



INDIRA GANDHI UNIVERSITY, MEERPUR, REWARI
(A state University Established under Haryana Act No. 29 of 2013)

Proceeding of the meeting of the Under Graduate Board of Studies & Research

A meeting of Under Graduate Board of Studies & Research (U.G.B.O.S. &R) was held online on 06.08.2026 at 11:00 AM on <https://meet.google.com/mow-goiy-bue>

The following members attend the meeting:

1. Dr. Suman Nagpal, Associate Professor
2. Dr. Mona Sharma, Professor, C.U.H., Mahendragarh
3. Dr. Ramesh Kumar, Chairperson

Chairperson
Outside Expert
Special Invite

The agenda items are as under: -

Agenda 1: To approve the Modified B.Sc. Environmental Sciences Scheme and Syllabus of Department of Environmental Sciences as per NEP-2020 i.e. New Curriculum design and Framework of IGU.

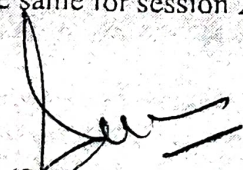
The B.Sc. (EVS) Scheme & Syllabus of Department of Environmental Sciences as per NEP-2020 i.e New Curriculum design and Framework of IGU for implementation w. e. f 2026 - 27 was presented by the Chairperson, Department of Environmental Sciences, IGU, Meerpur to the experts for the potential approval.

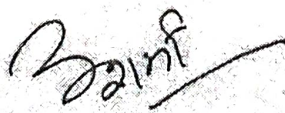
a. The content of the Scheme & Syllabus of Department of Environmental Sciences as per NEP-2020 i.e New Curriculum design and Framework of IGU for Session 2026-27 was examined and consent was given to adopt w. e. f 2026-27 onwards for the degree of B. Sc. (Environmental Sciences).

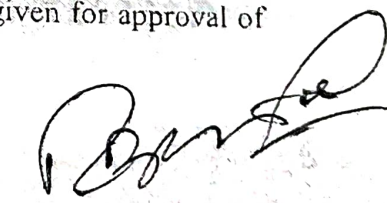
Agenda 2: To approve the panel of Examiner and paper setter for B.Sc. (Environmental Sciences).

The panel of Examiner and paper setter for B.Sc. (Environmental Sciences) was presented by the Chairperson, Department of Environmental Sciences, IGU, Meerpur to the experts for the potential approval.

a. The Members suggested to add some experts name in the list, the name of suggested experts have been added in final Panel of Examiner/paper setter, the consent was given for approval of the same for session 2026-27.


(Suman)


(Mona Sharma)


(Ramesh Kumar)

**INDIRA GANDHI UNIVERSITY,
MEERPUR-REWARI, HARYANA-122502**

(A State University Established under Haryana Act No.29 of 2013)
(Recognized u/s 12(B) & 2(f) of UGC Act, 1956)

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**Scheme- C of Examination
for
Environmental Sciences
in**

**Under Graduate Programmes
as per NEP 2020**

**Curriculum and Credit Framework for Undergraduate Programmes
(Multiple Entry-Exit, Internships and Choice Based Credit System LOCF)**

With effect from the session 2026-27 (in phased manner)

Department of Environmental Sciences

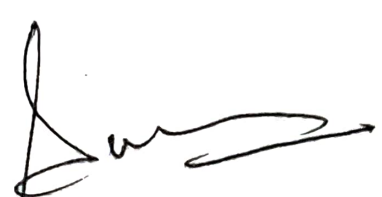
Indira Gandhi University

Meerpur- Rewari (122502)

Haryana, India

Details of Approvals

Council/Board	Date	Remark
Staff Council	29.07.2026	
Board of Studies	06.08.2026	
Faculty	Faculty of Life Sciences	
Academic Council		
Year of implementation 2026-2027		


Chairperson
(Signature with Stamp)


28/07/2026

Indira Gandhi University, Meerpur, Rewari

Scheme of Examination for the Subject: Environmental Sciences in Under Graduate Programmes
as per NEP 2020 Curriculum and Credit Framework for Undergraduate Programmes

