Estd. 1962
"A++" Accredited by NAAC (2021)
With CGPA 3.52

SHIVAJI UNIVERSITY, KOLHAPUR - 416004, MAHARASHTRA
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शिवाजी विद्यापीठ, कोल्हापूर -४१६००४,महाराष्ट्र
दूरध्वनी-ईपीएबीएक्स -२६०९०००, अभ्यासमंडळे विभाग दुरध्वनी ०२३१—२६०९०९४
०२३१—२६०९४८७

Ref.No.SU/BOS/Science/271 **Date: 03/05/2025**

To,

The Principal,
All Concerned Affiliated Colleges/Institutions
Shivaji University, Kolhapur.

Subject: Regarding revised syllabi of B.Sc. Part-II (Sem.III & IV) degree programme under the Faculty of Science and Technology as per NEP-2020 (2.0).

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the syllabi, nature of question paper B.Sc. Part-II (Sem. III & IV) degree programme under the Faculty of Science and Technology as per NEP-2020 (2.0).

B.Sc.Part-II (Sem. III & IV) as per NEP-2020 (2.0)			
1.	Pollution	8.	Food Science (Entire)
2.	Biochemistry	9.	Biotechnology (Entire)
3.	Food Science and Quality Control	10.	Environmental Science (Entire)
4.	Computer Science (Optional)	11.	Information Technology (Entire)
5.	Biotechnology (Optional/Vocational)	12.	Food Science and Technology (Entire)
6.	Animation (Entire)	13.	Food Technology & Management (Entire)
7.	Computer Science (Entire)	14.	All Faculty UG Part II Environmental Studies (VEC)

This syllabus, nature of question and equivalence shall be implemented from the academic year 2025-2026 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in NEP-2020@suk(Online Syllabus)

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2025 & March/April 2026. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,

Dy Registrar
Dr. S. M. Kubal

Encl: As above

for Information and necessary action

Copy to:

1	Dean, Faculty of Science & Technology	6	Appointment Section A & B
2	Director, Board of Examinations and Evaluation	7	I.T.Cell /Computer Centre
3	Chairman, Respective Board of Studies	8	Eligibility Section
4	B.Sc.-M.Sc. Exam Section	9	Affiliation Section (T.1) (T.2)
5	Internal Quality Assurance Cell (IQAC Cell)	10	P.G. Seminar Section

SHIVAJI UNIVERSITY, KOLHAPUR.

Established: 1962

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with CGPA 3.52

New Syllabus For

Bachelor of Science

B.Sc. Environment Science (Entire)

SEMESTER III AND IV

STRUCTURE AND SYLLABUS IN ACCORDANCE WITH NATIONAL EDUCATION POLICY-2020

WITH MULTIPLE ENTRY AND MULTIPLE EXIT OPTIONS

(TO BE IMPLEMENTED FROM ACADEMIC YEAR 2025-26 ONWARDS)

Syllabus of B.Sc. Part - II Environment Science (Entire)
SEMESTER III AND IV
(NEP 2020)
Syllabus to be implemented from academic year 2025-2026 onwards

- Guidelines shall be as per B. Sc. Regular Programme
- Rules and Regulations shall be as per B.Sc. Regular Programme
- **Preamble:**

  This syllabus is framed to give sound knowledge with understanding of Environment science to undergraduate students of B.Sc. Environment Science (Entire) Programme. Students will learn Environment Science as a separate course (subject) from B. Sc. I. The goal of the syllabus is to make the study of Environment Science popular, interesting and encouraging students for higherstudies including research.

Programme Outcome:

1. This programme will lay strong foundation of environmental concepts for postsgraduate education and research.
2. Helps students in capacity building, developing environmental programmes /projects based on sound technical, environmental and policy matters of Government of India.
3. Develop ability to carry out experiments and provide efficient conclusions.
4. Develop an approach to work for needs of society regarding environment, health,safety considerations.

Programme Specific Outcome:

1. This programme will make students to understand the concept of sustainable development.
2. This programme will provide in-depth knowledge to the students in respect of current environmental and safety problems faced by human society and to develop amongst students' scientific attitude based on interdisciplinary approach to enable them to take holistic view in decision taking.

B.Sc. (Environment Science)

1. Eligibility Criteria for B.Sc. (Environment Science):

The eligibility of students taking admission at B. Sc. Part-I [Level 4.5](initial entry) and the eligibility of students making lateral entry (Multiple entry-ME) admission at Level 5.0/ Level 5.5/ Level 6.0 are required to be scrutinized (with stipulated procedure) on the basis of following criteria:

(A) Eligibility requirements for admission to B. Sc. Part-I (Level 4.5):

i) The students passing the Higher Secondary School Certificate Examination with Science stream or Vocational subjects with science stream conducted by the Maharashtra State Board of Higher Secondary Education shall be allowed to enter upon the B. Sc. Part-I (or Undergraduate Certificate in Science).

OR

ii) An Examination of any other Statutory Board or an examining Body recognized as equivalent thereto.

OR

iii) Completed 2nd year of the 3-year diploma after 10th

(B) Eligibility requirements for admission to B. Sc. Part-II (Level 5.0):

i) The students passing or ATKT the B. Sc. Part-I (or Undergraduate Certificate in Science) shall be allowed to enter upon the B. Sc. Part-II (or Undergraduate Diploma in Science).

OR

ii) An Examination of any other Statutory University or an examining Body recognized as equivalent there to.

OR

iii) Completed 3-year diploma course with subjects allied / related to the subject at B.Sc. Part I

OR

iv) Completed first year of B.E./B. Tech. with subjects allied / related to the subject at B.Sc. Part I

(C) Eligibility requirements for admission to B. Sc. Part-III (Level 5.5):

i) The students passing (pass/ ATKT) the B. Sc. Part-II (or Undergraduate Diploma in Science) and successfully completed level 5 shall be allowed to enter upon the B. Sc. Part-III (or Three Year Undergraduate Degree in Science).

OR

ii) An Examination of any other Statutory University or an examining Body recognized as equivalent thereto.

OR

iii) Completed second year of B.E./B. Tech. with subjects allied / related to the subject at B.Sc. Part II

D) Eligibility requirements for admission to B. Sc. Part-IV (Level 6.0):

iv) The students passing the B. Sc. Part-III (or Three-Year Undergraduate Degree in Science) with 7.5 CGPA or 75% marks in Three-Year Undergraduate Degree in Science shall be allowed to enter upon the B. Sc. Part-IV (or Four-Year Undergraduate Degree in Science withHonours/ Honours with Research).

OR

v) An Examination of any other Statutory University or an examining Bodyrecognized as equivalent thereto.

2. Scheme of Examination:

Total marks shall be 50 for 2 credit course.

