T , Springer
10. Plant Growth Regulators Bio-stimulants and Chemicals on Horticultural Crops by Rajangam, J, A Subbiah, C Rajamanickam, K S Vijai Selvaraj, P Balasubramanian, T Sivakumar & K Balakrishnan, Satish Serial Publishing House
11. Plant Growth Regulators in Fruit Science by J.S. BAL
12. Plant Physiology by Ross, Salisbury (1999) CBS
13. Biochemistry- Plummer (1989) Mc Graw hills Publication
14. Plant Biochemistry - Day and Harborne (2000)
15. Introductory Plant Physiology Glenn Ray Noggle, George John Fritz

GE / OE- 4 - (Biochemistry)

Semester 2

ANTIMICROBIAL RESISTANCE (AMR) – (BGO2T04)

COURSE OBJECTIVES

After completion of the course students will be able to:

1. Learn about the global health challenge called Antimicrobial resistance(AMR)
2. Describe the role and importance of antibiotics, their sources and learn to categorize them on the basis of mechanism of action.
3. Enumerate and describe how bacteria can become resistant and the mechanisms that may be involved in that process
4. Describe how antimicrobial resistance emerges and spreads around the world
5. Understand the need for alternative therapeutics and global scenario on AMR.

UNIT 1

Antimicrobials and their action: Definition, natural sources, Antibiotics and antibiotic resistance in the pre-antibiotic era, Modern antibiotic era, classes of antibiotics, Antibiotic resistance(AMR): origin and current status. AMR in Agriculture, AMR in animals

UNIT 2

Mechanism of action of antibiotics: Inhibition of cell wall synthesis, Inhibitors of protein synthesis, Inhibitors of membrane function, Inhibitors of nucleic acid synthesis, antimetabolites

UNIT 3

Mechanism of resistance development: Drug resistant mutations in bacteria, antibiotic target modification, modifying cell wall permeability, Acquired resistance from gene transfer, antimicrobial efflux pumps, Bacterial biofilms, metabolic modifications, ESKAPE pathogens, Concept of MDR.

UNIT 4

AMR Challenges and threat, Sources of Antibiotic Resistance: Zoonotic, Human and Environment, causes of the antibiotic resistance crisis (drug related, patient related, environment related etc.), Strategies to overcome AMR, New approaches for alternatives to antibiotics, Role of WHO in AMR awareness.

List of Books:

1. Antimicrobial Resistance-Underlying Mechanisms and Therapeutic Approaches by Vinay Kumar, Varsha Shriram, Atish Paul, Mansee Thakur, Springer Singapore, Published: 03 January 2022
2. Antibiotics: Targets, Mechanisms and Resistance, Editor(s):Claudio O. Gualerzi, Letizia Brandi, Attilio Fabbretti, Cynthia L. Pon, Wiley-VCH Verlag GmbH & Co. KGaA, First published:4 October 2013
3. The End of an Antibiotic Era,Bacteria's Triumph Over a Universal Remedy By Rinke van den Brink · 2021 3 April 2019,
4. Antimicrobials, Antibiotic Resistance, Antibiofilm Strategies and Activity Methods; Publisher: IntechOpen, Editor:Sahra Kırmusaoğlu
5. Antimicrobial Stewardship: Principles and Practice 1st Edition,by K. LaPlante (Editor), Cheston Cunha (Editor), H. Morrill (Editor), Louis Rice (Editor), Eleftherios Mylonakis (Editor)

Open Elective Courses

SEMESTER – II

BIOETHICS AND BIOSAFETY IN BIOTECHNOLOGY

Course Code: BGO2T04 **Total Contact Hours: 30**

Course Outcomes:
After successful completion of this Course, students will be able to:
CO 1. Give an insight about the morals and principles while working in the field of biology.
CO 2. Make the students aware of the issues arising per while handling and developing genetically engineered organisms and laboratory animals.
CO 3. Understand the risks involved and the regulations to be followed when experimenting with biological samples.
CO 4. Develop a perception about the practices to be followed in a biotechnology laboratory and the management of the laboratory waste.

UNIT I 7 hours

An introduction to Bioethics; Medical ethics and environmental ethics; Concepts of Bioethics: Autonomy, Justice, Beneficence, Non-Maleficence; Control, resolution, and enforcement of regulations; Ethical committees and constitution

UNIT II 8 hours

Bioethics in health care: patient confidentiality, informed consent, euthanasia, artificial reproductive technologies, prenatal diagnosis, genetic screening, gene therapy, transplantation; Bioethics in research: cloning and stem cell research, Human and animal experimentation, animal rights/welfare; Genetically engineered food, environmental risk, labelling and public opinion

UNIT III 7 hours

Introduction to biosafety and biosecurity; Biological hazards: types; primary containment for biohazards; introduction to biological safety cabinets; Risk assessment: HACCP and management (Assessment, Mitigation and Performance), International Guidelines regarding Biosafety and Biosecurity: OIE, WHO, NIH, CDC

UNIT IV 8 hours

Biosafety Levels: High risk micro-organisms and their management; Good Laboratory Practices (GLPs) and Good Manufacturing Practices (GMPs); Bio-waste Management; Plant biosafety, Principles of safety assessment of transgenic plants – sequential steps in risk assessment

References:

- Kuhse, H. (2010). *Bioethics: an Anthology*. Malden, MA: Blackwell

- Karen F. Greif, Jon F. Merz - Current Controversies in the Biological Sciences_ Case Studies of Policy Challenges from New Technologies (Basic Bioethics)-The MIT Press (2007)

- V. Sreekrishna - Bioethics and Biosafety in Biotechnology-to New Age International Pvt Ltd Publishers (2007)

- Padma Nambisan (Auth.) - An Introduction to Ethical, Safety and Intellectual Property Rights Issues in Biotechnology- Academic Press (2017)

- Kshitij Kumar Singh (auth.) - Biotechnology and Intellectual Property Rights_ Legal and Social Implications-Springer India (2015)

- David Castle - The Role of Intellectual Property Rights in Biotechnology Innovation (2011)

- Goel, D., & Parashar, S. (2013). *IPR, Biosafety and Bioethics*. Pearson Education India.15. Guidelines for Safety Assessment of Foods Derived from Genetically Engineered Plants. 2008.

- Alonso, G. M. (2013). *Safety Assessment of Food and Feed Derived from GM Crops: Using Problem Formulation to Ensure "Fit for Purpose" Risk assessments*

B.Sc. Sem-II (Computer Science)
BGO2T04

WEB TECHNOLOGIES

Credits : 2 **Duration : 30 Hours**

Course Objectives:
1. To comprehend and analyse the basic concepts of web programming and internet protocols.
2. To describe how the client-server model of Internet programming works.
3. To demonstrates the uses of HTML and DHTML.

Course Outcome:
After completing this course satisfactorily, a student will be able to:
1. Differentiate web protocols and web architecture.
2. Apply HTML and DHTML effectively to create websites.

UNIT I :

Introduction to Internet, History of Internet, Internet users, Internet working, Information on Internet, Requirements for connecting to Internet, Basic Internet Terms, Introduction to world wide web, Evaluation of world wide web, basic features, web browsers, popular web browsers, web servers, HTTP, URL, Search Engines, Search Engines categories, how to use Search Engines, Searching criterion.

UNIT II :

HTML: Introduction, Objective, HTML Browsers, Windows Switching, HTML Command Tags, URLs, links, new web page creation, main body of the text, putting headers, adding paragraph , formatting text in HTML and font mechanism, Color settings, superscripts and subscripts and other manipulations on text and paragraphs, using directory and menu lists, creation of links, inserting graphics, using images, all manipulations on tables and its display, Detailed working with forms, allowing visitors to upload files, active images ,working with frames & framesets, Frames handling, scroll bars, alternatives to frames,

UNIT III :

Introduction to browsers, Working with e-mail, Parts of e-mail text, working with messages.
DHTML: using DHTML in internet explorer, heading and horizontal line, hidden message, the message at the center of the page, moving boxes ,changeable box.

UNIT IV :

Cascading style sheets
Introduction to css, creating style sheets, common tasks with CSS, Colors, the font -family, font metrics ,length units ,absolute units ,relative units ,the pixel unit ,percentages as values ,keywords as values, various properties such as the font -size property, font -size property etc, Assigning classes ,tags and attributes for applying classes, applying classes to an HTML tag, applying classes to other document parts ,the layer tag, CSS Tags

Books

1. Internet and web design by R Bangia, Second edition , firewall media
2. Multimedia and Wed technology by R Bangia
3. Internet and web designing by ITELS (Macmillan)
4. Web Enabled Commercial Application Development Using HTML, DHTML, JS, Perl by Ivan Bayross
5. Deitel, Deitel & Nieto, Internet and Worldwide Web how to Program, Pearson Education, PHI.
6. Internmet Programming with VBScript and Java Script. Kathhleen Kalata, (Thomsaon Publication)
7. Programming the World Wide Web By. Robert W. Sebesta. (Pearson)
8. Web Technology Theory and Practice By: M Srinivasan (Pearson Publication)

Semester – 2; OE2: Home Automation

Course outcome:

At the end of this course students will have ability to

1. Understand concept of Home automation
2. Able to deploy modules of Home Automation
3. Explain the connectivity issue associated with home automation4 Describe the tools and products used in home automation

Syllabus:

1. Concept & Need of Home automation, Historical Review of development, Current concepts in home automation, Basics of IoT, Sectors & types of control, Surveillance
2. Home automation & connectivity, WiFi, Cloud/ Bluetooth/ Cellular, Alexa ecosystem, Lights/appliances/climate control,
3. Video, cameras, Security/locks, entry system, fluid & Gas control , Sensors 4 Development Boards, Modules, Cyber/security, Designing of typical systems.

Books :

The Smarthome Book: Simple ideas to assist with your smarthome renovation by Andrew Howe

Smart Smart Home Handbook: Connect, control and secure your home the easy way: Control Your Home With Your Voice by Adam Juniper

The Smart Home Manual: How To Automate Your Home To Keep Your Family Entertained, Comfortable, And Safe by Marlon Buchanan

Alexa User Manual: The Illustrated Alexa User Guide - Hacks, Tips & Skills for All Amazon Alexa Devices, Including Other Smart Home Integrations by Gregory McGuire

GE/OE -4: Environmental Disaster and Management

Unit: I:

Natural Disasters: Meaning and nature of natural disaster, their types, causes and effects, Hydrological disasters (Flood, Flash flood, Drought and Cloud burst), Geological disasters (Earthquake, Volcanic eruption, Landslides, Avalanches, Tsunami and Mud flow).

Man-made Disaster: Man-made Disaster: Meaning and nature of man-made disaster, their types, causes and effects, Chemical, Biological, Radiological and Nuclear disaster, Fire (Building fire, coal fire, forest fire and oil fire), Accidents (Road, rail, air and sea accidents).

Unit: II:

Risk Assessment: Risk concept, Elements of risk, Role of Science and Technology in Disaster Risk Reduction, Strategies of risk reduction, Decision making for risk reduction, Problems in risk assessment.

Vulnerability: Observation and perception, vulnerability identification, vulnerability types and dimensions, Vulnerability (social & economic factor). Physical and social infrastructure for vulnerability reduction, Hazard resistant design and construction, systematic management and strategic planning for vulnerability reduction.

Unit: III

Disaster preparedness: Concept and significance, Disaster preparedness measures, Institutional mechanism for disaster preparedness, Policy and programme of disaster preparedness. Role of Government, NGOs and Information technology in Disaster preparedness.

Disaster Response: Essential components of disaster response, Disaster Response Plan (Communication, Participation and Activation of Emergency preparedness Plan), Search, Rescue, Evacuation and Logistic management, Relief and Recovery, Rehabilitation and Reconstruction.

Unit: IV

Mitigation and Management Techniques: Mitigation and Management techniques of Disaster, Training, awareness program and project on disaster management Training and drills for disaster preparedness, Awareness generation program, Usages of GIS and Remote sensing techniques in disaster management, National and State Bodies for Disaster Management.

Global Initiatives for Disaster management : GDPRR- Global platform for Disaster Risk Reduction, , AMCDRR – Asian Ministerial Conference on Disaster Risk Reduction, SENDAI Framework, SDG 11.5 – Reduce the adverse Effects of Natural Disasters, CDRI – Coalition for Disaster Resilient Infrastructure.

Reference Books:

1. Textbook of Environmental studies by Benny Joseph , *McGrew-Hill Publishing Company Limited.*
2. Disaster Management by Mukesh Dhunna, *Vayu Education of India, New Delhi, 2009First edition.*
3. Introduction to Environmental Science *by G. Tyler Miller, Jr. Scott Spoolman, Cengage learning Publication.*
4. Environmental Science by S.C. Santra, *New Central Book agency Pvt. Ltd. Kolkata ,India.*
5. Environmental Management *by H.P. Behera and M.S. Khan, Himalaya Publication.*
6. Disaster Management Programmes And Policies *by Siddhartha Gautam K LeelakrishaRao, Publication - Vista International.*
7. Introduction To Disaster Management *,by B.C.Bose 46 ,Rajat Publishers.*
8. Global Disaster Management ,*by Arun Kumar, SBS Publishers.*
9. Handbook Of Disaster Management (2 Vol.set) , *Author : Reepunjaya Singh ,ABD Publishers.*
10. Handbook of Disaster Management *William L. Waugh 2005.*
11. Disaster Management : Text and Case Studies *D.B.N. Murthy Jain Book Agency 2000.*
12. Disaster Management Guidelines, GOI-UND Disaster Risk Program (2009-2012)
13. Damon, P. Copola, (2006) Introduction to International Disaster Management, Butterworth Heineman.
14. Gupta A.K., Niar S.S and Chatterjee S. (2013) Disaster management and Risk Reduction, Role of Environmental Knowledge, Narosa Publishing House, Delhi.
15. Murthy D.B.N. (2012) Disaster Management, Deep and Deep Publication PVT. Ltd. New Delhi.

