

 Estd. 1962 "A++" Accredited by NAAC (2021) With CGPA 3.52	SHIVAJI UNIVERSITY, KOLHAPUR - 416004, MAHARASHTRA PHONE:EPABX-2609000, www.unishivaji.ac.in , bos@unishivaji.ac.in शिवाजी विद्यापीठ, कोल्हापूर - ४१६००४, महाराष्ट्र दूरध्वनी-ईपीएबीएक्स -२६०९०००, अभ्यासमंडळे विभाग दूरध्वनी ०२३१-२६०९०९४ ०२३१-२६०९४८७	 
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Ref.No.SU/BOS/Science/146

Date: 26/05/2026

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

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

B.Sc.Part-III (Sem. V & VI) as per NEP-2020 (2.0)			
1.	Animation (Entire)	6.	Food Science and Technology (Entire)
2.	Food Science (Entire)	7.	Food Technology & Management (Entire)
3.	Biotechnology (Entire)	8.	Environmental Science (Entire)
4.	Computer Science (Entire)	9.	Sugar Technology (Entire)
5.	Information Technology (Entire)		

This syllabus, nature of question and equivalence shall be implemented from the academic year 2026-2027 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in>Syllabus>Syllabus as per NEP2020.

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2026 & March/April 2027. 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

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 V AND VI

**STRUCTURE AND SYLLABUS IN ACCORDANCE WITH
NATIONAL EDUCATION POLICY-2020**

WITH MULTIPLE ENTRY AND MULTIPLE EXIT OPTIONS

**(TO BE IMPLEMENTED FROM ACADEMIC YEAR 2026-27
ONWARDS)**

Syllabus of B.Sc. Part - III Environment Science (Entire)
SEMESTER V AND VI
(NEP 2020)
Syllabus to be implemented from academic year 2026-2027 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 higher studies including research.

Programme Outcome:

1. This programme will lay strong foundation of environmental concepts for postgraduate 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 with Honours/ Honours with Research).

OR

- v) An Examination of any other Statutory University or an examining Body recognized 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 obtain 45% 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 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 obtaining 70% 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 ≥ 0.5 shall 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)

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

2. Cumulative Grade Point Average (CGPA)

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

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	
Total Credits	68+28=96		28	10	12	16	14	176	Exit Option

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
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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) -----16 marks

A)

B)

C)

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

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 V & VI

Structure–III

Level	S e m e s t e r	Subject-1	Subject-II	3-OE	4-VSC/SEC	5-AEC/VEC/IKS	6-OJT,FP,CEP,CC,RP	Total Credits
				IDC/MDC/OE/GE			CC /Summer Internship/ Field Project/ OJT Research Project/ Dissertation	
4.5				OE				
	I	Major IX Land and Water Management (2)	Major I (Elective) Remote Sensing and GIS (2)	OE-5 Will be selected from basket (T/P) (2)	VSC II (2) (P)	AEC III (2) English	OJT (04)	22
		Major X Environmental Health, Toxicology and Safety (2)	Major P I Lab Course XII (Elective) (2)					
		Major P V Lab Course XI (4)						
	Cre dits	4+4=8	2+2=4	2+0=2	2	2	4	22
	II	Major XI Environmental Legislation (2)	Major II (Elective) (Climate Change and Carbon Footprints) (2)		VSC III (2) (Major specific) (P)	AEC IV (2) (English)	FP (2)	
		Major XII Green Technologies and Urban Restoration (2)	Major P II (Elective) Lab Course XIV (2)		SEC III Ecological Restoration (2) (T/P)	IKS 2 (2) Environmental History and Ecology in Modern India) (2)		
		Major P VI Lab Course XIII (4)						
	Cre dits	4+4=8	2+2=4		2+2=4	2 +2=4	2	22
1 st Year	Cum Credi ts	16	8	2	6	6	6	44

Semester V
Major IX: Land and Water Management
Credits 2 (Marks 50) Hours 30, 30 Lectures of 60 minutes

Course Outcome:

1. Understand the need for land and water management.
2. Understand about land and water conservation practices.

Unit	Lecture Hours
Unit I	15
Introduction to Land Management: Global and Indian land-use patterns, Soil physical properties: texture, structure, porosity, bulk density, Soil chemical properties: pH, EC, organic matter, fertility Soil erosion: types, causes, and measurements Land capability classification Land degradation & desertification Remote Sensing and GIS for land evaluation	7
Introduction to Water Management Sources of water, Water pollution and scarcity, Uses of water resources Hydrology-concept and scope, concept of water balance Types of irrigation systems: surface and sub-surface Concept of watershed and catchment, Runoff estimation methods	8
Unit II	15
Measures of Land Conservation: Mechanical measures: Bunding, Terracing, Gully control structures, Check dams Vegetative measures: Agroforestry, Strip cropping, Cover crops, Grassed waterways Integrated pest Management, Integrated Plant Nutrient Management	7
Measures of Water Conservation: National water policy, Water management strategies and practices, Mitigation measures for water pollution, Rain water harvesting, Traditional methods of water conservation, Need of watershed planning, Rural and integrated watershed development, Watershed based farming system	8

SUGGESTED BOOKS:

1. Cunningham W.P, 1994, Understanding our environment: An introduction, W.C. Brown Publishers, Oxford
2. Khan et. Al, Wasteland Development
3. Dr. Rajvir Singh, Watershed planning and management, 2nd edition, Yash Publishing House, Bikaner, India
4. R.Suresh, Soil and Watershed Conservation engineering, 2nd edition, standard Publication Distributors, Delhi
5. G.O.Schwab, Soil and Water conservation engineering, 4th edition, John Wiley and sons
6. Manual of soil and water conservation practices, ICAR, CiOI
7. Bharat Kakade, Watershed Mnnual, BAIF publications
8. S.S. Negi, Forest Management in India, Published by Bishen Singh Matiendra Pal Singh
9. Madan K. Iha, V.V.N. Murty, Land and Water Management Engineering, 2013

Semester V
Major X: Environmental Health, Toxicology and Safety
Credits 2 (Marks 50) Hours 30, 30 Lectures of 60 minutes

Course Outcome:

1. Understand the basic concepts and scope of environmental toxicology.
2. To study negative impacts of xenobiotics and pesticides.

Unit	Lecture Hours
Unit I	15
Introduction to toxicology: Concept and scope of toxicology, principles of toxicology, Intake of toxic substances: Eye absorption, Inhalation, Ingestion, Injection Dose response relation, Carcinogens, Teratogens, Mutagens, Phytotoxins and animal toxins, Pandemic diseases, Zoonosis	7
Toxic substances and sanitation: Introduction to toxic substances, sources and effects Introduction to bioaccumulation, biotransformation and effects Lethal and Sub-lethal concentration, LD50 and LC50, Sanitation and human health, WHO and other organizations and their role in sanitation	8
Unit II	15
Genotoxicity and soil toxicology: Genotoxicity: toxic agents in environment industrial chemicals, safety regulation Organ specific toxicity studies: Neurotoxicity, Nephrotoxicity, Hepatotoxicity Fertilizers and pesticides and impacts on soil, water and human health Impacts of Barium, Arsenic, Cadmium, Chromium, Cobalt, Lead, Mercury	8
Pesticide toxicology and xenobiotics: Types of pesticides: Organochlorine, organophosphate, Carbamates Exposure to ionizing radiations, genetic effect, acute radiation syndrome, toxic residue, factors affecting toxicity, Xenobiotics: concept, absorption and distribution, Environmental hazard and risk assessment	7

SUGGESTED BOOKS:

1. Environmental Sanitation, Ehlers, V.M. , McGraw Hill book Co.
2. Toxic chemicals, health and environment, Lave I.B., 1987, The 1-Iopkin pteess Ltd., London
3. Basic environmental toxicology, Lorris G., CRC press
4. Introduction to environmental toxicology, Wayne G. Landi Ming Ho Yu
5. Toxicology-the basic science of poisons, Louis I Cassarate, Me Millan Publishing Co. Inc. New York
6. Principle and practices in toxicology in Public health, Ira s. Richard Jones and Bartlett Publisher