1. The question paper in each semester end examination for each theory course (paper) for B.Sc. (all Semesters) shall be of 40 marks for 2 credits. Total marks for each course shall be based on continuous assessments and semester- end examination. The division of internal assessment and semester–end examination for B. Sc. will be as follows:

Particulars	2 Credit Course	Duration
1. Semester-end Examination	40 Marks	1.5 hrs
2. Internal Assessment	10 Marks	1 hrs
Total marks for each course	50 Marks	--

1. The Examination for practical course will be of 50 marks at end of each semester. The rule for practical examination shall be as per the circular/ letter issued by respective board of studies.
2. The examination pattern for Co-Curricular Activities (CC), Field Project (FP), On Job Training (OJT), Community Engagement Program (CEP) and Research Project (RP) as per the University guidelines.

Internal Assessment Process shall be as follows:

(a) The internal assessment should be conducted after completing 50% of syllabus of the course/s.

(b) In case a student has failed to attend internal assessment on scheduled date, it shall be deemed that the student has dropped the test. However, in case of student who could not take the test on scheduled date due to genuine reasons, such a candidate may appeal to the Programme coordinator /Principal /Head of the Department.

The Programme coordinator /Principal /Head of the Department in consultation with the concerned teacher shall decide about the genuineness of the case and decide to conduct special test to such candidate on the date fixed by the concerned teacher but before commencement of the concerned semester-end examination.

The outline for continuous internal assessment activities shall be as under:

Outline for continuous internal assessment activities

Level	Semester	Activities Per Semester	Marks
4.5	Semester–I	Assignment	10 marks
	Semester–II	Unit test	10 marks
5.0	Semester–III	Unit test	10 marks
	Semester–IV	Oral examination/ Group discussion	10 marks
5.5	Semester– V	Seminar/ Group discussion/ Field Work/ Project Work	10 marks
	Semester– VI	Study tour / Field Work / Project Work / Seminar	10 marks
6.0	Semester– VII	Case Study /Field Work/ Project Work	10 marks
	Semester– VIII	Case Study/ Field Work/ Project Work	10 marks

3. **Equivalence of papers and chances for the students in previous-Semester pattern:** Two additional chances in subsequent semesters shall be provided for the repeater students of old three-year B.Sc. program. In such case the scores obtained by the students in NEP 1.0/CBCS scheme should be converted into equivalent credits in NEP 2.0. After that the students concerned shall have to appear for the examination as per this revised pattern.

   If a student fails in two consecutive chances he/she has to take admission for the respective course in NEP 2.0. In such cases his previous performance of incomplete academic years (B. Sc. I, B. Sc. II or B. Sc. III) will be cancelled.

4. **Standard of Passing:** The standard of passing shall be as per shown in the following table:

	Semester End Exam	**Internal Assessment**	**Course Exam (Total)**
Maximum Marks	40	10	50
Minimum Marks required for passing	14	4	18

1. There shall be a separate head of passing for semester end examination and internal examination.
2. Minimum 18 marks out of 50 are required for passing of practical examination of each course.
3. Passing criteria for Co-Curricular Activities (CC), Field Project (FP), On Job Training (OJT), Community Engagement Program (CEP) and Research Project (RP) as per the University guidelines.

A) To pass the three year B.Sc. degree examination, a candidate shall be required to pass in semester I, II, III, IV, V and VI examinations

a) To pass each semester examination a candidate shall be required to obtain a minimum of 35% of the total marks in each course.

b) A Candidate shall have to obtain 14 marks out of 40 for the semester end theory examination, 18 out of 50 for the semester end practical examination and 4 marks out of 10 in the internal examination in each semester. If the candidate fails/ absent in the internal examination then the candidate has to pass the internal examination as per University regulations.

c) The candidate has to complete the other applicable courses like VSEC, SEC, VEC, AEC OE, IKS, CC, OJT, CEP and FP according to the criterion applicable for the respective courses.

B) For Three year B. Sc Degree : Those of the successful candidates who obtain45% or more of the aggregate marks in Parts-I, II& III semester Examinations, (i.e. Semester-I to VI aggregate) shall be declared to have passed the B.Sc. Degree Examinations in Second Class and those obtaining 60% or more of the aggregate marks in Parts-I, II & III Examinations (i.e. Semester-I to VI aggregate) shall be declared to have passed the B.Sc. Degree Examinations in First Class and those obtaining 70% or more of the

aggregate marks in Parts-I, II & III (i.e. Semester I to VI aggregate) shall be declared to have passed the B.Sc. Degree Examination in First Class with Distinction.

For Four Year B. c. with (Hon./Research) Degree: Those of the successful l candidates who obtain 45% or more of the aggregate marks in Parts-I, II, III & IV Semester Examinations, (i.e. Semester-I to VIII aggregate) shall be declared to have passed the B.Sc. with (Hon./Research)Degree Examinations in Second Class and those obtaining 60% or more of the aggregate marks in Parts-I, II, III & IV Semester Examinations, (i.e. Semester-I to VIII aggregate) shall be declared to have passed the B.Sc. with (Hon./Research) Degree Examinations in First Class and those obtaining70% or more of the aggregate marks in Parts-I, II, III & IV Semester Examinations,(i.e. Semester-I to VIII aggregate) shall be declared to have passed the B.Sc. with(Hon./Research)Degree Examination in First Class with Distinction.

5. Gradation Chart:

% of Marks Obtained	Numerical Grade (Grade Point)		CGPA	Letter Grade
Absent	--		-	-
0 – 34	0		0.0 – 4.99	F (Fail)
35 – 44	5		5.00 – 5.49	C
45 – 54	6		5.50 – 6.49	B
55 – 64	7		6.50 – 7.49	B+
65 – 74	8		7.50 – 8.49	A
75 – 84	9		8.50 – 9.49	A+
85 – 100	10		9.50 – 10.0	O (Outstanding)

Note:

1. Marks obtained >= 0.5shall be rounded off to next higher natural number.
2. The SGPA &CGPA shall be rounded off to 2 decimal points.