    Modh S. (2010) Managing Natural Disasters, Mac Millan Publications

GE/OE (Forensic Science)

GE 2/A (BGO2T04): Forensic Gemology

Learning Outcomes: By the end of this Course, the learners will be able to:

1. Recall and recognize the fundamental concepts and terminology of gemology, including gemstone types, properties, and classification.
2. Demonstrate comprehension of the various techniques and instruments used in gemstone analysis, such as microscopic examination, spectroscopy, and X-ray techniques.
3. Apply analytical skills to identify and differentiate gemstones, including natural gems, synthetic gems, and treated gemstones, using appropriate laboratory techniques and instruments.
4. Analyze and evaluate gemstone origin through the interpretation of geological processes, gemstone deposits, and advanced techniques like elemental analysis, stable isotope analysis, and inclusion analysis.
5. Evaluate the forensic applications of gemology in real-world scenarios, including the identification of stolen jewellery, gemstone fraud, smuggling cases, and the role of gemstone analysis in trace evidence analysis and expert testimony.

Unit 1: Introduction to Forensic Gemology

Introduction to forensic science and its application in gemstone investigations. Basics of gemology: gemstone types, properties, and classification. Legal and ethical considerations in forensic gemology. Introduction to gemstone identification methods and instruments.

Unit 2: Gemstone Analysis Techniques

Microscopic examination: magnification, gemstone inclusions, and identifying synthetic gems Spectroscopy techniques: absorption, emission, and Raman spectroscopy. X-ray techniques: XRD (X-ray diffraction) and XRF (X-ray fluorescence). Advanced analytical techniques: FTIR (Fourier Transform Infrared Spectroscopy), UV-Vis (Ultraviolet-Visible Spectroscopy), and LIBS (Laser-Induced Breakdown Spectroscopy)

Unit 3: Gemstone Origin Determination

Geological processes and gemstone formation. Gemstone deposits and their characteristics. Geographic origin determination techniques: elemental analysis, stable isotope analysis, and inclusion analysis. Synthetic gemstone identification and differentiation.

Unit 4: Forensic Applications of Gemmology

Gemstone identification in forensic investigations: stolen jewellery, gemstone fraud, and smuggling cases. Trace evidence analysis using gemstones. Expert testimony and legal considerations. Case studies and real-world examples of forensic gemology.

GE/OE (Forensic Chemistry)

GE 2/B (BGO2T04): Chemistry of Drugs

Course Outcome: By the end of this Course, the learners will be able to:

1. Recall and identify the key terms and concepts related to pharmaceutical drugs, including drug classification, drug dependence, and examples of common drugs.
2. Understand the principles, practices, and challenges of pharmaceutical drugs in contemporary society, including the differences between narcotic drugs, psychotropic substances, and plant drugs.
3. Apply the knowledge and skills required to properly classify and identify different types of pharmaceutical drugs, including understanding the chemical composition, characteristics, and therapeutic applications of specific plant drugs.
4. Analyze the mode of action of antibiotics, including the chemistry and classification of penicillin, chloramphenicol, streptomycin, and tetracyclines, and their importance.
5. Evaluate the risks and benefits of using pharmaceutical drugs, including the potential for drug dependence and the ethical considerations surrounding the use of certain types of drugs.

Unit I: Pharmaceutical Drugs

Introduction, Classification, Origin of Drugs, Natural Drugs, Synthetic Drugs, Drug Dependence - Physical Dependence, Psychological Dependence, Analgesic, Antipyretic, Antibiotics and anti-histamines (examples of common drugs).

Unit II: Narcotic drugs and Psychotropic Substances

Introduction, Classification, Sign and Symptoms, Tolerance, Drug Dependence - Physical Dependence, Psychological Dependence, depressants, stimulants, hallucinogens and sedatives.

Unit III: Plant drugs

Introduction to Plant Drugs: Definition and significance, Historical background and cultural uses, Importance in traditional medicine systems. Overview of medicinal plants and their classification, Characteristics and therapeutic applications of the following plant drugs – Tulsi, Turmeric, ginger, Giloy, Garlic, Aloe vera, etc.

Unit IV: Antibiotics

Definition, Introduction and significance of antibiotics, Historical background and discovery of antibiotics, Importance in medicine and healthcare, Classification of antibiotics based on chemical structure and mechanism of action. Chemistry and mode of action of penicillin, chloramphenicol, streptomycin and tetracyclines etc.

GE/OE (Forensic Physics)

GE 2/C (BGO2T04): Introduction Forensic Ballistics

Course Outcomes: By the end of this Course, the learners will be able to:

1. Remember the various types of firearms commonly used in forensic investigations.
2. Understand the principles of ballistics and firearm identification, including the concepts of rifling, bullet trajectories, and gunshot residue analysis.
3. Analyze ammunition-related evidence, such as cartridge cases, bullet fragments, and firearm markings, to determine the type of firearm used, the sequence of shots, propellants and potential links between firearms and crime scenes.
4. Recall the fundamental concepts and principles of internal ballistics, including the ignition of propellant, pressure development, and projectile acceleration inside a firearm barrel.
5. Understand the factors influencing terminal ballistics, such as bullet design, velocity, target composition, and angle of impact, and how they affect the behaviour of projectiles during a shooting incident.

Unit I: Firearms

Early Fire Arms, Hand Cannons, Matchlock, Wheel Lock, Snaphaunce, Flintlock, Percussion System, Cartridge System, Centre Fire System, Dreyse Needle, Smooth Bore Firearms, Rifling, Revolver, Pistols, Actions of Firearms, Shotgun, Sub Machine Gun, Machine Gun, Improvised Firearms.

Unit II: Ammunition

Propellants- Black Powder, Smokeless Powders, Primers- Berdan Primer, Boxer Primer, Primer Cap Types- Rim Fire, Centre Fire, Pin Fire. Caseless, Blank Ammunition, Tear Gas, Grenade Launcher, Dummy, Cartridge Cases - Rimless, Semi Rimmed, Rimmed, Belted. Bulletsand Its Types, Components of Shotgun Ammunition.

Unit III: Internal Ballistics

Energy Considerations, Initiation, Combustion of Propellants, Density of Loading, Atmospheric Temperature, Shape of the Cartridge Case. Heat Problems, Barrel Pressure and Its Determination, Recoil, Measurement of Recoil, Vibration and Jump, Barrel Fouling.

Unit IV: Terminal Ballistics

Introduction, Stopping Power of Bullet, Shockwave and Cavitation Effect, Wounding Mechanism, Elements of Wound Ballistics; Nature of Target, Velocity of Projectile, Constructional Features of Projectile. Range.

GE/OE (Forensic Biology)

GE 2/D (BGO2T04): Basics of Biostatistics and Bioinformatics

Course Outcomes: By the end of this Course, the learners will be able to:

1. Gain a solid understanding of different types of sampling, data collection techniques and statistical techniques in reference with biostatistics.
2. Develop the understanding of concepts such as mean, median, mode, range, standard deviation, variance, probability, corelation and regression and distribution curves along with their significance.
3. Learn techniques to retrieve database and methods of deposition of database using different tools by understanding the formats and contents of data entries.
4. Gain a comprehensive understanding of Entrez, PubMed, DDBJ, DMBL.
5. Examine the properties of protein and nucleic acid sequence and understand the concept of comparative genomics along with their application.

Unit-I: Introduction to Biostatistics

Sampling techniques; Data collection; tabular and graphical representation of Data; Analysis of Mean, mode, median, range, variance, standard deviation and standard error (with examples).

Unit-II: Test of significance

Z-test, T-test and Chi-square test; Probability Distribution: Binomial Poisson and Normal distribution; Correlation and linear regression; Analysis of variance; ANOVA; One-way and two-way classification.

Unit-III: Databases

Introduction to databases with respect to organization of data; contents and formats of database entries; retrieval of data using text-based search tools; sources of data; method for deposition of data to databases; Introduction to Entrez, PubMed, DDBJ, EMBL.

Unit-IV: Proteomics and Genomics

Protein and nucleic acid sequences properties: Proteomics tools at the ExPASy server and GCG utilities and EMBOSS; Comparative genomics: Basic concepts and applications.

B.Sc. Sem-II (Forensic Science - Major)

GE/OE (Psychology)

GE 2/E (BGO2T04): Basics of Psychology

Learning Outcomes: By the end of this Course, the learners will be able to:

1. Define the fundamental concept of psychology, goals, types of psychological profession including its historical and modern perspective.
2. Analyse the structure and functioning of neurons, neurotransmitters, brain, central nervous system, peripheral nervous system etc.
3. Understanding the concept of learning, its definitions, and apply its knowledge to operant and classical conditioning along with their application and explanation with experiments.
4. Develop and implement the concept of memory and forgetting, types of memory, levels of processing theory and their physical aspects.

Unit I: The Science of Psychology

What is Psychology? definitions, goals, types of psychological professions, Historical perspectives in psychology: Structuralism, Functionalism, Gestalt, and Psychoanalysis. Modern perspectives in psychology: Behaviouristic, Humanistic, Bio-psychological, and Cognitive.

.

Unit II: Biological Foundation of Behaviour

Neuron: Structure, function, synapse, and neurotransmitters, Central Nervous System - Brain: Structure and function of brain; (ii) Cerebral hemispheres, Spinal cord- (i) Structure and function of brain, Peripheral Nervous System: Structure and function, Autonomic Nervous System, Somatic Nervous system, Glandular system.

Unit III: Learning

Learning: Definition, Classical Conditioning: Pavlov's experiment, extinction, spontaneous recovery, generalization, discrimination, higher-order conditioning. Operant Conditioning: Thorndike's Laws of learning, Skinner's experiment, positive reinforcer, negative-reinforcer, schedules of reinforcement, shaping. Cognitive Learning Theories Tolman's Latent Learning, Kohler's Insight Learning, Bandura's Observation Learning Theory., Application of classical and operant and classical conditioning to everyday life.

Unit IV: Memory

Memory: definition and Process, The information-processing model: Three stages of memory Sensory, Short-term, Long term. Types of long-term memory- Procedural, Declarative (episodic, semantic), Explicit and implicit. Levels of processing theory. Forgetting: Course of forgetting (Ebbinghaus' forgetting curve) Causes of forgetting (encoding failure, decay of memory traces, interference, motivated forgetting). Physical aspects of memory.

GE/OE (Digital & Cyber Forensics)

GE 2/F (BGO2T04): Internet and Web Development

Course Outcomes: By the end of this Course, the learners will be able to:

1. Demonstrate knowledge and understanding of the fundamental concepts, principles, and protocols of the internet, World Wide Web, HTML, and JavaScript.
2. Demonstrate a deeper understanding of the internet, World Wide Web, HTML, and JavaScript by interpreting and explaining concepts, protocols, and standards.
3. Apply their knowledge and skills in practical scenarios.
4. Develop the ability to analyze internet-based artifacts and web applications.

Unit I: **Internet**

History of internet, the early years, The global Internet, A global information infrastructure, Review of packet switching and its relevance to the internet, topologies, Routers, Dial-up access, IP address. Transmission Control Protocol (TCP), Domain names, Names and IP address, TCP/IP, Flexibility, Reliability and efficiency.

Unit II: **World Wide Web (WWW)**

Browsing the World Wide Web (WWW), HTML, Web page design with HTML, Features and importance of HTML, Advanced WEB technologies.

Unit III: **HTML**

General Introduction to Internet and WWW, Text tags, Graphics, Video and Sound Tags, Link and Anchor Tags, Table Tags, Frame Tags, Miscellaneous tags (layers, image maps etc), CSS, DHTML, HTML Forms and Fields.

Unit IV: **JavaScript**

Basic data types; control structures; standard functions; arrays and objects, event driven programming in Javascript; Example Applications.

Paper II: Tools and Techniques in Geology (BGO2T04)

Unit I

Thin section and polished section making; Sample etching, staining and model count techniques; heavy mineral analysis and paleocurrent interpretation; principle and geological application of X ray defractometry.

Unit II

Use of MS WORD in writing geological texts for fields; use of MS Excel in computing mineral variations, mean, average, standard deviation, covariance; use of MS Power Point in preparing geological texts for presentation.

Unit III

Use of computers in inserting geological pictures in geological reports; use of computers in inserting clip arts in geological reports; use of computers for illustrations by shapes – lines, basic shapes, block arrows, basic charts, callouts and stars and banners; use of computers in inserting symbols, equations.

Unit IV

Use of computers in insertion of columns, line charts, pie charts, bar charts, area charts, scatter diagrams in geological reports; addition of page numbers in WORD file; word counts; setting of margins, page orientation, page-size selection; addition of line numbers.