(Multiple Entry-Exit, Internships and Choice Based Credit System LOCF) with effect from the session 2026-27 (in a phased manner)
Semester-I

Semester - I																	
Course Type	Applicable Scheme	Course Code	Nomenclature of the Course	Credits			Contact hours				Internal Assessment Marks		End term Examination Marks		Total Marks	Examination hours	
				Total	Theory (Th)	Practical (P)	L	T	P	Total	Th	P	Th	P		Th	P
CC-1	Scheme A, B & C	26L4.5-EVS 101	Earth & Environment	4	3	1	3	0	2	5	25	5	50	20	100	3	2
MC-C-1	Scheme C	26L4.5-EVS 102	Natural Resources	4	3	1	3	0	2	5	25	5	50	20	100	3	2
CC-M1	Scheme A, B & D	26L4.5-EVS-103	Environment and Social Issues	2	1	1	1	0	2	3	5	5	20	20	50	2	2
CC-M1	Scheme C	From Available CC-1/MCC-1 of 4 credits as per NEP															
CC-M1	Scheme A, B & C	From Available pool of Multidisciplinary Courses from a subject of different discipline as per NEP.															
CC-M1	A, B & C	From Available pool of Ability Enhancement Courses as per NEP															
CC-M1	A, B & C	From Available pool of Skill Enhancement Courses as per NEP															
CC-M1	A, B & C	From Available pool of Value Added Courses as per NEP															

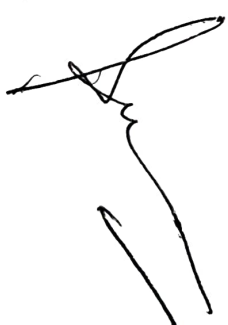
*For students who opt EVS as a minor subject

Semester-2

Course Type	Applicable Scheme	Course Code	Nomenclature of the Course	Credits			Contact hours				Internal Assessment Marks		End term Examination Marks		Total Marks	Examination hours	
				Total	Theory (Th)	Practical (P)	L	T	P	Total	Th	P	Th	P		Th	P
CC-2 MCC-3	Scheme A, B & C	26L4.5-EVS-201	Fundamentals of Ecology	4	3	1	3	0	2	5	25	5	50	20	100	3	2
DSCE-1	Scheme C	26L4.5-EVS-202	Techniques of Environmental Analysis	4	3	1	3	0	2	5	25	5	50	20	100	3	2
CC-M2	Scheme A, B & D	26L4.5-EVS-203	Climate Change	2	1	1	1	0	2	3	5	5	20	20	50	2	2
CC-M2	Scheme C	From Available CC-2/MCC-3 of 4 credits as per NEP															
	A, B & C	From Available pool of Multidisciplinary Courses from a subject of different discipline as per NEP															
	A, B & C	From Available pool of Ability Enhancement Courses as per NEP															
	A, B & C	From Available pool of Skill Enhancement Courses as per NEP															
	A, B & C	From Available pool of Value Added Courses as per NEP															
Internship	A, B & C	26L4.5-EVS-204	Internship of 4 Credits of 4-6 weeks duration after 2 nd Semester (Mandatory in case of exit)													100	

*For students who opt EVS as a minor subject.

*For students who opt EVS as a minor subject

Semester-3

Course Type	Applicable Scheme	Course Code	Nomenclature of the Course	Credits			Contact hours				Internal Assessment Marks		End term Examination Marks		Total Marks	Examination hours	
				Total	Theory (Th)	Practical (P)	L	T	P	Total	Th	P	Th	P		Th	P
CC-3 MCC-4	Scheme A, B & C	26L5.0 EVS - 301	Introduction to Biodiversity	4	3	1	3	0	2	5	25	5	50	20	100	3	2
MCC-5	Scheme B & C	26L5.0 EVS - 302	Disaster Management	4	3	1	3	0	2	5	25	5	50	20	100	3	2
MCC-2	Scheme B	26L5.0 EVS - 102	Natural Resources	4	3	1	3	0	2	5	25	5	50	20	100	3	2
CC-MB	Scheme A & C	From Available CC-3/MCC-4 of 4 credits as per NEP															
CC-MB(M)	Scheme B	From Available pool of Minor (Vocational) Courses VOC-1															
MCC-3	Scheme A, B & C	From Available pool of Multidisciplinary Courses from a subject of different discipline as per NEP															
MCC-3	Scheme A, B & C	From Available pool of Ability Enhancement Courses as per NEP															
MCC-3	Scheme A, B & C	From Available pool of Skill Enhancement Courses as per NEP															
MCC-3	Scheme C only	From Available pool of Value Added Courses as per NEP															