Calculation of SGPA& CGPA:

1. Semester Grade Point Average **(SGPA)**

$$\boldsymbol{SGPA} = \frac{\sum (\text{Course credits} \times \text{Grade points obtained}) \text{ of a semester}}{\sum (\text{Course credits}) \text{ of respective semester}}$$

2. Cumulative Grade Point Average **(CGPA)**

$$= \frac{\sum (\text{Total credits of a semester} \times \text{SGPA of respective semester}) \text{ of all semesters}}{\sum (\text{Total course credits}) \text{ of all semesters}}$$

Structure of programme

Shivaji University, Kolhapur
Bachelor of Science
Credit Framework

	SHIVAJI UNIVERSITY, KOLHAPUR NEP-2020: Credit Framework for UG (B. Sc.) Programme under Faculty of Science and Technology								
SEM (Level)	COURSES			**OE**	**VSC/SEC**	**AEC/VEC/ IKS**	**OJT/FP/CEP /CC/RP**	**Total Credits**	**Degree/Cum. Cr**
	Course-1	**Course-2**	**Course-3**						
SEM I (4.5)	DSC-I(2) DSC-II (2) DSC P-I(2)	DSC-I(2) DSC-II (2) DSC P-I(2)	DSC-I(2) DSC-II (2) DSC P-I(2)	OE-1(2) (T/P)		IKS-I(2)		**22**	**UG Certificate 44**
SEM II (4.5)	DSC-III(2) DSC-IV (2) DSC P-II(2)	DSC-III(2) DSC-IV (2) DSC P-II(2)	DSC-III(2) DSC-IV (2) DSC P-II(2)	OE-2(2) (T/P)		VEC-I(2) (Democracy, Election and Constitution)		**22**	
Credits	**8(T)+4(P)=12**	**8(T)+4(P)=12**	**8(T)+4(P)=12**	**2+2=4 (T/P)**	**--**	**2+2=4**	**--**	**44**	**Exit Option:4 credits NSQF/Internship/Skill courses**
	MAJOR		**MINOR**						
SEM III (5.0)	Major V(2) Major VI (2) Major P III (2)	--	Minor V(2) Minor VI (2) Minor P III(2)	OE-3(2) (T/P)	VSC I (2) (P) (Major specific) SEC I(2) (T/P)	AEC I(2) (English)	CC-I (2)	**22**	**UG Diploma 88**
SEM IV (5.0)	Major VII(2) Major VIII (2) Major P IV (2)	--	Minor VII(2) Minor VIII (2) Minor P IV (2)	OE-4(2) (T/P)	SEC-II(2) (T/P)	AEC-II(2) (English) VEC-II(2) (Environmental studies)	CEP-I(2)	**22**	
Credits	**8(T)+4(P)=12**		**8(T)+4(P)=12**	**2+2=4(T/P)**	**4(T/P)+2(P)=6**	**2+4=6**	**2+2=4**	**44**	**Exit Option:4 credits NSQF/Internship/Skill courses**

SEM V (5.5)	Major IX(2) Major X (2) Major P V (4)	Major I (ELEC)(2) Major P-I (ELEC) (2)	-	OE-5(2) (T/P)	VSC II (2) (Major specific)(P)	AEC III(2) (English)	**OJT(04)**	**22**	**UG Degree 132**
SEM VI (5.5)	Major XI(2) Major XII (2) Major P VI (4)	Major II (ELEC)(2) Major P-II(2) (ELEC)	-		VSC III (2) (Major specific) (P) SEC III(2) (T/P)	AEC IV(2) (English) IKS 2 (Major specific) (2)	**FP-(02)**	**22**	
Credits	**8(T)+8(P) =16**	**4(T)+4(P)=8**	**-**	**2(T/P)**	**2(T/P)+4(P)=6**	**4+2=6**	**4+2=6**	**44**	
Total Credits	**40+20=60**		**24**	**10**	**12**	**16**	**10**	**132**	**Exit Option**

SEM VII (6.0)	Major -XIII(4) Major -XIV(4) Major(P).- VII(4) Major (P) .- VIII(2)	MAJOR III (4) (ELEC)	RM-I(4)	**-**	**-**	-		**22**	**UG Honours Degree 176**
SEMV III (6.0)	Major -XV(4) Major -XVI(4) Major (P)- IX(4) Major (P). - X(2)	MAJOR IV (4) (ELEC)	-	**-**	**-**	-	**OJT(04)**	**22**	
Credits	**16(T)+12(P)=28**	**8(T)**	**4**	**-**	**-**	**-**	**04**	**44**	
									Exit Option
Total Credits	**68+28=96**		**28**	**10**	**12**	**16**	**14**	**176**	

SEM VII (6.0)	Major -XIII (4) Major -XIV (4) Major(P).-VII (2)	MAJOR (4) (ELEC)	RM-I (4)	**-**		-	**RP-4**	**22**	**UG Honours With Research**

SEMV III (6.0)	Major -XV (4) Major -XVI (4) Major (P)-VIII (2)	MAJOR (4) (ELEC)		**-**		-	**RP-8**	**22**	**Degree 176**
Credits	**16(T)+4(P)=20**	**8(T)**	**4**	**-**	**-**	**-**	**12**	**44**	
Total Credits	**60+28=88**		**28**	**10**	**12**	**16**	**22**	**176**	

Structure in Accordance with National Education Policy - 2020
With Multiple Entry and Multiple Exit Options

B.Sc. Part – I (Level-4.5) Semester I

Programme Structure:

Course Code	Teaching Scheme			Examination Scheme					
	Theory and Practical			University Assessment (UA)			Internal Assessment (IA)		
	Lectures + Tutorial/ (Hours/ week)	Practical (Hours/ week)	Credit	Maximum Marks	Minimum Marks	Exam. Hours	Maximum Marks	Minimum Marks	Exam. Hours
S1T1	2	0	2	40	14	1.5	10	4	1
S1T2	2	0	2	40	14	1.5	10	4	1
S1P1	0	4	2	50	17	4	--	--	--
S2T1	2	0	2	40	14	1.5	10	4	1
S2T2	2	0	2	40	14	1.5	10	4	1
S2P1	0	4	2	50	17	4	--	--	--
S3T1	2	0	2	40	14	1.5	10	4	1
S3T2	2	0	2	40	14	1.5	10	4	1
S3P1	0	4	2	50	17	4	--	--	--
OE-1 (T)/ (P)	2/ 0	0/ 4	2/ 2	40/ 50	14/ 17	1.5/ 4	10 --	4 --	1 --
IKS-1	2	0	2	40	14	1.5	10	4	1
TOTAL			**22**	**470/480**			**80/70**		

B.Sc. Part – I (Level-4.5) Semester II

Course Code	Teaching Scheme			Examination Scheme					
	Theory and Practical			University Assessment (UA)			Internal Assessment (IA)		
	Lectures (Hours/ week)	Practical (Hours/ week)	Credit	Maximum Marks	Minimum Marks	Exam. Hours	Maximum Marks	Minimum Marks	Exam. Hours
S1T3	2	0	2	40	14	1.5	10	4	1
S1T4	2	0	2	40	14	1.5	10	4	1
S1P2	0	4	2	50	17	4	--	--	--
S2T3	2	0	2	40	14	1.5	10	4	1
S2T4	2	0	2	40	14	1.5	10	4	1
S2P2	0	4	2	50	17	4	--	--	--
S3T3	2	0	2	40	14	1.5	10	4	1
S3T4	2	0	2	40	14	1.5	10	4	1
S3P2	0	4	2	50	17	4	--	--	--
OE-2 (T)/ (P)	2/ 0	0/ 4	2/ 2	40/ 50	14/ 17	1.5/ 4	10 --	4 --	1 --
VEC-1	2	0	2	40	14	1.5	10	4	1
TOTAL			22	470/480			80/70		
Cum. Total Sem I &II			44	940/960			160/140		