Books Recommended:

No Textbook - only handouts and web pages

SEMESTER II

5. BUSINESS STATISTICS –II

Course Outcomes: This course will enable the students to

1. Integrate concept in international & national business concept with functioning of global trade.
2. Evaluate the legal, social and economic environment of business.
3. Apply decision-support tools to business decision making.
4. Will be able to apply knowledge of business concepts and functions in an integrated manner.

UNITS	TOPICS	HOURS
Unit 1	Moments- Central & Non-Central Moments, Beta & Gamma Coefficients, Skewness, Kurtosis.	**8**
Unit 2	Correlation and Regression, Bivariate Data, Covariance, Correlation Data, Rank Correlation.	**8**
Unit 3	Probability and Probability Distribution, Attributes	**7**
Unit 4	Interpolation, Finite Differences, Newton's Forward & Backward Interpolation Formulae, Index Numbers, Time series Analysis.	**7**
	TOTAL	**30 HRS**

Recommended Books:

1. Business mathematical Statistics., N.G. Das, J. K. Das
2. Business Mathematics and Statistics, N.G. Das &Dr. J.K. Das McGraw Hill, New Delhi.
3. Fundamentals of Business Mathematics, M. K. Bhowal, Asian Books Pvt. Ltd New Delhi
4. Fundamentals of Mathematical Statistics, Gupta S. C. and Kapoor V. K.:, Sultan Chand and Sons, New Delhi.
5. Statistical Methods, Gupta S. P.: Sultan Chand and Sons, New Delhi.
6. Applied Statistics, Mukhopadhya Parimal New Central Book Agency Pvt. Ltd., Calcutta.
7. Fundamentals of Statistics, Goon A. M., Gupta, M. K. and Dasgupta, B. World Press, Calcutta.
8. Fundamentals of Applied Statistics, S. C . Gupta and V. K. Kapoor, Sultan Chand and Sons, New Delhi.

	Semester II (GE/OE)
	Name of the Paper - Statistics for Economics
	Paper code – (BGO2T04) 2 Credits (2 hrs Theory per week)
	Course Objectives
	The objectives of this paper are to acquaint the students of economics with basic methods of data analysis in Economics using statistical tools/models. The paper aids the students of economics in understanding the importance of decision in determining the choice
	Course Outcomes (CO)
	After the successful completion of the course, the students will have knowledge of basic statistical tools required in Economics.
	CONTENTS
	Unit 1 (15 Hrs)
	Introduction to Statistics **Statistics-** Meaning, Scope, Importance and Limitations; Sources of Data-Primary and Secondary;
	Classification of Data Qualitative and Quantitative; Geographical ,cross sectional and time series data; discrete and continuous data; frequency and non-frequency data
	Scales of measurement - Nominal, Ordinal, Interval and Ratio;
	Frequency and Tabulation of Data. Ungrouped and grouped, frequency distribution. Graphical representation of data: Histogram and Frequency Polygon. Primary and Secondary data,; Tabulation of data; Graphs and charts; Frequency distributions; Diagrammatic presentation of data
	Measures of Central Tendency: Mean-Arithmetic, Harmonic and Geometric, Median and Mode;
	Unit 2 (15 Hrs)
	Measures of Dispersion: Range, Inter-quartile Range, Mean Deviation, Standard Deviation and Co-efficient of Variation
	Correlation- Meaning and Types-Simple, Partial and Multiple Correlation; . Measures of Correlation-Karl Pearson and Spearman‟s Rank Correlation; **Regression**- Meaning and Types Simple Regression and Multiple Regression Analysis and its Applications
	References
1)	Gupta, S. P. (2012): Statistical Methods, S. Chand and Sons, Educational Publishers, New Delhi.
2)	2) Gupta, S.C. and Kapoor, V. K. (2016): Fundamentals of Applied Statistics, 3 rd Edition, Sultan Chand & Sons, New Delhi.
3)	3) Monga, G. S. (2015): Mathematics and Statistics for Economics, Second Revised Edition,Vikas Publishing House, Pvt. Ltd. New Delhi.
4)	4) Salvatore, D. (2015): Mathematics and Statistics, Schaum‟s Series, Tata McGraw Hill

GE/OE for B.Sc. II Fish Farming BGO2T04

Credit: 2

Course outcomes: After completion of the course, students will able to-

- Understand, describe and explain suitable aquaculture fish on specific criteria.
- Understand, describe and explain construction and management of fish pond.
- Understand, describe and explain breeding techniques.
- Comprehend the status of freshwater resources.
- Evaluate economically important freshwater biological resources for their commercial utilization.
- Adjudge different types of rearing process and steps along with procedure involve in preparation and management of nursery and rearing pond of fish culture.
- Understand, describe and explain the marketing of fish.
- Understand, describe and explain various diseases in fishes.

UNIT- I

1.1 Cultivable species of fish (Indian carps, exotic carps and other economic important fishes), Growth and fecundity.

1.2 Construction of fish farm: Selection of site, topography, layout of fish farm, Types of fish ponds (Nursery, rearing and stocking ponds), Construction of various ponds.

1.3 Management of fish pond: Pre-stocking management, fertilization of ponds, lining, liming, eradication of predatory and weed fishes, and control of aquatic insects.

1.4 Methods of fish cultivation: pond culture , cage culture, pen culture, Raceway culture, culture in recirculatory water system, monoculture and polyculture.

UNIT – II

2.1 Post stocking management of fish pond- Feeding, Thining, Harvesting.

2.2 Methods of collections of fish seed, resources (natural water bodies and hatcheries), Transport of fish seed

2.3. Induced breeding: Induced breeding of carps and other cultivable fishes.

2.4 Bundh breeding: dry and wet bundh breeding.

UNIT – III

3.1 Physical and chemical factors affecting fish culture.

3.2 Rearing of spawn, fry and fingerling.

3.3 Fishing crafts and gears- Spear, Harpon, Hooks and Lines, Types of fishing nets.

3.4 Preservation and processing of fish.

UNIT – IV

4.1 Fish marketing: Marketing practices, information, marketing channels and systems.

4.2 Fish diseases and its control: Biotic (Viral diseases, Bacterial diseases, Fungal, Protozoan, Helminthes, copepod) diseases and abiotic diseases (Air embolism, gas bubble diseases, acidosis, alkalosis)

4.3. Fishery Survey: Methods and techniques, Fish breeding centres of Maharashtra.

4.4. Fish products and by-products: i. Fish body oil, ii. Fish liver oil, iii. Fish meal, iv. Isinglass, v. Fish protein concentrate, vi. Fish glue, vii. Fish manure.

Suggested reading:

Pandey K and J.P. Shukla JP (2018). A Textbook of fish and fisheries Rastogi Publication, Meerut, pp. 588.

Khanna SS and Singh HR (2014). A text book of fish biology and fisheries. 3rd edition, Narendra Publishing House.

Gupta SK and Gupta PC (2006). General and applied Ichthyology (Fish and Fisheries). S. Chand and Company, pp. 1160.

GE/OE Basket Semester III
Faculty of Science and Technology

Semester	Course Category		Name of Course	BoS	Course code
III	**GE/OE**	1	Nutraceuticals	Botany	**BGO3T05**
		2	Sports Biochemistry	Biochemistry	
		3	Biotechnology in Forensic Science	Biotechnology	
		4	Chemistry in everyday life	Chemistry	
		5	Data Base Management System	Computer Science	
		6	Data Base Management System	Computer Application	
		7	Data Base Management System	Data Science	
		8	Basic Electronics for Life Science	Electronics	
		9	Modern Technologies for Environmental Management	Environmental Science	
		10	A. Forensic Meteorology/ B. Forensic Chemistry/ C. Forensic Physics/ D. Forensic Biology/ E. (Psychology)/ F. Digital & Cyber Forensic/ G. Criminal Law-II (Law)	Forensic Science	
		11	Pedology and Soil Testing	Geology	
		12	Applied Physics and Computer Application-I	Home Science	
		13	Data Base Management System	Information Technology	
		14	Financial mathematics	Mathematics	
		15		Microbiology	
		16	Digital systems	Physics	
		17		Statistics	
		18	Animal husbandry	Zoology	
		19		Applied Electronics	
		20	Introductory Pharmacology & Toxicology	Cosmetic Technology	
		21		Interior Design	
		22	Hand Printing	Fashion Design	
		23	Textile Testing-I	Textile Science	

GE/OE Basket Semester IV
Faculty of Science and Technology

Semester	Course Category		Name of Course	BoS	Course code
IV	**GE/OE**	1	Biofuels technology	Botany	**BGO4T06**
		2	Pharmacogenomics	Biochemistry	
		3	Biotechnology & Law	Biotechnology	
		4		Chemistry	
		5	Cyber security	Computer Science	
		6	Cyber security	Computer Application	
		7	Cyber security	Data Science	
		8	Mobile App development	Electronics	
		9	Biodiversity and Wildlife Conservation	Environmental Science	
		10	A. Forensic Photography/ B. Forensic Chemistry/ C. Forensic Physics/ D. Forensic Biology/ E. (Psychology)/ F. Digital & Cyber Forensic/ G. Criminal Law-III (Law)	Forensic Science	
		11	Engineering Properties of Rocks and Soil	Geology	
		12	Applied Chemistry - II	Home Science	
		13	Cyber security	Information Technology	
		14	Mathematics for Competitive Examinations	Mathematics	
		15	Basics of Biomolecules	Microbiology	
		16	Communication Systems	Physics	
		17		Statistics	
		18	Bio-statistics	Zoology	
			Communicable diseases	Zoology	
		19		Applied Electronics	
		20	Introductory Pharmacology & Toxicology	Cosmetic Technology	
		21		Interior Design	
		22	Home Linen Designing	Fashion Design	
		23	Textile Testing-II	Textile Science	

Annexure – V
Basket of Skill Enhancement Courses
(SEC)

SEC Basket Semester I

Faculty of Science and Technology

Semester	Course Category	Name of Course	BoS	Course Code
I	SEC	Communicative Skills and Personality Development 1	Languages	BVS1P02
		Soil analysis and hydrobiology	Botany	
		Beekeeping	Zoology	
		Desk Top Publishing	Computer Science	
		Aptitude and Reasoning	Mathematics	
		DNA Manipulation Techniques	Biotechnology	
		Quality control testing of fermented food	Microbiology	
		Food Adulteration Analysis	Chemistry	
		Food Adulteration Analysis	Biochemistry	
		Geo-statistics in Geology	Geology	
		Simulation and Modelling of Electronic Circuits 1	Electronics	
		Environmental Sampling and Monitoring	Environmental Science	
		PPT Presentation Course	Statistics	
		A. Chemical Laboratory Techniques B. General Practices in Forensic Biology C. Physics Workshop	Forensic Science	

Skills Enhancement Course (BoS Languages)

Title of the Course: Communication Skills and Personality Development: 1

Semester -I (2 Credits each)

Introduction: The course is designed to inculcate basic communication skills among the learners and to help them to become confident individuals. Communication Skills is one of the essential attributes in today's world. This course will help the learners to understand the different aspects of communication skills in a professional scenario. This course is based on Bloom's Taxonomy and guides the learners to remember, understand, analyze, and apply the acquired language skills. Each section in this course has exercises based on experiential learning.

Course Outcomes:

1. By the end of this course, the learners will imbibe the basic Listening and Speaking skills.
2. They will develop basic business vocabulary and will be able to use them proficiently.
3. The learners will be able to successfully construct correct sentences and use them appropriately in different situations.
4. This course will reinforce basic communication etiquettes and values.

Semester I (2 Credits-30 hours)

Communication Skills and Personality Development: 1

Unit I: Oral and Aural Communication Skills-1 (6 Hours)

1.1 Importance of Listening Skills
1.2 Active and Effective Listening Skills
1.3 Reading Skills

Unit II: Oral and Aural Communication Skills-2 (6 Hours)

2.1 Understanding the Use of Formal and Informal Language

2.2 Oral Communication Skills: Monologues and Dialogues

2.3 Situational Conversation (Introducing Yourself, Greeting People, Leave Taking)

Unit III: Let's Add Word Power- 1 (6 Hours)

3.1 Commonly confused words (Homonyms, Homophones, Homographs)

3.2 Word list with their etymology

3.3 Academic Word List 1 (formation of nouns, adjectives, and adverbs)

Unit IV: Let's Add Word Power- I (6 Hours)

4.1 Academic Word List 2 (Compound words, one word substitution)

4.2 Professional Vocabulary with Meanings

4.3 Some Common Errors (Error recognition exercises on vocabulary)

Unit V: Written Communication (6 Hours)

5.1 Pamphlets (Describing Places of attraction)

5.2 Advertisements (Classified Ads: Sale of Property, Vehicles and Advertisement for Vacancies)

5.3 E-mail Writing (Official Mails)

Reference Books:

1. English Language Skills for Academic Purposes: A Textbook for College Students, Charul Jain, Pradyumansinh Raj, Yunus Karbhari, Macmillan Education.
2. Communicative English II: An Active Course of Phonetics and Grammar, Macmillan Education.
3. Essential English for Indian Learners: Foundation, Dr. Jitendra Kumar Singh, Macmillan Education
4. Introduction to Life Skills: A Textbook for College Students, Arvind Nawale, Macmillan Education.
5. English in Action: A Textbook for College Students, Editors: T. Vijaykumar, K, Durga Bhawani, Y.L.Shrinivas, Macmillan Education.
6. English in Use: A Textbook for College Students, Macmillan Education.
7. Stream: English Coursebook for College Students, Suresh Gadhavi. Mahendra Mishra, Macmillan Education
8. Meera Banerjee, Business Communication Skills, Macmillan Education.