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Semester-4

Course Type	Applicable Scheme	Course Code	Nomenclature of the Course	Credits			Contact hours				Internal Assessment Marks		End term Examination Marks		Total Marks	Examination hours	
				Total	Theory (Th)	Practical (P)	L	T	P	Total	Th	P	Th	P		Th	P
CC-4 MCC-6	Scheme A, B & C	26L5.0 EVS - 401	Environmental Pollution And Management	4	3	1	3	0	2	5	25	5	50	20	100	3	2
MCC-7	Scheme B & C	26L5.0 EVS - 402	Land Degradation and Management	4	3	1	3	0	2	5	25	5	50	20	100	3	2
MCC-8	Scheme B & C	26L5.0 EVS - 403	Environmental Chemistry	4	3	1	3	0	2	5	25	5	50	20	100	3	2
DSE-1	Scheme B & C	26L5.0 EVS - 404	Solid Waste Management	4	3	1	3	0	2	5	25	5	50	20	100	3	2
		OR															
EC-M4(IV)	A, B & C	26L5.0 EVS - 405	Liquid Waste Management	4	3	1	3	0	2	5	25	5	50	20	100	3	2
		From Available pool of Minor (Vocational) Courses VOC-2															
EC-1	A, B & C	From Available pool of Ability Enhancement Courses as per NEP															
MCC-3	A & B	From Available pool of Value Added Courses as per NEP															
MCC-4	C	From Available pool of Value Added Courses as per NEP															
Internship	A, B & C	26L4.5EVS-406	Internship of 4 Credits of 4-6 weeks duration after 4th Semester (Mandatory in case of exit if not done after 2 nd Semester)													100	

Semester-5

Course Type	Applicable Scheme	Course Code	Nomenclature of the Course	Credits			Contact hours					Internal Assessment Marks		End term Examination Marks		Total Marks	Examination on hours		
				Total	Theory (Th)	Practical (P)	L	T	P	Total	Th	P	Th	P	Th		P		
CC-5 MCC-9	Scheme A, B & C	26L5.5 EVS - 501	Environmental Biotechnology	4	3	1	3	0	2	5	25	5	50	20	100	3	2		
MCC-10	Scheme B & C	26L5.5 EVS - 502	Water Resource and Management	4	3	1	3	0	2	5	25	5	50	20	100	3	2		
DSE-2	Scheme B & C	26L5.5 EVS - 503	Agroforestry and Agroecology	4	3	1	3	0	2	5	25	5	50	20	100	3	2		
DSE-2	Scheme B & C	26L5.5 EVS - 504	Ecological Restoration	4	3	1	3	0	2	5	25	5	50	20	100	3	2		
DSE-2	Scheme B & C	26L5.5 EVS - 505	Biomedical and E Waste Management	4	3	1	3	0	2	5	25	5	50	20	100	3	2		
DSE-3	Scheme B & C	26L5.5 EVS - 506	Hazardous Waste Management	4	3	1	3	0	2	5	25	5	50	20	100	3	2		
CC-ME(V)	A & C	From Available pool of Minor (Vocational) Courses VOC-1																	
Internship	A, B & C	26L4.5EVS-507	Internship of 4 Credits of 4-6 weeks duration (After 4 th Semester)														100		