- **S#T#–** Subject number Theory paper number
- **S#P#**– Subject number Practical paper number

- Total Marks for B.Sc.-I : **1100**
- Total Credits for B.Sc.-I (Semester I & II) : 44

• **OE# (T)** - Open Elective Theory Paper number • **OE# (P)** - Open Elective Practical Paper number • **IKS-1**– Indian Knowledge System Theory Paper 1 (Generic) • **VEC-1**–Value Education Course (Democracy) Theory	• ***Separate passing is mandatory for University and Internal Examinations***
• **Requirement for Exit after Level 4.5:** **Award of UG Certificate with 44 Credits and an additional 4 credits core NSQF course/Internship.**	

Theory Examination

- ✓ Equal weightage shall be given to all units of the theory paper
- ✓ Total number of questions – 03
- ✓ Question one will carry-08Marks,
- ✓ Question No. 1 will be of an objective type eight objective will carry-08Marks.
- ✓ Question 2 will be descriptive two questions are to be attempted out of three and will carry 16 Marks, 08 Marks each) Question 3 will be short answer type four questions are to be attempted out of six and will carry 16 Marks, 04 Marks each) **Nature of questions** - multiple choice, Descriptive and short answer type.
- ✓ All These questions will be answered in the same answer book

Semester End Theory Assessment 40 marks

- The duration of this exam will be of 1.5 Hrs (90 minutes)
- For each unit there will be at least one question
- All questions shall be compulsory with internal choice within the questions

Nature of question paper
Total Marks: 40
Instructions: 1. **All questions are compulsory**
2. Figures to the **RIGHT** indicate **FULL MARKS**

Nature of Question paper

Q.1 Multiple choice questions (08-Questions) ---- 08 marks

Q.2 Attempt **any two** of the following.

(Essay type/Broad answer questions) --- 16marks

A)

B)

C)

Q.3 Write short notes (**any four**) ---- 16marks

a)

b)

c)

d)

e)

f)

Structure of Program and List of Courses are as follows:

Structure of B. Sc. Environment Science (Entire) Programme Semester III & IV

Structure–II

Level	Semester	Subject-1	Subject-1I	3-OE IDC/MDC/ OE/GE OE	4-VSC/SEC	5- AEC/VEC/ IKS	6-OJT,FP,CEP,CC,RP CC /Summer Internship/ Field Project/ OJT Research Project/ Dissertation	Total Credits
4.5	I	**Major V** Environmental Impact Assessment **(2)** **Major VI** Environmental Microbiology **(2)** **Major P III** Lab course VII (2)	**Minor V** Disaster Management **(2)** **Minor VI** Environmental Ethics **(2)** **Minor P III** Lab Course VIII (2)	**OE-III** Quantitative techhiques **(T/P)** **(2)**	**VSC I (2) (P)** Soil and Nursery management **SEC I (2)** **(T/P)** (Environmental Economics)	**AEC I (2)** English	**CC-I (2)**	22
	Credits	**4+2=6**	**4+2=6**	**2+0=2**	2+2=4	**2**	**2**	**22**
	II	**Major VII** Environmental Engineering-I **(2)** **Major VIII** Occupational Health and Safety **(2)** **Major P III** Lab course VII (2)	**Minor VII** Biostatistics **(2)** **Minor VIII** Computer Application **(2)** **Minor P III** Lab Course VIII (2)	**OE-IV** Quantitative Skills **(T/P)** **(2)**	**SEC-II(2)** Forest Management **(T/P)**	**AEC II (2)** **(English)** **VEC II (2)** **(**Environmental Studies**)**	**CEP-I (2)**	
	Credits	**4+2=6**	**4+2=6**	**0+2=2**	2	**2 +2=4**	2	**22**
	1st Year Cum Credits	**12**	**12**	**4**	**6**	**6**	**4**	**44**

Semester III

Major V: Environmental Impact Assessment

Credits 2 (Marks 50) Hours 30, 30 Lectures of 60 minutes

Course Outcome:

1. Understand the need and objectives of EIA.
2. Understand the impacts of various developmental activities on environment.
3. Understand the scope, objectives and need of environmental auditing and EMS.

Unit	Lecture Hours
Unit I	**15**
Introduction to EIA Definition, concept, objectives and scope of EIA,Elements and components of EIA, Baseline studies in EIA: pre and post monitoring, public participation inEIA, EIA and legal aspects Types of impacts, Methodologies of impact prediction: matrix methodology, network methodologies, checklist methodizes, identification of publics, selection of public participation techniques, Public hearing	**7**
Prediction of impacts on Air, soil, groundwater, Surface water and socioeconomic environment; Identification of types and quantities of impacts on Air, soil, groundwater, Surface water Assessment of impact significance Prediction and identification of socio-economic impacts, traffic and transportation system impacts, Human health impacts EIA report writing	**8**
Unit II	**15**
Introduction to Environmental Auditing: Preamble, scope and objectives of environmental auditing, Qualities of an environment auditor, Contents of EA reports. Principle elements of an environmental audit: External audit and Internal audit, Need of Environmental Audit Framework for a comprehensive audit: Identifying the auditors, Tools for Auditing	**7**
Types and Procedure of Environmental Auditing: Environmental audit in India: Background of environmental audit, objectives and advantages of environmental audit, Environmental audit procedure: Pre audit activities, activities at site, Post audit activities. Introduction, definition and need of Environment ManagementSystem, Requirement of Environment Management System, Deming cycle of continuous improvement	**8**

SUGGESTED BOOKS:

1. Canter L.W. (1996) Environmental Impact Assessment, McGraw-Hill, Inc., New Delhi.
2. A.K. Shrivastava (2017) Environmental Impact Assessment, A P H Publishing Corporation, New Delhi.
3. R.R. Barthwal (2012) Environmental Impact Assessment, New age international Publishers, New Delhi.
4. G. Madan Mohan (2008) Environmental and Sustainable Development, omegaPublication, New Delhi.
5. M. Anji Reddy (2019) Environmental Impact Assessment theory and Practice, BS

Publication, Hyderabad.
6. Environmental audit by Mhaskar AK
7. Environmental audit by Mhaskar AK
8. Environmental Assessment and Statements by Harr and Hagerty (1977)
9. Environmental Auditing by Central Pollution Control Board.
10. Stoner, Freeman, Gilbert – Management – Prentice Hall of India Ltd., New Delhi – VI th Edition
11. Environmental Auditing by Central Pollution Control Board

Semester III

Major VI: Environmental Microbiology

Credits 2 (Marks 50) Hours 30, 30 Lectures of 60 minutes

Course Outcome:

1. Understand the basic concepts and scope of environmental microbiology.
2. Study the mechanism of various waterborne and airborne diseases.
3. Understand the need and importance of biofuels, biopesticides and vermicomposting.