Evaluation Scheme for SEC
(Communication skills and Personality Development: 1)

DISTRIBUTION OF MARKS (Theory Examination)				
UNITS	MCQs	SAQs	VSAQs	Total Marks
Unit I	06	04	05	15
Unit II		04	05	09
Unit III		04	05	09
Unit IV			05	05
Unit V		04x3 (3 questions of 4 marks each)		12
				50

Internal Assessment will be based on a continuous evaluation. It should ideally follow the following marking scheme:

Assignments & Viva-voce (15+15), Attendance (10), Participation in Classroom Projects and Activities (10)

Framework for Internal Evaluation		
Assessment Criteria	**Units**	**Marks**
Assignment and Viva-voce	Based on the contents from all the units	15+15
Attendance and Participation in Activities	Based on the contents from all the units	10
Classroom Projects and Activities (Seminars, Mini Projects, Discussion Forums and Elocution, Role Plays, Cue cards, competitions, etc.)	Unit I,II, IV, V	10
		50

Pattern of the Question Paper (Theory Examination)

Q1. (A) Six MCQs carrying 1 marks each from Unit I **[6 Marks]**

(B) One out of two SAQs with internal choice to be answered in 75 words from Unit I **[4 Marks]**

(C) One out of two SAQs with internal choice to be answered in 75 words from Unit II **[4 Marks]**

Q2. (A) One out of two SAQs with internal choice to be answered in 75 words from Unit III **[4 Marks]**

(B) 5 out of 6 VSAQs from Unit I (Carrying 1 mark each) **[5x1=5 Marks]**

(C) 5 out of 6 VSAQs from Unit II (Carrying 1 mark each) **[5x1=5 Marks]**

Q3. (A) Preparing a Tourist Pamphlet. **[4 Marks]**

(B) Draft an advertisement on any one of the given topics. **[4 Marks]**

(C) E-mail Writing. **[4 Marks]**

Q4. (A) 5 out of 6 VSAQs from Unit III (Carrying 1 mark each) **[5x1=5 Marks]**

(B) 5 out of 6 VSAQs from Unit IV (Carrying 1 mark each) **[5x1=5 Marks]**

B. Sc. Semester-I
SEC Botany
(BVS1P02)
Soil Analysis and Hydrobiology

VSEC Practical	Hours: 4 Hours/Week	Marks: 50+50=100	Credit: 2

Unit-I

Physical Properties of Soil — 15 Hrs.

1. To study the different types of soils.
2. To find out moisture percentage of the soil.
3. To study the texture of given soil samples.
4. To determine the soil pH.
5. To determine the water holding capacity of the soil.
6. To measure temperature of soil.
7. To study the colour of given soil samples.
8. To determine the porosity of soil samples.

Unit-II

Chemical Properties of Soil — 15 Hrs.

1. To study the soil flora.
2. To study and mapping of soils in the fields.
3. To determine electrical conductivity of given soil samples.
4. To determine the presence of carbonates in the given soil samples.
5. To determine the presence of nitrates in the given soil samples.
6. To determine the presence of Phosphate in the given soil samples.
7. To determine the presence of Potassium in the given soil samples.
8. To determine the base deficiency of given soil samples.

Unit-III

Properties of Water **15 Hours** — 15 Hrs.

1. To measure temperature and pH of given water samples.
2. To determine the Dissolved oxygen in given water samples.
3. To determine the BOD in given water samples.
4. To determine the COD in given water samples.
5. To determine the Turbidity in given water samples.
6. To determine the Nitrogen and Phosphates in given water samples.
7. To determine Total solids in given water samples.

Unit-IV	
1. To determine Boiling and Melting point of given water samples. 2. To determine conductivity of given water samples. 3. To determine Hardness of given water samples. 4. To determine Colour and odour of given water samples. 5. To determine Calcium and magnesium of given water samples. 6. Diversity of Hydrophytic plants of selected water bodies. 7. Count the density of phytoplanktons.	15 Hrs.

Note- (Minimum 5 Experiments should be conducted from each unit)

B.Sc. Semester-II BOTANY PRACTICAL
EXAMINATIONSEC-2 Botany (BVS1P02)
Subject: Soil Analysis and Hydrobiology

TIME: FIVE HOURS **MAX. MARKS: 50**

Q. 1:	To determine the Physical Properties of given soil samples	10 M
Q. 2:	To determine the Chemical Properties of given soil samples	10 M
Q. 3:	To determine the Physical and Chemical Properties of given Water samples	10 M
Q. 4:	To study Phytoplanktons and Hydrophytes of water bodies	10 M
Q. 5:	Practical Record, Viva Voce and Excursion report.	10 M

Suggested Readings:

1. Marc Pansu , Jacques Gautheyrou (2006), Handbook of Soil Analysis, Springer Berlin, Heidelberg.
2. Dr. D. K. Maharaj (2017), Laboratory Manual for Soil Testing, S.K. Kataria & Sons.
3. Bandyopadhyay, P. C. (2012), Soil analysis, Genetech.
4. P. D. Sharma (2013), Ecology and Environment, Rastogi Publ. New Delhi.
5. Dr. B. P. Pandey (2021), Modern Practical Botany, Vol-III, S. Chand Publishing, New Delhi.
6. Dr. R.S. Shukla and Dr. P.S. Chandel (2018), A text Book of Plant Ecology, S. Chand Publishing, New Delhi.
7. V.N. Sahai (2016), Fundamentals of Soil, 5th Edition, Kalyani Publishers.
8. S.K. Pal (2013), Soil Sampling and Methods of Analysis, New India Publishing Agency.
9. Dr. G.S. Wagh (1905), Experimental Methods for Water Analysis, Nirali Prakashan.
10. Priyanka Singh (2017), Practical Manual Of Water Analysis by SINGH,P, Agri Biovet Press.
11. Leo M.L. Nollet, Leen S. P. De Gelder (2013), Handbook of Water Analysis, 3rd edition, CRCPress.
12. Dr. Hem Raj (2021), Vinesh Aquatic Biology, S. Vinesh& Co.
13. Rajiv Tyagi (2011), Textbook of Hydrobiology, Discovery Publishing House Pvt Ltd.
14. Gelarld A. Cole (2015), Textbook of Limnology, CBS PUBLICATION.

SEC Basket Biochemistry (2 credit, 4-hour Practical) Semester 1

FOOD ADULTERATION ANALYSIS (BVS1P02)

Course Objective: The objective of this course is to impart practical skill enhancement in field of food adulteration testing. Completion of this course will enable the students to understand, learn and perform skills needed in Food Science/Quality Analysis laboratories.

1. General Laboratory Rules and Personal Safety Precautions
2. Detection of Added Starch / Cereal Flours/ Cellulose in Milk.
3. Detection test For Skimmed Milk Powder in Natural Milk.
4. Detection of Preservatives added to Milk.
5. Detection of Rancidity in edible oils and fats.
6. Detection of Argemone oil in edible oil and fats.
7. Detection of Cottonseed oil in edible oil.
8. Detection of Lead Salts in Turmeric Powder
9. Detection of Metanil Yellow in Turmeric Powder
10. Detection of Artificially Coloured Tea Dust Mixed with Genuine Tea or Used Tea Leaves
11. Detection of Artificial Invert Sugar Syrup in Honey (Fieh's Test)
12. Detection of Added Color in Chilli, Turmeric and Other Curry powders.

References:

1. FSSAI Manual of Methods of Analysis of Foods – Milk and Milk Products (2015) Food Safety and Standards Authority of India, Ministry of Health and Family Welfare
2. Government of India New Delhi FAO (2009). Milk Testing and Payment Systems Resource Book – A Practical Guide to Assist Milk Producer Groups. FAO, Rome. Pp. 38-43.
3. Roy, N.K. and Sen, D.C. (1994). Rapid Analysis of Milk. In Textbook of Practical Dairy Chemistry. Kalyani Publishers. New Delhi. Pp. 85-118. FSSAI Manual of Methods of Analysis of Foods – Oils and Fats (2015) Food Safety and

SEC (Biotechnology)

SEMESTER – I

DNA MANIPULATION TECHNIQUES (BVS1P02)

Course Code: BVS1P02 **Total Contact Hours: 60**

Course Outcomes:
After successful completion of this Course, students will be able to:
CO 1. Perform isolation of DNA from different sources
CO 2. Appreciate changes in DNA migratory properties by agarose gel electrophoresis
CO 3. Describe applications of restriction enzymes in DNA manipulation methods
CO 4. Compare effect of changes in DNA sequence and solution conditions on spectrophotometric properties of DNA
CO 5. Plan and analyse experiments pertaining to DNA manipulations.

PRACTICALS

1. Genomic DNA isolation from Bacteria
2. Genomic DNA isolation from Plant Cells
3. Genomic DNA isolation from Animal Cells
4. Total DNA isolation from soil
5. Check the homogeneity of isolated DNA by Agarose gel electrophoresis
6. Restriction digestion of lambda phage DNA and agarose gel electrophoresis
7. Comparison of different restriction enzyme digests of lambda DNA by agarose gel electrophoresis
8. Melting curve analysis of Lambda DNA
9. Effect of salt concentration on Tm value of lambda DNA
10. Demonstration of southern hybridisation
11. DNA ligase activity analysis by ligation of lambda DNA RE digests
12. Monitoring changes in lambda DNA Tm values on UV irradiation
13. DNA methyltransferase activity assay
14. DNA methylation analysis by restriction fragment analysis
15. DNA methylation quantification by ELISA

References:

1. Sambrook, Joseph, Edward F. Fritsch, and Tom Maniatis. *Molecular cloning: a laboratory manual*. No. Ed. 2. Cold spring harbor laboratory press, 1989.
2. Scarlett, Garry, ed. *DNA Manipulation and Analysis*. Vol. 2633. Springer Nature, 2023.
3. Davis, Leonard. *Basic methods in molecular biology*. Elsevier, 2012.
4. Chawla, H. (2011). *Introduction to plant biotechnology (3/e)*. CRC Press.
5. Doyle, Jeffrey. "DNA protocols for plants." *Molecular techniques in taxonomy* (1991): 283-293.

B.Sc. Semester – I
SEC (Chemistry)
BVS1P02: Food Adulteration Analysis
Practical 2 credits

Course Outcomes
By the end of this course, students will be able to:

1. *Get basic knowledge on various foods and about adulteration.*
2. *Understand the adulteration of common foods and their adverse impact on health*
3. *Comprehend certain skills of detecting adulteration of common foods.*
4. *Be able to extend their knowledge to other kinds of adulteration, detection and remedies.*
5. *Know the basic laws and procedures regarding food adulteration and consumer protection.*

List of Experiments

1. Collection of information on adulteration of some common foods from local market
2. Adulteration detection for Milk and Milk products
    - Detection of water in milk
    - Detection of detergent in milk
    - Detection of starch in milk and milk products (khoya, chenna, paneer)
    - Detection of mashed potatoes, sweet potatoes and other starches in ghee/butter
3. Adulteration detection for Oil and Fats
    - Detection of other oils in coconut oil
    - Detection of TOCP (Tri-Ortho-Cresyl-Phosphate) in oils and fats
    - Proper winterization of refined winterized salad oils
4. Adulteration detection for Sugar & Confectionery
    - Detection of sugar solution in honey
    - Detection of chalk powder in sugar/pithi sugar/jaggery
    - Detection of aluminium leaves in silver leaves
5. Adulteration detection for Food Grains & Its Products
    - Detection of extraneous matter (dust, pebble, stone, straw, weed seeds, damaged grain, weevilled grain, insects, rodent hair and excreta) in food grains
    - Detection of dhatura in food grains
    - Detection of excess bran in wheat flour
6. Adulteration detection for Salt, Spices & Condiments
    - Detection of foreign resin in asafoetida (hing)
    - Detection of papaya seeds in black pepper
    - Detection of light black berries in black pepper
7. Adulteration detection for Fruits & Vegetables
    - Detection of malachite green in green vegetables like bitter gourd, green chilli and others.
    - Detection of artificial colour on green peas.
    - Detection of rhodamine B in sweet potato.
8. Adulteration detection for Beverages
    - Detection of clay in coffee powder
    - Detection of chicory powder in coffee powder
    - Detection of exhausted tea in tea leaves
    - Detection of iron filings in tea leaves

9. Adulteration detection for chilli powder
    - Detection of Brick powder in chilli powder
    - Detection of salt powder in chilli powder
    - Detection of talc. powder in chilli powder
10. Invited lecture/training by local expert /Visit to a related nearby laboratory/ Assignments, Group discussion, Quiz etc.

Note: Minimum 10 experiments should be performed.