Semester V
Major P V
Lab Course XI
Credits: 4

Sr. No.	Title
1.	Study of land surveying instruments
2.	Study of soil types and its suitability for crops
3.	Study of mechanical soil conservation measures through model preparation
4.	Study of irrigation systems and its impact on soil quality
5.	Study of irrigation water quality
6.	Study of water usage for different crops
7.	Preparation of land capability map
8.	Precipitation analysis by Theissen's method
9.	Preparation of compost
10.	Study of carcinogens and teratogens
11.	Study of acute and chronic toxicity
12.	Study of pesticides and used in local area
13.	Study of bioremediation techniques
14.	Determination of Nitrite from water sample
15.	Determination of Nitrate from water sample
16.	Determination of Sulphate from given water sample
17.	Study of safety measures in toxicology laboratory
18.	Study of Material Safety Data Sheet

Semester V

Major I (Elective) Remote Sensing & GIS

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

Course Outcome:

1. To introduce students to remote sensing, GIS and satellites.
2. To study advantages and capabilities of remote sensing and GIS.

Unit	Lecture Hours
Unit I	15
Terms Related to Remote sensing Definition and Scope of Remote Sensing, Electromagnetic spectrum- Electromagnetic spectrum, Aerial photography- Classification of Aerial Photographs , Types of aerial photographs, Geometry of Aerial photograph, Scale and Relief Displacement, overlap, Principal Point and Conjugate Principal, Point of Aerial Photographs, elements of aerial photo interpretation and Applications of Aerial Photographs	8
Introduction to Satellites Satellite imageries Remote Sensing Satellites- Meteorological Remote Sensing Satellite (Polar and Geostationary Satellites), Non-Meteorological RS Satellites (Landsat, Spot, IRS), Resolution (Spectral and Spatial and Frequency of Coverage) , Satellite data products and selection of satellite data; Data Reception, Archiving and distribution	7
Unit II	15
Introduction to GIS Definition of GIS, Capabilities and advantages of GIS, Sources of data, types of data, hardware requirement, components of GIS. Data structure, Raster and Vector data models, advantages and disadvantages of vector data and raster data, GIS packages, Application of GIS in Environmental Management	8
Terms in GIS Topology Error and editing, GIS data quality, errors, policies. Vector data analysis: Buffering, Overlay analysis (point in polygon, line in polygon, polygon in polygon); Network analysis, Terrain analysis: DEM, DTM and TIN; Interpolation techniques in GIS; Raster data analysis; Non-spatial data: Database Management system (DBMS)	7

SUGGESTED BOOKS:

1. Principles of Photo geology by Singh
2. Principles of Remote Sensing by Currain
3. Fundamentals of Photo geology by SN Pandey
4. Remote Sensing and Image Interpretation:-Tomas M.Lillesand and Ralph W.Keifer John Wiley and sons Inc.NewYork.

5. Introduction to Remote sensing:-James B. Campbell, Tylor and FraneisLtd.Londan.
6. Remote Sensing application in applied geosciences:-Sumitra Mukherjee, Milton Book Company.
- 7.Principles of Remote Sensing:-A.N.Gatel and S.Singh, Scientific Publishers (India). Jodhpur (1999Edition).
9. Remote Sensing for Environment and Forest Management:-A.Mehrotra and R.K.Suri. Indus Publishing Co.New.Dehli(1994 Edition) Remote sensing for large wildfires:-E.Chuvieco, Springer, New York (1999 Edition).
10. Textbook of Remote Sensing and GIS by Anil Reddy
11. Fundamentals of Remote Sensing by George Joseph
12. Principles of Geographical Information system by Burrough, Peter A.
13. Remote Sensing and GIS by Bhatta B.

Semester V
Major P I (Elective)
Lab Course XII
Credits: 2

Sr. No.	Title
1.	Study of Aerial photographs.
2.	Study of scale of aerial photographs.
3.	Study of Resolution Types.
4.	Visual interpretation of satellite images
5.	Identification topographical features by using satellite images.
6.	Introduction to GIS software
7.	Study of overlaps of aerial photographs
8.	Use of Remote sensing and GIS in EIA
9.	Case study using Remote sensing and GIS in disaster management
10.	Case study using Remote sensing and GIS in Deforestation Analysis

Semester-V
Open Elective V
Credits 2

OE V will be selected from basket of other faculties.