Unit	Lecture Hours
Unit I	**15**
Introduction to Microbiology: Definition, Scope and history of Microbiology, Types of Microbiology Types of Microorganisms: Algae, Fungi, Protozoa, Viruses, Bacteria. Water Microbiology**,** Human diseases associated with water, Microbial agents associated with water borne diseases, Prevention and control of water borne diseases, Role of micro- organisms for the treatment of waste water, most probable number	**7**
Air and Soil Microbiology, Bio-fertilizer: Introduction to aerial microbiology, Transport and deposition of micro-organisms in air, Types of air borne microbial diseases and their causal agents, Introduction to soil microbiology: Micro flora of soil, their functions, factors affecting their population Methods of studying Soil microflora: Sample collection, Sample processing Isolation of culture Biofertilizers study	**8**
Unit II	**15**
Introduction to environmental biotechnology: Introduction to environmental biotechnology, scope and objectives ofenvironmental biotechnology, Vermicomposting: introduction, composting process, factors affectingcomposting, characteristics of vermicompost and benefits Biopesticides: introduction and approaches of biological control of pest, various bacterial insecticides, advantages and disadvantages of microbial insecticides, Use of pheromones for pest management, Biological control of weeds	**8**
Biotechnology in combating environmental pollution Air pollution and its control through biotechnology, methods of biofiltration, Xenobiotics in environment Genetically Modified Organisms in environment, effects of GMO's on environment, effects on human health, biosafety management Environmental biotechnology and Intellectual Property Rights	**7**

SUGGESTED BOOKS:

1. Sohal H.S (1994), Environment and biothechnology, Ashish Publishing house, NewDelhi.
2. T. Srinivas (2008), Environmental Biotechnology, New age International Publishers,New Delhi.
3. H.K. Das (2017), Textbook of Biotechnology, Wiley Publications, New Delhi.
4. Scragg Alan (2011), Environmental Biotechnology, Oxford University Press, NewYork.
5. Buddola Viswanath, Environmental Biotechnology, Narosa publication house, NewDelhi.

6. Colin R., Kristiansen B.(2001),Basic Biotechnology,Cambridge University press, UK.
7. Bhattacharyya B. C., (2010), Environmental biotechnology, Oxford university press,New Delhi.
8. Jha Ashwini (2017), Environmental Biotechnology Principles and applications, AnmolPublication Pvt. Ltd., New Delhi
9. Mark Coyne (1999), Soil Microbiology, Delmar Thomson lerning, New York.
10. K. Vijaya Ramesh (2004), Environmental microbiology, MJP Publishers, Chennai.
11. I Edward Alcamo (1998), Microbiology, Schaum's outline series, McGRAW- Hill, NewDelhi.
12. G. Rangaswami (1993), Agricultural Microbiology, Prentice- Hall of India Ptv. Ltd., NewDelhi.
13. P.D. Sharma (2005), Environmental Microbiology, Narosa Publishing House, New Delhi.
14. RG Buckley 2016), Environmental Microbiology, CBS Publishers, New Delhi.

Semester III
Major P III
Lab Course VII
Credits: 2

Sr. No.	Title
1.	Preparation of media for microbial culture
2.	Isolation of bacteria from soil and decaying matter
3.	Isolation of culture of microbes from water
4.	Study of cultural characteristics of microorganisms
5.	Gram Staining
6.	Study of motility of microorganisms
7.	Study of microorganisms by Standard Plate Count Method
8.	Determination of MPN from given water sample

Semester III

Minor V Disaster Management

Credits 2 (Marks 50) Hours 30, 30 Lectures of 60 minutes

Course Outcome:

1. Understand the concepts, effects and mitigation measures of natural disasters.
2. Get acquainted with assessment of hazards and legal aspects.
3. Understand various measures of disaster preparedness and disaster management in India.

Unit	Lecture Hours
Unit I	**15**
Introduction to natural disasters: Definition and types of natural disasters, concept ofhazards, vulnerability, risk Guidelines for hazard assessment and vulnerability analysis Flood: Flood risk mapping, flood forecasting, flood mitigation Droughts: Causes and types of droughts, effects and mitigation Tsunami: Causes and effects of Tsunami, warning andmonitoring of Tsunami	**8**
Tornadoes, Hurricanes, Earthquakes and Natural disaster mitigation and legal aspects Types of hurricanes, Effects of winds on buildings Introduction to tornado and mitigation measures Earthquakes: warning, effects and preventive measures National Calamity Management Act, State Disaster Management Act Disaster management in India Practical and sustainable approaches to disaster recovery	**7**
Unit II	**15**
Introduction to man-made disasters: Concept and types of man-made disasters, Causes effects and management of man-made disasters: fire accident, road, rail and air traffic accident, industrial accidents Case studies: Bhopal gas leakage, Chernobylnuclear explosion Biological disasters: Epidemics: causes, effects and management, Dengue, HIV & AIDS, Covid 19, Mad cow disease Introduction to disaster risk Role of stakeholders in man-made disasters	**8**
Enhancing disaster preparedness: Key considerations for enhancing disaster preparedness for effective response of industrial, nuclear and transport hazards, UNECE convention on transboundary effects of industrial accidents Role of community in disaster management Reducing the risk of hazards, GIS and remote sensing Role of UNDP and NCDM in disaster management	**7**

SUGGESTED BOOKS:

1. Talwar A. K. and Juneja Satish (2009). Natural Disaster Management, Commonwealth Publication, New Delhi
2. Kapur Anu, Neeti, Meeta, Deeptima, Roshani, Debanjali., Disasters in India, Rawat Publications, New Delhi
3. Brenda D. Philips (2016). Disaster recovery. CRC press, London.
4. Arvind Kumar (2006). Disaster Management, Amol publications, New Delhi.
5. Prabhas C. Sinha (2006) Disaster Relief, SBS Publishers & Distributers PVT. Ltd., New Delhi.
6. Gupta Manisha (2018), Disaster Management, DND Publications, Jaipur
7. Gaur R.C. (2018), Environmental Engineering and Disaster Management, New Age International Publishers, Delhi.
8. Kapur Anu, Neeti, Meeta, Deeptima, Roshani, Debanjali., Disasters in India, Rawat Publications, New Delhi
9.Brenda D. Philips (2016). Disaster recovery. CRC press, London.
10. Arvind Kumar (2006). Disaster Management, Amol publications, New Delhi.