Course Type	Applicable Scheme	Course Code	Nomenclature of the Course	Semester 6 Credits			Contact hours			Internal Assessment Marks		End term Examination Marks		Total Marks		Examination hours	
				Total	Theory (Th)	Practical (P)	L	T	P	Total	Th	P	Th	P		Th	P
							P: Practical T: Tutorial										
CC-6 MCC-11	Scheme A, B & C	26L5.5 - EVS-601	Basics of Remote Sensing And GIS	4	3	1	3	0	2	6	25	5	50	20	100	3	2
DSE-12	Scheme B & C	26L5.5 - EVS-602	Waste Management	4	3	1	3	0	2	6	25	5	50	20	100	3	2
	Scheme B & C	26L5.5 - EVS-603	Environmental Legislation	4	3	1	3	0	2	6	25	5	50	20	100	3	2
DSE-4	Scheme B & C	26L5.5 - EVS-604	Environmental Management System and Standards	4	3	1	3	0	2	6	25	5	50	20	100	3	2
			Energy and Environment	4	3	1	3	0	2	6	25	5	50	20	100	3	2
DSE-5	Scheme B & C	26L5.5 - EVS-605	Or														
			Renewable & New Energy Sources	4	3	1	3	0	2	6	25	5	50	20	100	3	2
CC-M6	A	From Available CC-6/MCC-11 of 4 credits as per NEP															
CC-M5(M)	B	From Available pool of Minor (Vocational) Courses VOC-3															
CC-M6(M)	C																
CC-M7(M)	A																
SFC-4	C	From Available pool of Skill Enhancement Courses as per NEP															

Dr. S. S. Sani

Semester-7 (Honours/ Honours with Research)

Course Type	Applicable Scheme	Course Code	Nomenclature of the Course	Credits						Contact hours			Internal Assessment Marks		End term Examination Marks		Total Marks	Examination hours	
				Total	Theory (Th)	Practical (P)	L	T	P	Total	Th	P	Th	P					
															P: Practical T: Tutorial				
CC-H1	Scheme B & C	26L6.0 - EVS-701	Applications of Remote Sensing and GIS	4	4	0	4	0	0	4	30	0	70	0	100	3	-		
CC-H2	Scheme B & C	26L6.0 - EVS-702	Environmental Microbiology	4	4	0	4	0	0	4	30	0	70	0	100	3	-		
CC-H3	Scheme B & C	26L6.0 - EVS-703	Environmental Statistics & Modeling	4	4	0	4	0	0	4	30	0	70	0	100	3	-		
DS-E6	Scheme B & C	26L6.0 - EVS-704	Occupational Health & Safety	4	4	0	4	0	0	4	30	0	70	0	100	3	-		
Or																			
PC-H1	Scheme B & C	26L6.0 - EVS-705	Environmental Toxicology	4	4	0	4	0	0	4	30	0	70	0	100	3	-		
		26L6.0 - EVS-706	Practical Based on 26L6.0 - EVS-701 to 703 and any one out of 704/705	4	0	4	0	0	8	8	0	30	0	70	100	0	3		
CC-HM1	B & C	From Available Core Courses in Minor Subject of 4 credits as per NEP																	

Semester-8 (Honours)

Course Type	Applicable Scheme	Course Code	Nomenclature of the Course	Credits			Contact hours				Internal Assessment Marks		End term Examination Marks		Total Marks	Examination hours	
				Total	Theory (Th)	Practical (P)	L	T	P	Total	Th	P	Th	P			
																L: Lecture P: Practical T: Tutorial	
CC-H4	Scheme B & C	26L6.0 - EVS-801	Environmental Impact Assessment	4	4	0	4	0	0	4	30	0	70	0	100	3	-
CC-H5	Scheme B & C	26L6.0 - EVS-802	Research Methodology & Ethics	4	4	0	4	0	0	4	30	0	70	0	100	3	-
CC-H6	Scheme B & C	26L6.0 - EVS-803	Environmental Economics	4	4	0	4	0	0	4	30	0	70	0	100	3	-
DSE-7	Scheme B & C	26L6.0 - EVS-804	Indian Knowledge System and Environment	4	4	0	4	0	0	4	30	0	70	0	100	3	-
				Or													
PG-H2	Scheme B & C	26L6.0 - EVS-805	Space Mission for Earth System Monitoring	4	4	0	4	0	0	4	30	0	70	0	100	3	-
		26L6.0 - EVS-806	Practical Based on 26L6.0 - EVS-801 to 803 and any one out of 804/805	4	0	4	0	0	8	8	0	30	0	70	100	-	3
CC-HM2	B & C	From Available Core Courses in Minor Subject of 4 credits as per NEP															