Semester V
Major VSC II (Practical)
Credits: 2

Sr. No.	Title
1.	Study of wildlife census by capture and recapture method
2.	Study of population census by transect and camera trapping method
3.	Wildlife census by block count method
4.	Determination of volatile fatty acids from wastewater
5.	Design of physical unit
6.	Determination of Gypsum requirement of soil
7.	Determination of lime requirement of soil
8.	Estimation of Magnesium from Talcum powder
9.	Study of measures to restore fertility of soil
10.	Prediction of impacts by dispersion model
11.	Study of site selection criteria under EIA

Semester VI
Major XI: Environmental Legislation

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

Course Outcome:

1. Study the concept and need of environmental legislation.
2. Study and understand various environmental laws.

Unit	Lecture Hours
Unit I	15
Introduction to Environmental Legislation Concept, scope, and need for environmental laws, Evolution of environmental policy in India and globally, Key international conferences: Stockholm (1972), Rio Earth Summit (1992), Kyoto Protocol, Paris Agreement, Constitutional provisions for environmental protection (Articles 48A, 51A(g), 21), Roles of Government, Judiciary, Pollution Control Boards, NGOs	8
Major Environmental Acts in India Environment (Protection) Act, 1986, National Green Tribunal (NGT) Act, 2010, Water (Prevention & Control of Pollution) Act, 1974 Air (Prevention & Control of Pollution) Act, 1981, Noise Pollution Rules	7
Unit II	15
Natural Resource & Biodiversity Legislation Wildlife Protection Act, 1972 Forest Conservation Act, 1980 Biological Diversity Act, 2002 Coastal Regulation Zone (CRZ) Notification Mines and Minerals (Regulation & Development) Act Wetland Conservation Rules	8
Environmental Governance, Policies & International Laws Environmental Policy of India (2006) National Forest Policy International environmental agreements: Convention on Biological Diversity (CBD), Ramsar Convention, CITES, UNFCCC & Kyoto Protocol, Paris Climate Agreement Role of judiciary: PILs, landmark judgments (MC Mehta cases)	7

SUGGESTED BOOKS:

1. Bell stuart, MC Gillivray, Environmental law, Oxford University Press, New Delhi
2. Singh Gurdeep (2005) Environmental law in India, Macriillan India Ltd, Delhi
3. Shastri S.C. (2015), Environmental Law, Eastern Boom Company, Lucknow
4. Divan Shyam, Rosencranz (2013), Environmental Law and policy in India, Oxford University Press, New Delhi
5. Venkat Aruna 2011), Environmental Law and Policy, PHI Learning Pvt. Ltd., New Delhi

6. Chatterjee Benimadhab (2003), Environmental Laws, Deep and Deep Publications Pvt. Ltd., New Delhi
7. Dr. S. R. Myneini (2016), Environmental Law, Asia Law House, Hyderabad
8. Shastri S. C. (2005), Environmental Law, Eastern Book Company, Lucknow

Semester VI

Major XII: Green Technologies and Urban Restoration Credits 2 (Marks 50) Hours 30, 30 Lectures of 60 minutes

Course Outcome:

1. Understand the principle of circular economy and sustainability.
2. Study and understand concepts of ecological planning and urban restoration.

Unit	Lecture Hours
Unit I	15
Introduction to Green Technologies: Concept, scope, and need for green technologies, Environmental challenges in urban ecosystems, Principles of sustainability & circular economy, Green design, eco-efficiency, life cycle assessment (LCA), Renewable and non-renewable resources, International frameworks: SDGs, green economy, green building norms Climate change, carbon footprint, ecological foot print	8
Green Technologies for Urban Sustainability Renewable Energy Technologies, Solar PV and solar thermal systems, Wind energy systems, Bioenergy and waste-to-energy, Small hydropower & geothermal systems, Green buildings (LEED, GRIHA standards), Cool roofs and reflective surfaces, Energy-efficient lighting and appliances	7
Unit II	15
Urban Restoration and Ecological Planning Concept of urban ecological restoration, Urban ecosystem degradation: causes & impacts, Brownfield and landfill restoration, Riverfront development and watershed-based planning, Biodiversity conservation in urban landscapes, Urban heat island mitigation strategies, Nature-based solutions (NBS)	8
Policy, Governance, Tools & Applications National and international policies supporting green technologies, Environmental regulations for urban development, Role of municipalities, urban planners, and public participation, Green financing & carbon credits, Remote sensing & GIS in urban restoration, Environmental impact assessment (EIA) for urban projects, Smart cities mission & sustainable urban development models	7