References

1. A firstcourseinFoodAnalysis–A.Y.Sathe,NewAgeInternational(P)Ltd.,1999
2. https://eatrightindia.gov.in/dart/
3. Choudhary A., Gupta N., Hameed F., Choton S. An overview of food adulteration: Concept, sources, impact, challenges and detection. Int. J. Chem. Stud. 2020;8:2564–2573. doi: 10.22271/chemi.2020.v8.i1am.8655.
4. Ayza A., Yilma Z. Patterns of milk and milk products adulteration in Boditti town and its surrounding, South Ethiopia. J. Agric. Sci. 2014;4:512–516.
5. El-Loly M.M., Mansour A., Ahmed R. Evaluation of raw milk for common commercial additives and heat treatments. Internet J. Food Saf. 2013;15:7–10.
6. Everstine K., Spink J., Kennedy S. Economically motivated adulteration (EMA) of food: Common characteristics of EMA incidents. J. Food Protection. 2013;76:723–735. doi: 10.4315/0362-028X.JFP-12-399.
7. FoodSafety,casestudies–Ramesh.V.Bhat,NIN,1992
8. https://old.fssai.gov.in/Portals/0/Pdf/Draft_Manuals/Beverages and confectionary.pdf
9. https://cbseportal.com/project/Download-CBSE-XII-Chemistry-Project-Food-Adulteration#gsc.tab=0 (Downloadable e material on food adulteration
10. https://www.fssai.gov.in/

SEC Basket

B.Sc. Sem-I (Computer Science)

BVS1P02

DESK TOP PUBLISHING

Credits: 2 **Duration : 60 Hours**

Course Objectives:

1. To understand the fundamentals & concepts of Page Maker
2. To give the students a hands-on experience on Page Maker
3. To understand the fundamentals & concepts of Adobe Photoshop
4. To give the students a hands-on experience on Adobe Photoshop.

Course Outcomes:

After completing this course satisfactorily, a student will be able to:

1. understand the fundamentals & concepts of Page Maker
2. create book works, building booklets.
3. create animations
4. work with multiple layers

Unit I

Page Maker: Creating & opening publications, using the tool box, working with Palettes, text & Graphics, starting a publication from a template, saving & closing a publication

Drawing & Shaping Objects: Positioning ruler guides, typing text, formatting graphics, creating columns, creating styles, changing type style & alignment, rotating & moving of text block & graphics , placing text file ,setting tab, indents, leaders, copying graphic between publications ,positioning & resizing the logo.

Unit II

Page Maker: Setting up pages, changing document setup, using master pages, choosing a measurement system & setting up rulers, adjusting layout, numbering pages, rearranging pages, creating running header & footers, importing text, threading text blocks, balancing columns, edit story, customizing the dictionary, hyphenation, layers, frames, locking object, wrapping text around graphics, cropping a graphic

Unit III

Photoshop: Introduction to Adobe Photoshop, History of Photoshop, Hardware requirements of Adobe Photoshop, installation of Adobe Photoshop, Features of Photoshop, Interface Layout of Photoshop, Fundamentals: Digital Image, pixels, resolution, DPI, raster images/bitmaps, vector images/graphics, various file formats: PSD, JPEG, GIF, TIF, PNG etc., colour modes Exploring the workspace: Application bar, Menu Bar, Options Bar, Workspace ,Document Window, Document ,Title Bar, Status Bar, Toolbox.

Unit IV

Photoshop: Getting Familiar with Palettes: layers, channels, colors, history, Opening an existing file, Creating a new document, Saving files, Reverting Files, Closing Files, Getting Familiar with different Workspaces, Selecting a Workspace, Saving & Deleting Workspace & quitting the Application, Tools: brushes, Move Tool, Eyedropper Tool, Zoom Tool, Hand Tool, Type Tool, Quick Selection Tool Editing Images, Making Colour adjustments, working with Selection tools: Marquee Tool, Lasso Tool, Magic Wand Tool, making a selection based on colour Range, Modifying a Selection.

Books

1.Desk Top Publishing from A to Z by Bill Grout and Osborne, McGraw Hill
2. Desk Top Publishing for PC user by Houghton, Galgotia public.
3.Adobe Pagemaker 6.5 by Shashank Jain and Satish Jain, BPB public.
4. Desk Top Publishing on PC by M. C. Sharma, BPB public.
5.Adobe Photoshop CS2 Classroom, Adobe Press.

Semester – 1; SEC -2 : Simulation and Modelling of Electronic Circuits 1

(BVS1P01)

Course outcome:

At the end of this course students will have ability to1 Understand

importance of simulation

2 Acquittance with simulation modules , software and limitations3 Drawing and

testing simple circuit

4 Learning concepts through simulation

Syllabus

1 Introduction to circuit simulation software, Basics Accessing tools and features, file management , Drawing Schematic, Analog Simulation

2 Different Analysis parameters3

Digital logic simulation

4 Mix mode simulation

Books:

User Manual : CircuitMaker, Proteus, Tinkercad, Easyada

SEC-1 (Environmental Science)

Environmental Sampling and Monitoring (BVS1P0)

Unit-I: Weather and Air Monitoring

Introduction to weather system and parameters: Light, Rainfall, Wind direction, Wind velocity, (Movement of pollutants), Temperature, Pressure, Humidity, Weather Monitoring tools / instruments and their working principle.

Air sampling: types, techniques, site and parameter selection, National standards for ambient air quality, Monitoring of particulate matter, SOx and NOx, Ambient and stack air monitoring techniques, air monitoring tools/instruments used for air and their working principle.

Unit-II: Water and Soil Monitoring / Sampling and its Analysis

Water Monitoring and its Analysis: Objectives of water monitoring, Collection of samples, sample preservation, Physical, chemical, biological parameters of water & its monitoring, General effluent standards, stream standards Drinking water standard (IS10500 and WHO Standards).

Soil Monitoring and its Analysis: Objectives of soil monitoring / testing, Types of soil sampling and sample units, Site selection, important soil quality indicators Instruments / equipment's used in soil monitoring.

Unit-III: Noise and Radiation Monitoring

Noise and Radiation Monitoring Introduction of noise & vibration, National standard for noise Sound Exposure Level (SEL), Equivalent Sound Level [Leq(h)] Noise Index, Radiation types and measurement, G. M counter, scintillation counter, personal dosimetry, Units of measurements, Half-life period, and radiation dose measurement

Instruments used in Environmental Monitoring: pH meter, Conductivity meter, Colorimeter, UV Spectrophotometer, Atomic Absorption Spectrophotometer (AAS), Flame photometer, Hot air oven, autoclave, Laminar flow, RDS, RSPM 2.5, Handy sampler, Gas chromatography, Mass spectroscopy, Scanning electron microscopy.

Unit-IV: Unit-IV: Field work/Assignment/ Training/Seminar related to:

Ambient Air Quality Monitoring, Stack Monitoring, Water Sampling & Monitoring Noise/ Quality Monitoring, Analysis of Water and Wastewater, Soil Monitoring

Books for References:

1. Handbook of Methods in Environmental Studies: Vol.1 By Maiti, Subodh. (2003)
2. Handbook of Methods in Environmental Studies: Vol 2 (Air, noise, soil and overburdenanalysis). By Maiti, Subodh. (2003).
3. Waste Water Engineering, Metcalf and Eddy, INC, Tata McGraw Hills
4. Indian Standard for Drinking Water, BSI, New Delhi. Environmental Pollution Control, S.Rao, Wiley Eastern Ltd.,1993
5. Air Pollution Control and Engineering, De Nevers, McGraw Hills, 1993, 10.
6. Fundamentals of Air Pollution, Samuel, J. W., 1971, Addison Wesley Publishing
7. Fundamentals of Environmental Pollution, Krishnan Khannan, S. Chand and CompanyLtd., 1994.
8. Noise Pollution, Vandana Pandey, Meerut Publishers, 1995. Environmental PollutionControl, C. S. Rao, Wiley Eastern Ltd., 1993.
9. Air Pollution Control and Engineering, De Nevers, McGraw Hills, 1993.
10. Fundamentals of Environmental Pollution, Krishnan Khannan, S. Chand and CompanyLtd.,1994.
11. Environmental Chemistry, A. K. De., New Age Intl. Pub Co, New Delhi, 1990.
12. Environmental Pollution Analysis - S. M. Khopka.

SEC (Forensic Chemistry)

A. Chemical Laboratory Techniques (BSV1P02)

Course Outcome: By the end of this Course, the learners will be able to:

1. Gain hands-on experience in various laboratory techniques and analytical methods.
2. Perform purification, separation, measurement, and analysis of substances using appropriate instruments and procedures.
3. Develop practical skills in purification, separation, measurement, and analysis.
4. Apply these techniques and methods to conduct experiments, analyze data, and draw conclusions.

List of Practical

1. Purification by Crystallization Distillation, Centrifuge, and Washing.
2. Evaporation, Sublimation.
3. Measuring MP & BP.
4. Measurements of Flash point and Fire point.
5. Detecting solubility.
6. Measurement of Viscosity.
7. Determination of rate of a reaction (kinetics).
8. Volumetric analysis.
9. Titration experiments -Determining strength of acid, Saponification & Iodine value of fat/oil.
10. Solvent extraction.
11. Paper Chromatography.
12. Thin layer chromatography.

SEC (Forensic Biology)

B. General Practices in Forensic Biology (BSV1P02)

Course Outcome: By the end of this Course, the learners will be able to:

1. Demonstrate proficiency in measuring pH of solutions using appropriate techniques and instruments, and interpret the results to assess the acidity or alkalinity of the solution.
2. Prepare commonly used buffers and understand their composition and purpose, and evaluate their effectiveness in maintaining stable pH conditions.
3. Perform the preparation of agarose gel and polyacrylamide gel, understanding the principles and procedures involved, and demonstrate proficiency in gel preparation techniques.
4. Conduct electrophoresis of proteins and DNA on agarose or polyacrylamide gels, analyze the resulting gel patterns, and interpret the migration behavior of biomolecules based on their size or charge.
5. Apply spectrophotometric techniques to measure the concentration of proteins and DNA,

List of Practical:

1. Measurement of pH of the solution.
2. Preparation of commonly used buffers (Phosphate Buffer Saline, Glycine buffer)
3. Preparation of agarose gel.
4. Preparation of Polyacrylamide gel.
5. Electrophoresis of protein.
6. Electrophoresis of DNA.
7. Spectrophotometric measurement of protein.
8. Spectrophotometric measurement of DNA.
9. Paper Chromatographic separation of amino acids.
10. Thin layer Chromatographic separation of lipids.
11. Determination of Isoelectric point of protein.
12. Preparation of silica gel column.

SEC (Forensic Physics)

C. Physics Workshop (BSV1P02)

Course Outcome: By the end of this Course, the learners will be able to:

1. Develop practical skills in the use of laboratory instruments and tools, data analysis, electrical circuitry, electronic component soldering, and the application of various measurement devices.
2. Gain a comprehensive understanding of the functioning and principles of the travelling microscope, spectrophotometer, and various electrical components used in laboratory experiments.
3. Design and construct electronic switches using transistors and relays, and study the operation of timer circuits
4. Gain a solid foundation in experimental techniques and electrical principles.

List of Practical

1. Familiarization with Meter Scale, Vernier Calliper, Screw Gauge and their Utility
2. Study of Travelling Microscope
3. Study of Spectrophotometer
4. Study of Pulleys and Levers
5. Study of Cutting and Drilling Tools
6. Determination of Thickness of Thin Wires and Metal Sheets
7. Study of Electrical Components
8. Study of Transformer Characteristics
9. Study of Ammeters, Voltmeters and Ohm-meters
10. Study of Digital Multimeter for Measuring Voltage
11. Study of CRO as a Versatile Measuring Device
12. Soldering of electrical circuits having discrete components and ICs on PCB
13. Making regulated power supply
14. Study of Electronic Switch using Transistor and Relay Study of Timer Circuit using IC 555

SEC (Geology)

Geostatistic in Geology (BVS1P02)

Practical:

Practicals on arithmatic mean, mode, median, range, variance, frequency, skewness, kurtosis, standard deviation of grain sizes; identification of depositional environment based on grain size distribution; CM plot, depositional environment based on grain size distribution from probability ordinate paper.

Books Recommended:

1) Blatt, H., Middleton, G.V. and Murray, R.C. (1980) Origin of Sedimentary Rocks, Prentice-Hall Inc.
2) Reineck, H.E. and Singh, I.B. (1973) Depositional Sedimentary Environments, Springer-Verlag.
3) Isaaks, E.A. and Srivastava, R.M. (1990) An Introduction to Geostatistics, Oxford University Press.
4) Morrison, D.F. (1967) Multivariate statistical methods, McGraw-Hill.
5) Tucker, M.E. (1981) Sedimentary Petrology: An Introduction, Wiley and Sons, New York.