Scheme of MDC, VAC, SEC, AEC and VOC courses offered in the University Pool by the

Department of Environmental Sciences

Scheme of MDC, VAC, SEC and VOC courses

Department of Environmental Sciences

Scheme of MDC, VAC, SEC and VOC courses

Semester	Course Type	Applicable Scheme	Course Code	Nomenclature of the Course	Credits			Contact hours			Internal Assessment Marks		End term Examination Marks		Total Marks	Exam. Hours		
					Total	Theory (T)	Practical (P)	L	T	P	Total	T	P	T		P	T	P
1	MDC-1	Scheme A, B, C & D	26L.4.5-MDC-EVS-101	Basics of Environmental sciences	3	2	1	2	0	2	4	15	5	35	20	75	2	2
2	MDC-2	Scheme A, B, C & D	26L.4.5-MDC-EVS-201	Environmental issues	3	2	1	2	0	2	4	15	5	35	20	75	2	2
3	MDC-3	Scheme A, B, C & D	26L.5.0-MDC-EVS-301	Environmental Conservation	3	2	1	2	0	2	4	15	5	35	20	75	2	2
3	VAC-1 & VAC-2	Scheme A, B, C & D	26L.4.5-VAC-EVS-101	Environmental Studies	2	2	0	2	0	0	2	15	0	35	0	50	2	0
2	SEC-2	Scheme A, B, C & D	26L.4.5-SEC-EVS-201	Food Waste and By-Product Utilization	3	2	1	2	0	2	4	15	5	35	20	75	2	2
6 20																		

2	SEC-2	Scheme A, B, C & D	26L.4.5-SEC-EVS-202	Environmental Auditing	3	2	1	2	0	2	4	15	5	35	20	75	2	2
3	SEC-3	Scheme C only	26L.5.0-SEC-EVS-301	Waste Management Techniques	3	2	1	2	0	2	4	15	5	35	20	75	2	2

10/10/20

20/10/20

20/10/20

VISION AND MISSION OF THE UNIVERSITY

VISION

To be a globally renowned university, recognized for excellence in teaching, innovative research, and welfare of the society, imbining the spirit of "*Vasudhaiv kutumbham*".

MISSION

- To introduce and implement innovation in teaching and learning process matching up the global standards to strengthen academic delivery through curriculum design, teaching pedagogy and usage of ICT.
- To develop a mechanism that attracts talented, qualified and experienced faculty from across the globe for pursuing their academic and research careers at the University.
- To offer academic programs at UG, PG, doctoral, Post-Doctoral levels which are learner-centric, industry focused, and adhere to outcome based international models.
- To create an ambience that is conducive for undertaking sponsored research, innovation and consultancy services to a wide spectrum of societal and industrial requirements while encouraging interdisciplinary approach of learning, team work, and research.
- To establish state of art centres of excellence in frontier areas of research and design innovation through industry collaboration to innovate and incubate the products and services.
- To establish smart campus and promote e-governance activities in the university for the digitally empowered society and knowledge economy.
- To provide a hygienic, modern, environment friendly and vivacious campus attuned to the urgent needs of Green Technology.
- To consider and implement norms, metrics, standards, procedures and benchmarks for assessing and improving the quality in every aspect of University system and achieve quality certifications by National and International bodies.
- To make society self-reliant by organizing various programmes including literacy, gender sensitization, health awareness, and dissemination of information about livelihood generation.



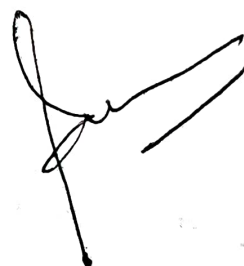
VISION AND MISSION OF THE DEPARTMENT

VISION

"A department that can effectively harness its multidisciplinary strength by imparting in-depth knowledge of scientific, technical, legal and social aspects of the environment to produce technologically adept Environmental under-graduates and researchers, that can address emerging challenges to sustainability for the betterment of society."