SUGGESTED BOOKS:

1. Urban Sustainability and River Restoration: Green and Blue Infrastructure, Katia Perini & Paola Sabbion Wiley-Blackwell / John Wiley & Sons Ltd.
2. Revising Smart Cities with Regenerative Design, Zaheer Allam & Peter Newman, Springer Cham
3. EcoTech Urbanism: Pioneering Sustainable Technologies for Developing Cities, Venkatesh Baskaran, S.M. Renuka & R. Velkennedy, Springer Cham.
4. Sustainable Cities: Pioneering Approaches to Green Urbanism and Climate Resilience, Simon Elias Bibri, Giuseppe Resta & Dorina Papa, et al., Springer Chan
5. Future of Green Techonolgy: Editor: DR S N Pandey Publishers: Jnanada Prakshan

Semester VI
Major P VI
Lab Course XIII
Credits: 4

Sr. No.	Title
1.	Case study of Bhopal gas tragedy
2.	Case study of Narmada Bachao Andolan
3.	Case study of Silent Valley movement
4.	Study of consent procedure (CTE and CTO)
5.	Study of environmental clearance procedure
6.	Study of landmark environmental PIL cases
7.	Case study of international environmental agreements
8.	Preparation of green audit report
9.	Comparative study of conventional vs energy efficient equipment's
10.	Life cycle analysis of commonly used urban products
11.	Study and comparison of eco-friendly construction material
12.	Study of solar energy devices
13.	Preparation of eco-friendly products
14.	Study of working principle and environmental advantages of electric vehicle
15.	Study of landmark NGT cases
16.	Study of emission/ effluent standards prescribed by CPCB
17.	Preparation of Environment Management Plan
18.	Environmental impact comparison of conventional vs green products

Semester VI
Major II (Elective): Climate Change and Carbon Footprints
Credits 2 (Marks 50) Hours 30, 30 Lectures of 60 minutes

Course Outcome:

1. Understand the causes, effects and adaptation measures for climate change.
2. To understand the carbon accounting method and life cycle analysis.

Unit	Lecture Hours
Unit I	15
Fundamentals of Climate Science: Introduction to climate and weather, Components of the climate system: atmosphere, hydrosphere, biosphere, cryosphere, Natural greenhouse effect & enhanced greenhouse effect, Climate drivers: solar radiation, volcanic activity, atmospheric composition, Climate feedback mechanisms: albedo, water vapor, clouds, Paleoclimate and evidence of climate change, Global and regional climate patterns	7
Climate Change – Causes, Impacts & Adaptation Causes of Climate Change: Greenhouse gases (CO ₂ , CH ₄ , N ₂ O, CFCs), Anthropogenic emissions: industrialization, agriculture, transport, Land-use and land-cover change Impacts of Climate Change: Sea-level rise, Glacial melt and cryosphere degradation, Extreme weather events (heat waves, cyclones, droughts, floods), Impacts on biodiversity, ecosystems, agriculture, water resources Adaptation Strategies: Water resource adaptation, Climate-resilient agriculture, Coastal zone management, Disaster risk reduction, Nature-based adaptation	8
Unit II	15
Carbon Footprint – Measurement & Mitigation Definition and components of carbon footprint, Sources of carbon emissions: energy, transport, food systems, waste Carbon accounting methods: Scope 1, Scope 2, Scope 3 emissions, Life Cycle Assessment (LCA) principles, Carbon footprint calculators & carbon audits, Carbon sequestration: natural (forests, soils, oceans) and technological (CCS, BECCS) Mitigation strategies: Renewable energy, Energy efficiency, Sustainable transportation, Waste reduction and recycling, Behavioral changes	7
Climate Policy, Agreements & Sustainable Solutions: UNFCCC framework, Kyoto Protocol: mechanisms (CDM, Emissions Trading), Paris Agreement and Nationally Determined Contributions (NDCs), IPCC reports and climate models, National Action Plan on Climate Change (NAPCC – India), Carbon pricing: carbon tax, carbon credits, cap-and-trade, Corporate sustainability: ESG, Net Zero pathways, Sustainable development goals (SDGs) related to climate action Case studies: countries/cities achieving low-carbon transitions	8