B.Sc. Mathematics (Major): SEMESTER 1

SEC-Aptitude and Reasoning (BVS1P02)

Course Outcome

On successful completion of the course the students will be able to:

1. Understand the basic concepts of quantitative ability
2. Understand the basic concepts of logical reasoning Skills
3. Acquire satisfactory competency in use of reasoning
4. Solve campus placements aptitude papers covering Quantitative Ability, Logical
5. Reasoning Ability

TOPICS:

1. Logarithm
2. Permutation and Combinations
3. Profit and Loss
4. Time, Speed and Distance
5. Time & Work
6. Ratio and Proportion
7. Data Interpretation
8. Tables
9. Column Graphs
10. Bar Graphs
11. Line Charts
12. Pie Chart
13. Venn Diagrams
14. Analogy
15. Blood Relation
16. Directional Sense
17. Number and Letter Series
18. Coding – Decoding
19. Calendars
20. Clocks

Reference books:

1. A Modern Approach To Verbal & Non Verbal Reasoning By R S Agarwal
2. Analytical and Logical reasoning By Sijwali B S
3. Quantitative aptitude for Competitive examination By R S Agarwal
4. Analytical and Logical reasoning for CAT and other management entrance test By
1. Sijwali B S
5. Quantitative Aptitude by Competitive Examinations by Abhijit Guha 4th edition
6. https://prepinsta.com/
7. https://www.indiabix.com/
8. https://www.javatpoint.com/

Quality Control Testing of Fermented Food
Course Code: (BVS1P02)

SEC	Hours: 04 Hours /Week	Marks: SEE= 50 CIE= 50	Credit: 02

60 Hrs

LIST OF EXPERIMENTS
(Perform at least 10 practical)

A) 1. **Chemical quality**

1) Determination of titrable acidity
2) Determination of Protein by Macro Kjeldahl method
3) Determination of fats
4) Determination of ash
5) Determination of moisture, fibre & carbohydrate
6) Quantitative estimation of reducible sugar by DNSA colorimetric method
7) Estimation of sodium by flame photometry.
8) Estimation of potassium by flame photometry.
9) Estimation of iron by colorimetry.
10) Estimation of ascorbic acid by titrimetric method.
11) Estimation of phosphates/phosphorus by colorimetric method.
12) Assay of Niacin

B) Microbiological quality

1) Assessing sanitary of contact surface by swabbing method.
2) Assessing air of processing facility of air for microbial load.
3) Bacteriological analysis of water intended for fermented food preparation.
4) Determination viable bacterial count by SPC in finished food product.
5) Determination of yeast & mold count in finished product.
6) Detection of *E.coli* in finished product.
7) Detection of *Salmonella* in finished products
8) *Detection of Bacillus cereus* in finished product.
9) Detection of *Staphylococcus aureus* in finished product.
10) Detection of Aflatoxin in finished product by TLC
11) Detection of anaerobic spore formers in finished product.

Perform at least five experiments from section **A & B each.**

Scheme of Practical Examination:

1. Two long expt.----------. 15 Marks each
2. Viva-voce----------. 10 Marks
3. Record---------- 10Marks

Total Marks = 50

Reference Books:

1) Manual of Methods of Analysis of Microbiological Examination of Food and Water-FSSAI Manual-2016

2) Manual of methods of analysis of foods milk and milk products -fssai-2016

3) Manual of methods of analysis of foods food safety and standards authority of india ministry of health and family welfare government of india new delhi 2015 beverages (coffee, tea, cocoa, chicory) sugar and sugar products & confectionery products -lab manual-2015

4) Manual of Methods of Analysis of Foods- Alcoholic Beverages- FSSAI-2021

5) Manual of Methods of Analysis of Foods- Spices,Herbs & Condiments-FSSAI-2021

6) Manual of Methods of Analysis of Foods- Cereal & Cereal products- FSSAI-2016

7) Manual of Methods of Analysis of Foods-Mycotoxins,FSSAI-2021

8) Manual of Methods of Analysis of Foods- Meat & Fish products- FSSAI-2016

9) General guidelines for Sampling for Microbiological Analysis of Food-FSSAI-2022

10) Manual of Methods of Analysis of Foods- FOOD ADDITIVES- FSSAI-2016

11) Manual of Methods of Analysis of Foods-Water-FSSAI-2016

12) A Manual of Laboratory Techniques-National Institute of Nutrition-ICMR-Hyderabad

Course outcomes

After this course the students will be able to

Sr. No.	Course outcome
1.	Student will learn the basic knowledge of different types of quality control testing of fermented foods.
2.	The knowledge is very useful for opting job in industries.

	Semester I (SEC) BOS (Statistics)
	Paper code – BVSIP02 2 Credits (4 hrs practical per week)
	NAME OF THE PAPER - PPT PRESENTATION COURSE
	List of Practicals
1	**Introduction to PowerPoint**: This section will cover the basics of PowerPoint, including the interface, tools, and functions. Student will learn how to create new slides, add content, and use themes**.**
2	**Design principles** : In this section, student will learn about design principles and how to apply them to PowerPoint presentations. Student will learn about layout, color, typography, and more
3	**Content creation**: This section will cover how to create compelling content for PowerPoint presentations. You'll learn how to structure the presentation, use images and videos, and incorporate data effectively.
4	**Animation and transitions**: In this section, student 'll learn how to use animations and transitions to make the PowerPoint presentations more engaging. Student will learn about the different types of animation and transition effects and how to use them effectively
5	**Delivery and presentation skills**: This section will cover how to deliver PowerPoint presentation effectively. Student will learn about public speaking skills, body language, and how to engage audience.
6	**Advanced features**: This section will cover some of the more advanced features of PowerPoint, such as using macros, customizing templates, and creating interactive presentations.
7	**Tips and tricks**: In this section, student will learn some tips and tricks for making PowerPoint presentations more effective and professional.
8	**Conclusion:** The course will end with a conclusion that summarizes what is learned and provides tips for continuing to improve PowerPoint presentations

B.Sc. Sem. I (Zoology) - SEC

Course: Bee Keeping (BVS1P02)

Credit: 2

Course outcomes: After completion of course, students will

- Able to identify queen, drones and workers of honey bee.
- Able to handle artificial bee hive.
- Understand the economic importance of honey bee.
- Identify and recognized enemies of honey bee.
- Able to do internship in commercial bee keeping unit.

Practical:

1. Introduction to Apiculture.
2. To demonstrate construction of bee hive and different species of bees.
3. To study the morphology and anatomy of bee.
4. To study the life cycle and division of labour.
5. To analyse the social behaviour of bees.
6. To study the handling of artificial bee hive and its maintenance.
7. To collect and preserve the bee pasture.
8. To study the seasonal management of colony (Season: Vasant, Grishma, Sharad and Shishir).
9. Manipulation for honey production.
10. Economics of bee keeping.
11. To study the queen rearing.
12. To find out and study bee enemies and their control.

Suggested reading:

1. **Goud R (2022).** Practical Manual on Apiculture, Sericulture and Lac culture. Jaya Publication House
2. **Jayashree KV, Tharadevi CS, Arumugam N. (2014).** Apiculture. Saras Publication, pp. 360.
3. **Brett J (2012).** Apiculture and Bee keeping simplified. Alfa one Publishing Company, pp. 106.
4. **Elumalai D, Mohan C, Poovizhiraja B, Ramamurthy R (2012).** Principles and practices of apiculture. Jaya Publishing House.
5. **Petterson J (2016).** Beekeeping: Everything You Need to Know to Start Your First Beehive. Weldon Owen Publisher, pp. 192.
6. **Sathe TV (2018).** Fundamentals of bee keeping. Daya Publishing House.

SEC Basket Semester II (BVS2P04)
Faculty of Science and Technology

Semester	Course Category	Name of Course	BoS	Course Code
II	**SEC**	Communicative Skills and Personality Development 2	Languages	**BVS2P04**
		Plant Pathology and Disease Management	Botany	
		Tally	Computer Science	
		Financial Mathematics	Mathematics	
		Wine Technology	Biotechnology	
		Tools and Techniques in Geology	Geology	
		Water and wastewater analysis	Chemistry	
		Lac culture	Zoology	
		Testing of food adulteration	Microbiology	
		Teaching Material for Young Children Extension Teaching Material	Home Science	
		Blood Processing Techniques	Biochemistry	
		File Handling in C	Electronics	
		Entrepreneurship Development and Services by Environmental Consultancy	Environmental Science	
		Financial literacy	Statistics	
		A. Security Features of Security Documents B. General Techniques and Recombinant DNA Technology in Microbial Forensics C. Mobile App Development	Forensic Science	

Title of the Course: Communication Skills and Personality Development: 2

Semester -II (2 Credits-30 Hours)

Unit I: Communication Skills: Concepts and Context (6 Hours)

1.1 Communication Skills: Definition and Importance

1.2 Communication Process

1.3 Situational Conversation

(Making announcements, Giving Statements, Giving Commands and making requests, Asking questions and Expressing surprises.)

Unit II: Building Confidence and Self-esteem (6 Hours)

2.1 Developing Self-awareness (Activity Based)

2.2 Social Awareness and Civic Skills (Elocution and Extempore Activity)

2.3 Developing Critical Thinking (Group Discussions and Case Studies)

Unit III: Communication Focus: Writing with a purpose. (6 Hours)

3.1 Reading and Comprehension

3.2 Creative Writing (Writing a review of a Movie or a book review)

3.3 Paragraph Writing (Describing People and Places)

Unit IV: Professional Etiquettes and Manners (6 Hours)

4.1 Asking and Giving permission.

4.2. Use of Courtesy Words (“please”, “excuse me”, “sorry” “Thank you” etc.)

4.3 Greetings and Salutations (Verbal and Non-verbal Communication)

Unit V: Brush up on your Interview Skills (6 Hours) (Activities on Mock-interviews and Telephonic Interviews)

5.1 Preparing a Professional CV

5.2 Grooming for the interview (Non-verbal and Verbal Skills)

5.3 Spotting the errors (Subject Verb Agreement, Use of Appropriate Words, Use Prepositions)

Reference Books:

1. English Language Skills for Academic Purposes: A Textbook for College Students, Charul Jain, Pradyumansinh Raj, Yunus Karbhari, Macmillan Education.
2. Communicative English II: An Active Course of Phonetics and Grammar, Macmillan Education.
3. Essential English for Indian Learners: Foundation, Dr. Jitendra Kumar Singh, Macmillan Education
4. Introduction to Life Skills: A Textbook for College Students, Arvind Nawale, Macmillan Education.
5. English in Action: A Textbook for College Students, Editors: T. Vijaykumar, K, Durga Bhawani, Y.L.Shrinivas, Macmillan Education.
6. English in Use: A Textbook for College Students, Macmillan Education.
7. Stream: English Coursebook for College Students, Suresh Gadhavi. Mahendra Mishra, Macmillan Education

Evaluation Scheme for SEC (Communication skills and Personality Development: 2)

DISTRIBUTION OF MARKS (Theory Examination)				
UNITS	MCQs	SAQs	VSAQs	Total Marks
Unit I	06	04	05	15
Unit II		04	05	09
Unit III		4x3 (3 questions of 4 marks each)		12
Unit IV			05	05
Unit V		04	05	09
				50

Internal Assessment will be based on a continuous evaluation. It should ideally follow the following marking scheme:

Assignments & Viva-voce (15+15), Attendance (10), Participation in Classroom Projects and Activities (10)

Framework for Internal Evaluation		
Assessment Criteria	**Units**	**Marks**
Assignment and Viva-voce	Based on the contents from all the units	15+15
Attendance and Participation in Activities	Based on the contents from all the units	10
Classroom Projects and Activities (Seminars, Mini Projects, Discussion Forums and Elocution, Role Plays, Cue cards, competitions, etc.)	Unit I,II, IV, V	10
		50

Pattern of the Question Paper (Theory Examination)

Q1. (A) Six MCQs carrying 1 marks each from Unit **[6 Marks]**

(B) One out of two SAQs with internal choice to be answered in 75 words from Unit I **[4 Marks]**

(C) One out of two SAQs with internal choice to be answered in 75 words from Unit II **[4 Marks]**

Q2. (A) 5 out of 6 VSAQs from Unit I (Carrying 1 mark each) **[5x1=5 Marks]**

(B) 5 out of 6 VSAQs from Unit II (Carrying 1 mark each) **[5x1=5 Marks]**

Q3. (A) Comprehension. **[4 Marks]**

(B) Write a review of a book/ a movie **[4 Marks]**

(C) Paragraph Writing **[4Marks]**

Q4. (A) CV writing. **[4 Marks]**

(B) 5 out of 6 VSAQs from Unit IV (Carrying 1 mark each) **[5x1=5 Marks]**

(C) 5 out of 6 VSAQs from Unit V (Carrying 1 mark each) **[5x1=5 Marks]**

B. Sc. Semester-II SEC
Botany (BVS2P04)
Plant Pathology and Disease Management

VSEC Practical	Hours: 4 Hours/Week	Marks: 50+50=100	Credit: 2

Unit-I

1. Acquaintance with various laboratory equipment: (Laboratory equipment and their use:pH meter, autoclave, hot air oven, laminar flow, spectrophotometer, electrophoresis, light and electron microscopy, incubator, Centrifuge / ultracentrifuge, ELISA Reader, Freeze dryer, GC-MS, HPLC, Thermocycler, {Practical to be conducted from available instruments}. 2. Methods of sterilization, Methods of inoculation. 3. Nutritional media and their preparations. Preservation of microorganisms in pureculture. 4. Enumeration of microbial population in soil- bacteria, fungi. 5. Methods of isolation and purification of microbial cultures	15 Hrs.

Unit-II

6. General study of different Vegetative and reproductive structures of fungi. 7. Study of symptoms of various plant diseases. (Fungal diseases of cereals, millets, oilseeds, pulses, fruits, vegetables, plantations, fibers, spices, medicinal and ornamental crop with special reference to etiology, disease cycle, perpetuation, epidemiology and management). 8. Measurement of plant disease *9.* Study of representative fungal genera *Colletotrichum, Alternaria, Cercospora, Aspergillus, Helminthosporium, Curvularia, Penicillium, Rhizopus, Mucor, Trichoderma*etc.	15 Hrs.