Semester III

Minor VI: Environmental Ethics

Credits 2 (Marks 50) Hours 30, 30 Lectures of 60 minutes

Course Outcome:

1. Understand the causes and effects of various environmental issues.
2. Get acquainted with environmental ethics from Indian perspective.

Unit	Lecture Hours
Unit I	**15**
Introduction to environmental issues: Environmental Problems: indoor and workplace, water and sanitation, overcrowding, accident, garbage, disease vectors, hazardous waste, Global environmental issues with case studies Development and environmental issues in India	**8**
Urbanization and Environmental Issues Demographic profile, population density, Impact of urbanization on environment, Denudation of rural population and urbanization and environmental protection, Role of NGOs in tackling environmental issues, Cities and ecological sustainability, City problems with global perspectives	**7**
Unit II	**15**
Environmental Ethics: Introduction to environmental ethics, concept and history of environmental ethics, relation between environment and people, spirituality and environmental ethics, population and environmental ethics, challenges to the world environmental ethics, Human nature interaction in third world country	**8**
Environmental Ethics from Indian Perspectives: Significance of Indian traditions, women in forest, Indian heritage of conservation ethics, women in forest, indian heritage of conservation ethics, environment protection in Indian culture: cultural evolution, nature worship, tribal tradition, reservation of forest, movement for environmental protection, Population control in the light of environmental protection	**7**

SUGGESTED BOOKS:

1. Sayeed Unisa (2016), Population, health and environment, Rawat publicatons, Jaipur.
2. S.C.Naik (2005), Society and Environment,Oxford & IBH PublishingCo.Pvt.Ltd.,New Delhi.
3. Prakash Chand Kandpal (2018), Environmental Governance in India, SagePublications, London.
4. Dr. M.N.Madhyastha (2003), Prospects and problems of Environment,Daya Publishinghouse, Delhi.
5. G. Tyler Miller,Jr. (2007), People and Environment, Cengage learning India Ptd.Ltd.,New Delhi.
6. George A. James(1999), Ethical Perspectives on Environmental issues in India,A.P.H.Publishing corporation, New Delhi.
7. Diana Mitlin David Satterthwaite Environmental problems in third world cities,Earthscan publications Ltd., London.

Semester III
Minor P III
Lab Course VIII
Credits: 2

Sr. No.	Title
1.	Preparation of wind rose diagram
2.	Demonstration of fire extinguishers
3.	Study of human wildlife conflict
4.	Preparation of Disaster Management Plan
5.	Soil rating and fertilizer dose recommendation
6.	Estimation of Water Quality Index
7.	Determination of nitrite from water sample
8.	Analysis of Sulphur Dioxide in ambient air
9.	Analysis of Nitrogen Dioxide in ambient air

Semester III
Open Elective III: Quantitative Techniques
Credits 2 (Marks 50) Hours 30, 30 Lectures of 60 minutes

COURSE OUTCOMES:

1. Get basic knowledge of quantitative techniques
2. Instill the practical knowledge about calculation of interest

Unit no.	Contents	No. of Hours
I	**Introduction to Quantitative Techniques** ▪ Introduction, Meaning and Definition of Quantitative Techniques ▪ Classification and Functions of Quantitative Techniques ▪ Uses of Quantitative Techniques ▪ Limitations of Quantitative Techniques	**15**
II	**Interest** ▪ Simple Interest- Meaning and Calculation of Simple Interest ▪ Compound Interest- Meaning and Calculation of Compound Interest ▪ Difference between Simple Interest and Compound Interest	**15**

References:

1. Business Mathematics and Statistics- Ravikiran Kakade, Dr. M. Waghmare
2. Fundamentals of Statistics- S. P. Gupta
3. Introduction to Statistics- m. Girija and V. Girija
4. Statistics for Management- P. N. Arora and S. Arora
5. Business Statistics- D. R. Agrawal

Semester III

Vocational Skill Course I: Soil and Nursery Management

Credits 2 (Marks 50)

Sr. No.	Title
1.	Mechanical Analysis of soil and particle size analysis
2.	Determination of pH of soil
3.	Determination of Water Holding Capacity of soil
4.	Soil rating and fertilizer dose recommendation
5.	Determination of Organic Carbon from soil
6.	Determination of Available Phosphorus from soil sample
7.	Determination of Available Nitrogen from soil sample
8.	Determination of Available Potassium from soil
9.	Preparation of seed bed for germination
10.	Study of pre-germination treatments for various seeds
11.	Vegetative propagation by grafting method
12.	Vegetative propagation by budding
13.	Study of various irrigation methods

Semester IV
SEC I: Environmental Economics
Credits 2 (Marks 50) Hours 30, 30 Lectures of 60 minutes

Course Outcome:

1. Study the need of economics for environment management.
2. Study the environmental valuation and techniques of biodiversity valuation.

Unit	Lecture Hours
Unit I	**15**
Introduction to environmental economics Role of economics in environment, Need of eco-principles, Environmental economics Vs traditional economics, evolution and growth of environmental economics, Training environmental inputs into the economy, environment and economic growth, environment and development.	**8**
Environmental valuation and theories Introduction to environmental valuation: meaning and types of environmental values, valuation of intangible benefits of the environment Hardin's thesis of tragedy of the commons, social cost benefit analysis, cost effectiveness analysis	**7**
Unit II	**15**
Sustainability of economic development: Concept of sustainable development, Policy approach of sustainable development, role of technology and human values, Management of sustainable development and institutions Techniques of biodiversity valuation: Market based techniques revealed preferences techniques, stated preference techniques.	**8**
Economics of environmental policies: Introduction to environmental management policy, need for environmental policy, Instruments for environmental policy, Instruments for environmental policy Principles of commercial forestry economics, Economic incentives for environment regulations.	**7**

SUGGESTED BOOKS:

1. Ashwani Mahajan (2010), Environmental Economics, Centrum Press, New Delhi.
2. Ranbindra N. Bhattacharya (2004), Environmental Economics, Oxford university Press, New Delhi.
3. G.S. Nayudu(2008), Environmental Economics, Adhyayan Publishers & Distributers, New Delhi.
4. K. Singh (2007), Environmental Economics, SAGE Publications, New Delhi.
5. Ramprasad Sengupta (2001), Ecology and Economics, Oxford University Press, New Delhi.
6. N. Hanley (1997), Environmental Economics in Theory and Practice, Macmillan Press Ltd., London.
7. S.L. Lodha (1991), Economics Of Environment, RBSA Publishers, Jaipur.