SUGGESTED BOOKS:

1. The Climate Book: The Facts and the Solutions, Greta Thunberg, Penguin Random House
2. The Carbon Footprint Handbook, Subramanian Senthilkannan Muthu, CRC Press / Taylor & Francis Group, 2016
3. Carbon Footprint Assessments: Case Studies & Best Practices, Subramanian Senthilkannan Muthu, Springer Cham, 2024
4. How to Avoid a Climate Disaster: The Solutions We Have and the Breakthroughs we Need, Bill Gates, Alfred A. Knopf
5. The Parrot and the Igloo: Climate and the Science of Denial, David Lipsky, W. W. Norton & Company

Semester VI
Major P II
Lab Course XIV
Credits: 2

Sr. No.	Title
1.	Calculation of individual carbon footprint
2.	Measurement of electricity use of college campus
3.	Preparation of energy audit report
4.	Estimation of institutional carbon emissions
5.	Study of temperature and rainfall trends over last 20 years
6.	Case study of impact of deforestation on climatic conditions
7.	Comparative analysis of carbon emissions from different energy sources
8.	Study of local species affected by climate change
9.	Study of local climate adaptation strategies
10.	Survey of climate change awareness and behaviour

Semester VI
VSC III (Practical)
Credits: 2

Sr. No.	Title
1.	Study of sustainable agricultural practices
2.	Case study of watershed management
3.	Compliance assessment of local industry
4.	Analysis of long-term temperature and rainfall trends
5.	Case study of extreme weather events in India
6.	Study of biomedical waste segregation and handling
7.	Study of circular economy model for a product
8.	Study of deco-tourism impact assessment
9.	Study of Environment Management System framework
10.	Study of Environmental Social Governance

Semester VI
SEC III: Ecological Restoration
Credits 2 (Marks 50) Hours 30, 30 Lectures of 60 minutes

Course Outcome:

1. Understand about need and methods of ecological restoration.
2. Study and understand monitoring, evaluation and future directions for ecological restoration.

Unit	Lecture Hours
Unit I	15
Foundations of Ecological Restoration: Definition, scope, and history of ecological restoration, Restoration ecology principles, Ecosystem structure, function, and services, Disturbance, succession, resilience, and thresholds, Causes of ecosystem degradation Restoration vs. conservation, rehabilitation, and mitigation	7
Planning and Design for Restoration: Site assessment: soil, hydrology, vegetation, fauna, Reference ecosystems and historical ecology, Goal setting and success criteria, Landscape-scale and watershed approaches, Stakeholder participation and socio-economic factors, Legal and policy frameworks	8
Unit II	15
Restoration Techniques and Applications: Terrestrial restoration: forests, grasslands, drylands, Wetland, river, and lake restoration, Coastal and marine restoration basics, Invasive species management, Species selection, native biodiversity, and restoration genetics, Use of traditional and indigenous ecological knowledge	7
Monitoring, Evaluation, and Future Directions: Indicators of restoration success, Monitoring techniques and data analysis, Adaptive management, Climate change and restoration, Carbon sequestration and nature-based solutions, Ethics, economics, and sustainability of restoration projects, Case studies and emerging technologies	8

SUGGESTED BOOKS:

1. Ecological Restoration, Susan M. Galatowitsch, Sinauer Associates
2. Foundations of Restoration Ecology, Margaret A. Palmer, Joy B. Zedler & Donald A. Falk, Island press
3. Ecological Restoration, Andre F. Clewell & James Aronson, Island Press Washington, DC
4. Ecological Restoration: Moving Forward Using Lessons Learned, Singarayer Florentine, Paul Gibson-Roy, Kingsley Wayne Dixon & Linda Broadhurst, Springer Cham
5. Routledge Handbook of Ecological and Environmental Restoration, Stuart K. Allison & Stephen D. Murphy, Routledge
6. Ecological Restoration in India: Perspective and Practices, Dheeraj Mittal & Dharmendra Kumar Gupta, Springer Nature Singapore

Semester VI
Indian Knowledge Systems (IKS)
Credits 2 (Marks 50) Hours 30, 30 Lectures of 60 minutes
Environmental History and Ecology in Modern India

Course Outcomes:

1. Understand traditional environmental practices and natural resource use in India.
2. Explain the impact of colonial policies on water resources and irrigation systems.