Unit-III

10. Staining and identification of plant pathogenic bacteria 11. Study of phanerogamic plant parasites 12. Transmission of plant viruses 13. Study of morphological features and identification of plant parasitic nematodes. 14. Extraction of nematodes from soil	15 Hrs.

Unit-IV

15. Koch's postulates 16. Study of fungicides and their formulations 17. Methods of pesticide application and their safe use. **18.** Calculation of fungicide sprays concentrations**.** 19. Collection and preservation of disease specimen. 20. Detection and Diagnosis of pathogens in seeds and other planting materials: Nucleic acid probes, Southern, Northern and Western hybridization, ELISA, ISEM and PCR. Nucleic acid probes, Southern, Northern and Western hybridization, ELISA, ISEM and PCR (Methodology only)	15 Hrs.

B.Sc. Semester-II

PRACTICAL EXAMINATION

SEC Botany (BVS2P04)

Subject: Plant Pathology and Disease Management

TIME: FIVE HOURS	**MAX. MARKS: 50**
Q.1. Identify giving reasons two of the given plant pathology material and "A".	10 Marks
Q.2. Make suitable stained preparation of the given Fungal culture "B"	10 Marks
Q.3. Perform Gram staining of the given Bacterial culture/ Curd "C"	5 Marks
Q.4. Techniques of inoculation "D"	5 Marks
Q.5. Spotting:	10 Marks
E. One of the instruments of Micro biology laboratory.	
F. Whole specimen or a permanent slide of Fungal pathology specimen.	
G. Whole specimen or a permanent slide of bacterial.	
H. Whole specimen or a permanent slide of Plant disease studied Viral, phytoplasma.	
I. Instrumentation.	
Q.6. Viva-voce	5 Marks
Q.7. Practical Record and pathology field report,	5 Marks

Suggested Readings

1. Pathak, V. N. Essentials of Plant Pathology. Prakash Pub., Jaipur 2) Agrios, GN. 2010. PlantPathology. Acad. Press.
2. Kamat, M. N. Introductory Plant Pathology. Prakash Pub, Jaipur 4) Singh RS. 2008. PlantDiseases.8th Ed. Oxford & IBH. Pub. Co.
3. Singh RS. 2013. Introduction to Principles of Plant Pathology. Oxford and IBH Pub. Co.
4. Alexopoulos, Mims and Blackwel. Introductory Mycology
5. Mehrotra RS &Aggarwal A. 2007.Plant Pathology.7th Ed. Tata McGraw Hill Publ. Co. Ltd.
6. Gibbs A & Harrison B. 1976. Plant Virology – The Principles. Edward Arnold, London.
7. Hull R. 2002. Mathew. S Plant Virology. 4th Ed. Academic Press, New York.
8. Verma JP. 1998. The Bacteria. Malhotra Publ. House, New Delhi.
9. Goto M. 1990. Fundamentals of Plant Bacteriology. Academic Press, New York.
10. Dhingra OD & Sinclair JB. 1986. Basic Plant Pathology Methods. CRC Press, London, Tokyo.
11. Nene YL &Thapliyal PN. 1993. Fungicides in Plant Disease Control. 3rd Ed. Oxford & IBH, NewDelhi.
12. Vyas SC. 1993. Handbook of Systemic Fungicides. Vols. I-III. Tata McGraw Hill, New Delhi.
13. Rajeev K & Mukherjee RC. 1996. Role of Plant Quarantine in IPM. Aditya Books.
14. Rhower GG. 1991. Regulatory Plant Pest Management. In: Handbook of Pest Management inAgriculture. 2nd Ed. Vol. II. (Ed. David Pimental). CRC Press.
15. Singh RS & Sitaramaiah K. 1994. Plant Pathogens – Nematodes. Oxford & IBH, New Delhi.
16. Thorne G. 1961. Principles of Nematology. McGraw Hill, New Delhi.

Walia RK & Bajaj HK. 2003. Text Book on Introductory Plant Nematology. ICAR, New Delhi

SEC Basket Biochemistry (2 credit, 4-hour Practical) Semester 2

Blood Processing Techniques (BVS2P04)

Course objective: After completion of this course student will have practical knowledge of various skills needed for blood processing and handling.

1. Instrumentation and facilities required for blood processing laboratories.

2.Separation of plasma from a given blood sample.

3. To prepare fresh frozen plasma and its processing for use in patients.

4. Separation of Serum from a given blood sample.

5. Types and principal of working of autoanalyzer.

6. Demonstration of blood analysis using autoanalyzer.

7. Separation of blood components using centrifugation technique.

8. To perform capillary blood collection.

9. To perform venous blood collection.

10. Differential leucocyte count of blood.

11. To Perform WBC count

12. To perform RBC count

13. To perform ESR of blood.

14. To perform platelet count.

References:

1. Dicken Weatherby. Blood Chemistry and CBC Analysis. Bear Mountain publisher.
2. Diana Garza. Phlebotomy Handbook: Blood Specimen Collection from Basic to Advanced. Pearson publication.
3. F.A. Davis Company. Blood Collection. 2nd Edition. FA Davis company publication.

Skill Enhancement Courses (Biotechnology)

SEMESTER – II

WINE TECHNOLOGY

Course Code: BVS2P04 **Total Contact Hours**: **60**

Course outcomes:

On completion of this course, students will be able to:

CO 1. Demonstrate an understanding of the basic concepts of wine chemistry and wine microbiology
CO 2. Students will be able to learn wine production
CO 3. Students will be able to check quality of grapes and wine
CO 4. Students will be able to evaluate wine quality using chemical and sensory techniques

PRACTICALS

1. Introduction to Wine technology Laboratory and common Wine technology laboratory instruments e.g., Lab fermenter, Refractometer, Hydrometer Colorimeter, pH Meter, Distillation Unit and Chemical Balance
2. Preparation of Malt Extract Glucose Yeast extract Peptone (MGYP) medium for growth & identification of yeast.
3. Isolation of bacteria and yeast from fruits
4. Determination of reducing sugar in molasses sample
5. Identification of grape and wine varieties
6. Preparation of wine from fruits (grapes/apple)
7. Determination of viable count of yeast from fermenting wine sample by Neubaur's chamber
8. Determination of viable count of yeast from fermenting wine sample by Spread plate method.
9. Determination of alcohol content of wine by titrimetric/hydrometer/ specific gravity methods
10. To study the effect of alcohol concentration on yeast growth
11. To learn the techniques of Stem cuttings and its propagation
12. To learn the technique of "Whip" grafting for propagation of grape plants
13. To collect infected fruit samples and study the morphology of major disease-causing organisms
14. Sensory evaluation of white wine and red wine.
15. Determination of BOD of given sample (winery/distillery/brewing waste)
16. Determination of COD of given sample (winery/distillery/brewing waste)

Reference Books

1) Casida L. E. (Jr) (1993) Industrial Microbiology, 5th Reprint
2) Frobisher M. (1974) Fundamentals of Microbiology, 9th Edition
3) Patel A. H. Industrial Microbiology.
4) Prescott S. C. and Dunn C.G. (1983) Industrial Microbiology, Reed, g. (Ed.) AVI Tech books.
5) Stanbury P. F., Whitaker A. and Hall S. J., (1997) Principles of Fermentation, 2nd Edition
6) Boltan R. B. (1996) Principles and practice of winemaking, Chapman and Hall.
7) Glaudio Delfins & Formica J. V. (2001) Wine microbiology Science and Technology.
8)The microbial world – Stainer
9). General Microbiology – Volume I and II Power and Daginwala
10) Elements of Microbiology – Pelczar

B.Sc. Semester – II (Chemistry)
Skill Enhancement Course (SEC)
Water and wastewater analysis (BVS2P04)
Practical 2 credits

Course Outcomes

By the end of this course, students will be able to:

1. *Identify sampling locations for different types of water samples.*
2. *Carry out sampling of water and wastewater from various sources.*
3. *Analyze spot parameters at sampling location.*
4. *Carry out complete physico-chemical analysis of different types of water samples.*
5. *Suggest remedial measures for water detoxification.*

List of Experiments

A. Physicochemical analysis:

1. Determination of temperature of water sample.
2. Determination of pH of water sample using pH paper as well as pH meter.
3. Determination of electrical conductivity of water sample.
4. Determination of turbidity of water sample.
5. Determination of total dissolved solids (TDS) in water sample.
6. Determination of alkalinity (hydroxide, bicarbonate and carbonate) of water sample.
7. Determination of chloride content of water sample.
8. Determination of sulphate content of water sample.
9. Determination of hardness (total, temporary and permanent) of water sample.
10. Determination of calcium and magnesium hardness of water sample.

B. Demand analysis:

1. Determination of Dissolved Oxygen (DO) in water sample.
2. Determination of Chemical Oxygen Demand (COD) of water sample.
3. Determination of Biochemical Oxygen Demand (BOD) of water sample.

C. Heavy metals:

1. Estimation of iron by spectrophotometry using 1,10-phenanthroline.
2. Estimation of copper by solvent extraction with DDC.
3. Estimation of Cr(VI) by spectrophotometry using DPC.

Note: Minimum 10 experiments should be performed.

References:

1. William C. Lipps, Ellen Burton Braun-Howland, Terry E. Baxter (2012), Standard Methods for the Examination of Water and Wastewater, Amer Public Health Assn.
2. Ramteke, Moghe (1987), Laboratory manual of Water Analysis, CSIR-NEERI, Nagpur.
3. Leo M.L. Nollet, Leen S. P. De Gelder, (2014) Handbook of water analysis, CRC Press, Taylor and Francis.

SEC Basket

B.Sc. Sem-II (Computer Science)

BVS2P04

TALLY

Credits: 2 **Duration : 60 Hours**

Course Objectives:

1. To understand the concepts of accounting.
2. To give the students a hands-on experience on Tally.
3. To understand the different features of Tally.

Course Outcomes:

After completing this course satisfactorily, a student will be able to:

1. understand the fundamentals of accounting
2. work on Tally Software
3. prepare Ledger, Voucher and Orders in Tally.
4. prepare balance sheet, payroll report and VAT report in Tally

UNIT I

Accounting Basics - Defining the need for accounting, Defining accounting, Exploring the branches of accounting, Describing the functions of accounting, Listing the advantages of accounting, Listing the limitations of accounting, Explaining important terms in accounting, Exploring the concepts of accounting, Understanding the conversions of accounting, Describing an account and its types, Explaining the rules of debit and credit, Describing a journal, Describing a ledger, Describing trial balance, Describing a financial entries, Understanding adjustment entries.

Introduction to Tally ERP 9 – Features of Tally, Enhancement in Tally. ERP 9, Installation procedure of Tally. ERP 9, Opening Tally. ERP 9, Components of the Tally. ERP 9 window, Creating a Company.

UNIT II

Stock and Godown in Tally ERP 9 – Stock groups, Stock categories, Stock items, Units of measure, Godowns. **Group, Ledgers, Vouchers and Orders** – Introducing groups, Introducing ledgers, Introducing vouchers, Introducing purchase orders, Introducing a sales order, Introducing invoices.

UNIT III

Reports in Tally ERP 9 – Working with balance sheet, Working with profit & loss A/c report, Working with stock summary report, Understanding ratio analysis, Working with trial balance report, Working with day book report. **Payroll** – Exploring payroll in Tally. ERP 9, Required features to create a pay slip, Description of payroll info, Working with payroll vouchers, Defining payroll reports, working with statements of payroll report, Describing salary disbursement.

UNIT IV

Taxation – Indian Tax Structure, Tax deducted at source in tally.ERP 9, Create a Tax Ledger, TDS Vouchers, Printing a TDS Challan, Tax collected at source in Tally.ERP 9, TCS reports in Tally ERP 9, Calculating VAT in Tally.ERP 9, VAT Classification, VAT Vouchers, VAT Reports in Tally ERP 9, Service Tax.

Books :

1.Business Accounting with MS Excel and Tally.ERP 9 Course Kit, Vikas Gupta, Dreamtech Press.
2.Computerised Accounting using Tally.ERP 9 1 , Sahaj Enterprise, Tally Education Private Ltd (TEPL).
3.SIMPLIFIED TALLY.ERP 9, Vishnu Priya Singh, Computech Publications Limited (Asian Publishers)
4.Mastering Tally Erp 9: Basic Accounts, Invoice, Inventory, A.K. Nadhani, BPB Publication
5.Tally 6.3 Tutorial, A.K. Nadhani, K.K. Nadhani BPB Publication.
6.Accounting Principles, Robert N. Anthony, James S. Reece, Irwin Professional Publishing

Semester – 2; SEC Semester II

File Handling in C (BVS2P04)

Course Outcome:

At the end of this course students will demonstrate the ability to

1. Handle various kinds of files.
2. Implement file Operations in C programming for a given application.

File handling: Streams in C, Types of Files, File Input/ Output Operations: Modes of file opening, Reading and writing the file, Closing the files.

Entrepreneurship Development and Services by Environmental Consultancy

Unit-I:

Introduction: Most popular business types and requirements for formation, Need for Government/ Professionals/ Licenses and Collaboration, Understanding psychology ofsustainability and circular economy as a consultant, Current Projects and Thrust Area of CPCB/MPCB, Patents for Business Development, Copyrights and Logos for consultancies.