8. Rabindra N. bhattacharya (2001), Environmental Economics, Oxford University Press, New Delhi

Semester III

Major VII: Environmental Engineering

Credits 2 (Marks 50) Hours 30, 30 Lectures of 60 minutes

Course Outcome:

1. Understand the demand of water for various purposes.
2. Understand various steps involved in water treatment.

Unit	Lecture Hours
Unit I	**15**
Introduction to Environmental Engineering & Water Supply Engineering Introduction to environmental engineering, Quality of water: rate of demand, factors affecting rate of demand, Population forecasting and methods of population forecasting, sources of water supply: Surface runoff, precipitation, measurement of rainfall Characteristics of waste water: Physical, Chemical and Biological	**8**
Primary and treatments to waste water: Screening: types of screens, gravity separation, particle settling theory, grit removal: grit characteristics and types of grit chambers, equalization tank, primary and Secondary settling tank Aeration, types of aeration systems,stabilization ponds. Objectives of biological treatment, coagulation and flocculation, Aerobic biological oxidation, Trickling filters and types of trickling filters, activated sludge process, sludge drying beds, lagoons	**7**
Unit II	**15**
Tertiary treatments to waste water: Introduction to filtration, theory of filtration, classification of filters, essential parts of filter, advantages and disadvantages of filters, Membrane filtration Disinfection: introduction to disinfection, methods of disinfection, Chlorination, Reverse Osmosis Softening, and water conditioning, Types of hardness, removal of temporary and permanent hardness, Lime soda process, Ion exchange and carbon adsorption	**8**
B: Designing of treatment plants Septic tank, Water sterilization: ozonation, UV Radiation Flow chart of WTP, STP, ETP and CETP Water quality standards: drinking and effluent Water Quality Index Designing of WTP, STP, ETP and CETP plant	**7**

SUGGESTED BOOKS:

1. Mathur Shruti, Kumar Rajendra (2017), Water on earth, Rawat Publication, New Delhi
2. Rangwala S.C., Rangwala K.S. (2004, Water supply and sanitary engineering, Charotar Publising House, Anand
3. Basak N.N. (2012), Environmental Engineeing, Tata McGraw Hill Education Private Limited, New Delhi

4. Rao M.N., Datta A.K. (2018), Waste water treatment, CBS Publishers and Distributors Pvt Ltd, New Delhi
5. Mark J. Hammer (2015), Water and wastewater, Pearson Publication, Noida
6. Mackenzie L. Davis, David A. Cornwell (2014), Introduction to environmental engineering, New York
7. R. Parker, N. Morris, F.N. Fair, S.C.Bhatia (2008), Waste water engineering, CBS publishers and Distributors, New Delhi

Semester IV

Major VIII: Occupational Health and Safety

Credits 2 (Marks 50) Hours 30, 30 Lectures of 60 minutes

Course Outcome:

1. Get acquainted with importance of industrial safety to workers and use of PPE'S.
2. Making students to understand the methods of strategic planning for hazard prevention.

Unit	Lecture Hours
Unit I	**15**
Introduction to Occupational Health and Safety Introduction: Occupational Health and hazards, Types of Industrial Hazards Prevention of Occupational Health Hazards: medical, Engineering, Legislation and Administrative Measures. Accidents: Introduction, causes: potential and actual causes, Approach to Accident Prevention Policy and Responsibilities, Accident Prevention Measures: 5E's, Preventing unsafe acts and conditions, Safety tag system, Safety in Housekeeping, Employees training in safety and hazard check list	**7**
Fire Safety Introduction of fire and its effects, Class of fire and fire extinguisher rating Fire precautions, measures to prevent fire, Types of fire extinguishers Key elements of Safety Management System (ISO 14001, OHSAS 18001), ILO Legislation: Convention and Recommendation concerning Safety, Health and Environment as Human Right issue. Safety Auditing	**8**
Unit II	**15**
Safety Education and Training Safety training, Safety Habits: Needs and Priorities, Training Methods and Aids Participative Safety Activities: safety campaigns, safety contests, safety meeting Safety management system, communication, emergency preparedness, system audit, review, safety committees, corrective action plan, rights of employees, personal protective equipment	**7**
Industrial Hygiene Concept and importance of industrial hygiene, Physical hazards: heat, stress and its control, ventilation, noise, thermal radiation, X-ray and UV radiation, effects of exposure, prevention and control Motivating employees for safety: characteristics, importance, kinds, methods and advantages of motivation, Emergency Preparedness Plan, MSDS, Personal Protective Equipment's,	**8**

SUGGESTED BOOKS:

1. Manual of fire safety by N Sesha Prakash.
2. Industrial and occupational Health by SK Haldar.
3. Safety Management by RK Mishra
4. Essentials of Safety Management by H.L.Kaila, A. Singh, S. Ravishankar and S.V Kamat

Semester IV
Major P III
Lab Course VIII
Credits: 2

Sr. No.	Title
1.	Determination of oil and grease from given water sample
2.	Visit to Sewage Treatment Plant
3.	Determination of Permanganate value of water
4.	Demonstration of Personal Protective Equipment's
5.	Langeliar Calcium Carbonate Saturation Index
6.	Determination of Hexavalent Chromium
7.	Jar Test
8.	Residual Chlorine Bleaching Powder Analysis
9.	Chlorine Dose

Semester IV
Minor VII: Biostatistics
Credits 2 (Marks 50) Hours 30, 30 Lectures of 60 minutes

Course Outcome:

1. Understanding use of statistical methods for environmental studies.
2. Understanding methods of collection and analysis of data.

Unit	Lecture Hours
Unit I	**15**
Introduction to statistics: Definition and functions of statistics, origin of statistics, statistical methods, characteristics of statistical data, importance of statisticsin biological and physical sciences, limitations of statistics, Types of data, methods of collecting data: primary and secondarydata, classification and organization of data, Vital statistics: Introduction, measures of mortality, standard death rate, measures of fertility, life tables	**7**
Diagrammatic representation and measures of central tendency Bar graph, histogram, frequency polygon, pie chart, Ogive curveIntroduction to measures of central tendency, Arithmetic mean, weighted arithmetic mean, geometric mean, harmonic mean, mode, median: introduction, merits and demerits,relation between mean, mode and median	**8**
Unit II	**15**
Measures of dispersion: Introduction and characteristics of good measure of dispersion,absolute and relative measures, Mean deviation and coefficient of mean deviation, mean deviationin continuous and discrete series, merits and demerits, Range and co-efficient of range, Quartile deviation and co-efficient of quartile deviation Standard deviation: standard deviation for discrete and continuousseries, merits and demerits, Variance, coefficient of variation	**7**
Sampling, Coerrelation and regression Introduction to sampling, steps involved in sampling, types andmethods of sampling, Correlation and regression: relation between variables, linear, regression analysis, regression analysis of grouped data, correlationanalysis, Karl Pearson's coefficient of correlation	**8**