Unit	Lecture Hours
Unit I	15
Introduction to Traditional Environmental Practices: Traditional use of natural resources in India Traditional water management systems (tanks, wells, ponds) Community management of forests and water Decline of traditional environmental practices	7
Colonialism and Water Resource Management Water resource management during colonial period Development of large-scale canal irrigation Environmental effects of canal irrigation Changes in traditional water systems	8
Unit II	15
Wildlife Management: Hunting practices in ancient and medieval India Hunting during colonial period and its social aspects Wildlife conservation and establishment of national parks Human–animal conflicts around protected areas	7
Environmental Issues and Movements in Modern India Industrial use of forest resources (biomass and wood) Environmental problems caused by large dams Urban environmental issues: health, hygiene, waste disposal and air pollution Environmental movements in India ,Forest Conservation Act (1980) ,Forest Rights Act (2006)	8

SUGGESTED BOOKS:

1. "Ecological Restoration: Principles, Values, and Structure of an Emerging Profession" by Andre F. Clewell and James Aronson
2. The Society for Ecological Restoration (SER): A professional organization dedicated to advancing the science and practice of ecological restoration.
3. The International Union for Conservation of Nature (IUCN): A global organization that works to conserve and restore ecosystems.
4. The Ecological Restoration Alliance: A network of organizations and individuals working to advance ecological restoration.

5. Erach Barouche – *Textbook of Environmental Studies* Publisher: Universities Press
6. P. D. Sharma – *Ecology and Environment* Publisher: Rastogi Publications
7. P. S. Verma & V. K. Agarwal – *Environmental Biology* Publisher: S. Chand / Rastogi Publications
8. Mahesh Rangarajan – *India's Environmental History* Publisher: Oxford University Press
9. V. B. Saharia – *Wildlife in India* Publisher: Natraj Publishers
10. "Ecological Restoration: An International Journal" (a peer-reviewed journal)
11. "Restoration Ecology" (a peer-reviewed journal)
12. "The Encyclopedia of Ecological Restoration" by the Society for Ecological Restoration

SHIVAJI UNIVERSITY, KOLHAPUR
FACULTY OF SCIENCE
B.Sc. III POLLUTION
ON-THE-JOB TRAINING (OJT) AND FIELD PROJECT
(As per NEP, 2020)

1. Course Title: **On-the-Job Training(OJT)and Field Project**
2. Course Code:.....
3. Credits: **04**
4. Total LearningHours:**120 Hours**
5. Semester: **VthSemester.**
6. Course Type:Mandatory|Skill-based|Experiential Learning
7. Nature of Assessment: Internal Assessment Only
8. Total Marks: **100**

9. Course Rationale

In accordance with the National Education Policy (NEP) 2020 and the Internship/OJT guidelines of Shivaji University, Kolhapur, This course aims to integrate theoretical knowledge with real-life practical exposure. The On-the-Job Training (OJT) and Field Project provide undergraduate Pollution students with hands-on experience in academic, research, industrial, ecological, and community-based settings, enabling holistic learning and skill development.

10. Course Objectives

The objectives of this courseareto:

1. Provide experiential learning through direct engagement with professional work environments.
2. Enable application of environmental conversation and protection related knowledge in laboratory, field, and industrial contexts.
3. Develop technical skills related to industrial pollution monitoring, EIA, ecology, biodiversity conservation.
4. Promote professional ethics, discipline, teamwork, and communication skills.
5. Enhance employability, entrepreneurship, and research aptitude among students

Course Outcomes (COs)

Upon successful completion of the course, the learner will be able to:

1. Demonstrate hands-on skills in environmental and industrial pollution monitoring field and laboratory techniques.
2. Apply theoretical concepts of Environmental conservation and protection to practical situations.
3. Collect, document, analyze, and interpret field data related to environmental and industrial pollution monitoring.
4. Prepare structured scientific OJT/Field Project report.
5. Communicate findings effectively through oral presentation and viva-voce.