Development of Laboratory and Training Centre: Guidelines for Recognition of Environmental Laboratories under the Environmental (Protection) Act, 1986, Guidelines for Recognition as NABL Accredited Laboratory, Importance of Training Centre.

Unit-II:

Compliance Requirements by MPCB/CPCB: Detailed study of SPCB/CPCB/MoEFCC websites, Registration with MPCB and Application for consent Service (Maitri Portal), Consent under Water and Air Act, Authorization's required under rules of Environment Act, CEPI and categorization of the Industries.

Water and Wastewater Treatment/ Air Pollution Control: Design and Development of STP/ETP, Treatment and Maintenance Services, Phyto-remediation and Patents, Supply of Equipment's and Installation of Air Pollution Control Devices.

Unit-III:

Important Services Provided by Consultants: Remote Sensing and GIS Mapping Services, Energy Conservation Services, Restoration of Lands/Water bodies, Organic farming and Green Belt Development. Preparation of EMS reports, Green Building Certifications: LEED,WELL buildings, IGBC, TERI Griha , Life Cycle Assessment reports. Ecological and Carbon Footprints.

Establishment of an NGO: Cause and Mission of NGO, Board of Directors/members and name of your NGO, Memorandum Articles of incorporation/ Articles of Association, NGO registration, Fund's collection, Building a wide network. **Individual Start up in the field of Environment:** Sole Proprietorship/Freelance – Minimum requirements and Registration, One Person Company (OPC): The Companies Act, 2013, Section 2(62), Section 3(1) (c), Sole Proprietorship vs OPC**.**

Unit-IV: Field Work/ Project/ Training/Assignment related to Entrepreneurship Development and Services by Environmental Consultancy.

B.Sc. Sem-II (Forensic Science - Major)

SEC (Forensic Science)

A. Security Features of Security Documents (BVS2P04)

Course Outcome: By the end of this Course, the learners will be able to:

1. Identify and describe security features of different currency notes.
2. Examine and explain security features of various identification documents.
3. Study and describe security features of educational documents, stamp papers and credit cards/debit cards.

List of Practical:

1. To study the security features of Indian Currency note INR 100.
2. To study the security features of Indian Currency note INR 500.
3. To study the security features of Indian Currency note INR 2000.
4. To examine the security features of Passport.
5. To examine the security features of Cheque.
6. To examine the security features of Pan card.
7. To study the security features of Aadhar card.
8. To study the security features of educational documents.
9. To study the security features of Stamp paper.
10. To study the security features of Credit Card/ Debit Card.

B.Sc. Sem-II (Forensic Science - Major)

SEC (Forensic Biology)

B. General Techniques and Recombinant DNA Technology in Microbial Forensics

(BVS2P04)

Course Outcomes: By the end of this Course, the learners will be able to:

1. Demonstrate the ability to operate a high-speed cooling centrifuge machine effectively.
2. Perform the separation of serum and plasma from blood samples using centrifugation techniques.
3. Apply centrifugation methods to separate and collect bacterial cells from a broth.
4. Perform gradient centrifugation to separate components in a given sample effectively.
5. Conduct turbidimetric evaluation of bacterial suspensions to assess their optical density and growth characteristics.

List of Practical

1. To study the operation of high-speed cooling centrifuge machine.
2. Separation of serum from blood.
3. Separation of plasma from blood.
4. Separation and collection of bacterial cells from the broth using centrifugation.
5. To perform gradient centrifugation of the given sample.
6. To perform the turbidimetric evaluation of bacterial suspension.
7. To study the restriction enzyme activity.
8. To set the program of the PCR cycle.
9. To study negative staining of bacteria.
10. To perform the plasmid DNA isolation from bacteria.
11. To study Salient features of BAC
12. To study Salient features of YAC

B.Sc. Sem-II (Forensic Science - Major)

SEC (Digital & Cyber Forensics)

C. Mobile App Development (BVS2P04)

Course Outcome: By the end of this Course, the learners will be able to:

1. Gain a solid understanding of the Android Studio IDE, its features, and its role in Android application development.
2. Apply principles of user interface design to create visually appealing and user-friendly layouts using different layout types in Android applications.
3. Implement various features and functionalities in Android applications, such as displaying shapes, creating a calculator, handling notifications, and designing a BMI calculator.
4. Develop skills in implementing navigation within Android applications, allowing users to move between screens and interact with different activities.
5. Learn techniques for optimizing performance, such as implementing multithreading for smooth image display, ensuring responsive user experiences in Android applications.

List of Practical

1. Study of Android Studio IDE
2. Displaying “Welcome to Android Laboratory”
3. Designing Simple Toast
4. Designing User Interface based on Layouts
5. Displaying different Shapes
6. Designing Simple Calculator Application
7. Navigation in Android
8. Displaying the Notification
9. Creating an Alarm
10. Designing BMI Calculator Application
11. Displaying images using multi-threading

SEC (Geology)

Tools and Techniques in Geology (BVS2P04)

Practical:

Sample etching, staining and model count techniques; heavy mineral analysis and paleocurrent interpretation; use of computers in insertion of columns, line charts, pie charts, bar charts, scatter diagrams in geological reports.

Books Recommended:

No Textbook - only handouts and web pages

B.Sc. Mathematics (Major): SEMESTER II (SEC)

Financial Mathematics (BVS2P04)

Course Outcomes

1. Calculate variables using both simple and compound interest;
2. Calculate variables using annuities formulas, including bond market value calculations;
3. Describe the features of promissory notes, bonds, and annuities;
4. Judge if a project is viable based on a Net Present Value calculation;
5. Demonstrate the interaction between interest rates and market prices for bonds;
6. Communicate using financial terminology;
7. Solve common business problems employing mathematics of finance.

TOPICS:

1. Arbitrage and risk aversion
2. Interest (simple and compound, discrete and continuous),
3. Time value of money,
4. Inflation,
5. Net present value,
6. Internal rate of return,
7. Comparison of Net Present Value (NPV) and Internal Rate of Return (IRR)
8. Bonds, bond prices and yields. Floating-rate bonds
9. Immunization
10. Asset return
11. Short selling
12. Portfolio return, (brief introduction to expectation, variance, covariance and correlation) random returns
13. Portfolio mean return and variance
14. Diversification
15. Portfolio diagram
16. Feasible set

Reference BOOKS:

1. David G. Luenberger; Investment Science; Oxford University Press, Delhi, 1998.
2. John C. Hull; Options, Futures and Other Derivatives, 6th Ed.; Prentice-Hall India, Indian reprint, 2006.
3. Sheldon Ross; An Elementary Introduction to Mathematical Finance, 2nd Ed.; Cambridge University Press, USA, 2003.

SEC (Microbiology)

Testing of Food Adulteration

Course Code: (BVS2P04)

SEC	Hours: 04 Hours /Week	Marks: SEE= 50 CIE= 50	Credit: 02

60 Hrs

LIST OF EXPERIMENTS
(Perform at least 12 practical)

1) Detection of starch in milk & milk products
2) Detection of developed acidity in milk
3) Detection of carbonates as neutralizers in milk
4) Detection of urea in milk.
5) Detection of Margarin or Vanaspati in ghee & butter
6) Detection of mineral oil in oils & fats.
7) Detction of Mentanil yellow in ice cream.
8) Detection of Mentanil yellow in beverages.
9) Detection of Mentanil yellow in pulses
10) Detction of Kesari dal in pulses.
11) Detection of Argimone seeds in mustard seeds.
12) Detection of aluminium in silver foil.
13) Detection of sugar solution in honey.
14) Detection of chicory in coffee.
15) Detection of artificial color (coal tar) dyes in tea
16) Detection of Talc powder in cardmum.
17) Detection of tamarind powder in coffee.
18) Detection of coloring matter in turmeric powder
19) Detection of RhodamineB in red chilly powder

Scheme of Practical Examination:

1. Three expt. ----------. 10 Marks each
2. Viva-voce---------- 10 Marks
3. Record---------- 10Marks

Total Marks = 50

Reference Books:

1) Manual of Methods of Analysis of Microbiological Examination of Food and Water- FSSAI Manual-2016

2) Manual of methods of analysis of foods milk and milk products -fssai-2016

3) Manual of methods of analysis of foods food safety and standards authority of India ministry of health and family welfare government of India new Delhi 2015 beverages (coffee, tea, cocoa, chicory) sugar and sugar products & confectionery products -lab manual-2015

4) Manual of Methods of Analysis of Foods- Alcoholic Beverages- FSSAI-2021

5) Manual of Methods of Analysis of Foods- Spices, Herbs & Condiments-FSSAI-2021

6) Manual of Methods of Analysis of Foods- Cereal & Cereal products- FSSAI-2016

7) Manual of Methods of Analysis of Foods-Mycotoxins,FSSAI-2021

8) Manual of Methods of Analysis of Foods- Meat & Fish products- FSSAI-2016

9) General guidelines for Sampling for Microbiological Analysis of Food-FSSAI-2022

10) Manual of Methods of Analysis of Foods- FOOD ADDITIVES- FSSAI-2016

11) Manual of Methods of Analysis of Foods-Water-FSSAI-2016

12) A Manual of Laboratory Techniques-National Institute of Nutrition-CMR- Hyderabad

Course outcomes

After this course the students will be able to

Sr. No.	Course outcome
1.	Student will learn the basic knowledge of food adulteration testing
2.	The knowledge is very useful for opting job in industries.

	Semester II (SEC) Statistics
	NAME OF THE PAPER – FINANCIAL LITERACY Understanding basic financial concepts can be incredibly helpful in both your personal and professional life. Consider taking courses on topics like budgeting, investing, and financial planning.
	Paper code – BVS2P04 2 Credits (4 hrs practical per week)
	List of Practicals
1	**Budgeting**: This topic covers the basics of creating and sticking to a budget, including tracking expenses, setting financial goals, and prioritizing spending.
2	**Saving and investing**: This topic covers the different types of savings accounts and investment vehicles available, as well as how to assess risk and build a diversified portfolio.
3	**Credit and debt management:** This topic covers the basics of credit scores and reports, as well as strategies for paying off debt and avoiding high interest rates.
4	**Retirement planning:** This topic covers the different types of retirement accounts available, as well as how to calculate retirement needs and develop a retirement savings plan.
5	**Insurance:** This topic covers the basics of different types of insurance (such as health, life, and auto insurance) and how to determine which types of insurance are necessary.
6	**Taxes:** This topic covers the basics of income taxes, including how to file a tax return, how to take advantage of deductions and credits, and how to plan for tax obligations.
7	**Financial goal-setting**: This topic covers strategies for setting and achieving short-term and long-term financial goals, as well as how to adjust goals as circumstances change.

B.Sc. Sem. II SEC

Course Name: Lac culture (BVS2P04)

Credit: 2

Course outcomes: After completion of the course, students will able to-

- Identify, recognized, describe and explain male and female Lac insect and different stages of its life cycle.
- Identify, recognized, describe and explain various host plants of Lac insect.
- Handle different tools and materials involved in Lac culture.
- Separate Lac from sticks; dry and wash the crude Lac.
- Process the crude lac to Shellac.
- To do internship and work in commercial Lac cultivation unit.

Practical:

1. Study of systematic position of Lac insects, *Laccifer lacca* .
2. Identification and classification of host plants of Lac insect.
3. Identification of male and female lac insect and different life stages of Lac insects.
4. Study appropriate pruning tools, cutting tools and harvesting tools.
5. Estimation of male: female ratio in the brood.
6. Demonstration of manual scraping of rejected brood Lac and sticks.
7. Study of brood Lac with expected larval emergence.
8. Study of dead and living encrustation on brood lac.
9. Study of features of active and inactive brood
10. Demonstration of easy separation of Lac from the sticks.
11. Demonstration of drying of Lac in open air for optimum moisture content.
12. Demonstration of washing of stick Lac with an alkaline solution to clean off impurities.
13. Demonstration of processing of crude Lac to shellac by different methods (handmade, traditional native process, heat process and solvent process).

Suggested reading:

Glover PM (1931). A practical manual of lac cultivation. Criterion Printing Works, pp. 81.

Goud R (2022). Practical Manual on Apiculture, Sericulture and Lac culture. Jaya Publication House

Jaiswal AK, Sharma KK, Ramani R (2011). LAC Culture Operations When, why and How? Indian Institute of Natural Resins and Gums, pp. 18.

Ghorai N (2021). Lac culture in India. International Books and Periodicals Supply Service, pp.167.

SEC Basket
Semester IV
Faculty of Science and Technology

Semester	Course Category	Name of Course	BoS	Course Code
IV	**SEC**	English for Business Communication	Languages	**BVS4P06**
		Medicinal plants, cultivation, practices and marketing	Botany	
		Clinical Pathology	Zoology	
		Visual Basic Programming	Computer Science	
		Logic and sets	Mathematics	
		Plant Transformation Techniques	Biotechnology	
		Phytochemistry	Chemistry	
		Mushroom Cultivation	Microbiology	
		Enzyme Kinetics	Biochemistry	
		Data Interpretation and Drafting of Geological Reports	Geology	
		Troubleshooting of Electronic Gadgets	Electronics	
		Biomedical Waste Management	Environmental Science	
		A. Forensic Psychology B. Law	Forensic Science	