SUGGESTED BOOKS:

1. Gaur A.S., Gaur S.S. (2006), Statistical Methods for Practice and Research, Sage Publication, New Delhi
2. Gupta C. B., Gupta Vijay (2010) An Introduction to Statistical Methods, Asian Books Pvt. Ltd., New Delhi
3. Bhowal M. K., Barua Pronob (2006) Statistics. Daya Publishing House, New Delhi.
4. Gupta S. P. (2005), Statistical Methods, Sultan Chand and Sons Publishers, New Delhi

Semester IV

Minor VIII: Computer Application

Credits 2 (Marks 50) Hours 30, 30 Lectures of 60 minutes

Course Outcome:

1. Understand the basic concepts of hardware and software.
2. Learn various computer applications through report writing in MS word and presentation of data through Excel and power point

Unit	Lecture Hours
Unit I	**15**
Introduction to Computer Computer characteristics and Functionalities, Applications, Generations Types, Block Diagram, Concept of Hardware and Software	**7**
Input and Output Devices Input devices- Keyboard, mouse, joystick, scanner, MICR, OMR, OCR. Output Devices- Monitor, Printers (Impact and non-impact), plotterFlat-bed and drum, Selection of printer and paper for output depending upon user requirements. Memory- concept, primary memory – RAMSRAM, DRAM, ROM- PROM, EPROM, EEPROM, cache memory, Secondary memory- floppy disk, hard disk, Optical storage devices, Pen drive.	**8**
Unit II	**15**
MS Excel Basics of Excel – Ribbon, Workbook, worksheet, Format options, templates, data validation , sorting and filtering of data ,FunctionsCount and Sum, Logical, Date and Time, Text, Lookup and References, financial and statistical functions, using formula , Charts- column, pie, bar, line, scatter plot, data series	**7**
MS Word and MS PowerPoint MS Word : Introduction and feature , Creating word document, Editing features, Text formatting options, page formatting –adding header and footer, page number, insert page break, blank page, cover page, page orientation, print options. Working with tables, creating Table of Contents, Mail merge, shortcut keys, cursor control keys. MS PowerPoint: Features, factors to be considered for effective presentation, Creating Basic presentation, Editing and formatting options, inserting picture, chart, table, audio and video to slide, using animation and slide transition	**8**

SUGGESTED BOOKS:

1. Computer Fundamentals- P. K. Sinha
2. Operating System – Godbole
3. Computer Today- S. Basndara
4. Computer Fundamentals- V. Rajaraman

Semester IV
Minor P III
Lab Course VIII
Credits: 2

Sr. No.	Title
1.	Study of plotting of graphs and diagrams
2.	Determination of measures of central tendency
3.	Determination of measures of dispersion
4.	Determination of correlation coefficient and regression
5.	Determination of fertility, natality and mortality rate of given population
6.	Use of MS word for report preparation
7.	Use of MS excel for result preparation
8.	Use of MS power-point for preparing presentation

Semester IV

Open Elective IV: Quantitative Skills

Credits 2 (Marks 50) Hours 30, 30 Lectures of 60 minutes

COURSE OUTCOMES:

1. Get acquainted with basic quantitative skills
2. Instill the practical knowledge about calculation of mean, median, mode and dispersion

Unit no.	Contents	No. of Hours
I	**Measures of Central Tendency** ▪ Mean, Median, Mode ▪ Relation of Mean, Median, Mode ▪ Comparison of Mean, Median, Mode ▪ Merits and Demerits of Measures of Central Tendency	**15**
II	**Measures of Dispersion** ▪ Measures of Dispersion- Meaning, Methods ▪ Range, Quartile Deviation ▪ Mean Deviation, Standard Deviation	**15**

References:

1. Business Mathematics and Statistics- Ravikiran Kakade, Dr. M. Waghmare
2. Fundamentals of Statistics- S. P. Gupta
3. Introduction to Statistics- m. Girija and V. Girija
4. Statistics for Management- P. N. Arora and S. Arora
5. Business Statistics- D. R. Agrawal

Semester IV
SEC II: Forest Management
Credits 2 (Marks 50) Hours 30, 30 Lectures of 60 minutes

Course Outcome:

1. Study the need of forest management and agroforestry, principles of forest management and legal aspects of forest management.
2. Understand the concept of silvicultural systems and management of forest resources.

Unit	Lecture Hours
Unit I	**15**
A: Forest Management and Silvicultural System Definition, Objectives, Importance of forest management in India Introduction to silviculture&silvivultural systems, types & advantages and disadvantages of different systems History of forest management in India Forest as ecosystem, productivity, forest types in India	**7**
B: Forest Management Systems and Forest Resources **Forest Management Systems:** Objective and principles; techniques; sustained yield relation; rotation of growing stock through management, Forest Working Plan**,** integrated approach, Forest Mensuration - Methods of measuring - diameter, girth, height and volume of trees; form-factor **Forest Resources and Utilization :** Direct and indirect, Environmentally sound forest harvesting practices, logging and extraction techniques and principles, transportation system, storage and sale, Need and importance of wood seasoning and preservation; Non-Timber Forest Products (NTFPs) definition and scope	**8**
Unit II	**15**
A: Agroforestry and Joint Forest Management Agroforestry, Social forestry, taungya system, shifting cultivationIntroduction, classification, scope Advantages & disadvantages of all these practices Joint Forest Management, introduction, objectives	**7**
B: Laws and Regulations Regarding Forest Conservation Forest conservation, need, services provided by forest, tangible, intangible Indian forest Act, 1927 Forest Conservation Act, 1980 National Forest Policy,1894, National Forest Policy ,1952, National Forest Policy, 1988	**8**

SUGGESTED BOOKS:

1. Sarma, P. K.: Forest Resources and their Utilization in India, Mittal Publishers, New Delhi
2. Agrawal, V. P.: Forestsin India, Oxford & IBH, New Delhi
3. Desai, V. : Forest Management in India : Issues and Problems, Himalaya Publishing House, New Delhi

4. Principle and practices of Silviculture by L. S. khanna
5. Forestry in India by A. P. Dwiwedi
6. Forest and Forestry by KP Sagaraya
7. Handbook of Forestry by S SNegi
8. Social Forestry by K M Tiwari
9. Forest Ecology by A S Puri
10. Forest Mensuration by L. S. Khanna
11. India's Forest Policies: Analysis and Appraisal by L K Jha