MISSION

- To impart training for capacity building to tackle various Environmental challenges in a sustainable manner.
- To provide holistic education to develop Environment leaders, policymakers, and solution seekers.
- To provide interdisciplinary and transformative research in the field of Environmental Science.
- To provide technological exposure to the students through industrial training programs/ Dissertations.
- To promote outreach activities for public awareness and societal benefit.



ABOUT THE PROGRAMME

About the Programme

Bachelor of Science (B.Sc.) in Environmental Sciences

The Bachelor of Science (B.Sc.) in Environmental Sciences is a multidisciplinary undergraduate programme offered by the Department of Environmental Sciences, Faculty of Life Sciences, Indira Gandhi University, Meerpur- Rewari, in accordance with the National Education Policy (NEP) 2020 and the UGC Curriculum and Credit Framework for Undergraduate Programmes (CCFUGP). The programme is designed to develop a strong foundation in environmental science by integrating biological, physical, chemical, and social sciences to understand and address contemporary environmental challenges.

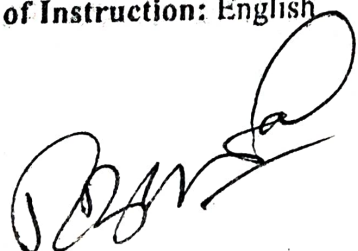
The curriculum emphasizes scientific knowledge, laboratory skills, field-based learning, environmental monitoring, natural resource management, pollution control, biodiversity conservation, climate change, environmental legislation, geospatial technologies, and sustainable development. It provides experiential learning through practical courses, field visits, internships, projects, and skill-based components to enhance employability, entrepreneurship, and research aptitude.

The programme follows the Choice Based Credit System (CBCS), Learning Outcome-Based Curriculum Framework (LOCF), and Multiple Entry-Exit provisions under NEP 2020, offering flexibility for interdisciplinary learning and academic mobility. It integrates Indian Knowledge Systems (IKS), constitutional values, environmental ethics, and the Sustainable Development Goals (SDGs) to prepare graduates for responsible environmental stewardship and sustainable societal development.

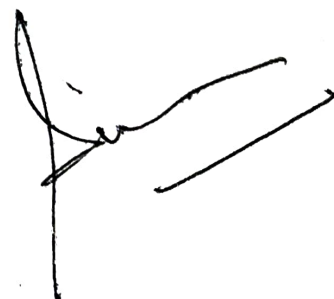
Graduates of the programme will be equipped with analytical, technical, communication, and problem-solving skills to pursue careers in government departments, environmental consultancies, research institutions, industries, pollution control boards, NGOs, academia, and entrepreneurship, as well as higher education and research in environmental sciences.

Programme Duration

- **Duration:** Three year (Six Semester) OR Honors Four Year (Eight Semester)
- **Mode of Study:** Full-time
- **Programme Framework:** Undergraduate Programme as per NEP-2020, CCFUGP, Multiple Entry-Exit and Choice Based Credit System (CBCS/LOCF)
- **Total Credits:** As per University/UGC CCFUGP norms
- **Total Marks:** As prescribed by the University
- **Medium of Instruction:** English



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Programme Structure

The B.Sc. Environmental Sciences programme comprises the following components:

- Major/Core Courses (CC)
- Minor Courses
- Discipline Specific Elective Courses (DSE)
- Multidisciplinary Courses (MDC)
- Ability Enhancement Courses (AEC)
- Skill Enhancement Courses (SEC)
- Value Added Courses (VAC)
- Vocational Courses (VOC)
- Practical/Practicum Courses
- Internship
- Project Work/Research Component (where applicable)

The programme provides flexibility under NEP-2020 through multiple entry-exit options, interdisciplinary learning, and skill-oriented courses. The curriculum is designed to develop subject knowledge along with laboratory skills, professional competency, and entrepreneurship abilities.

Internship

Every student shall successfully complete an internship as prescribed under the University regulations. The internship may be undertaken in environmental industries, research laboratories, government organizations, universities, healthcare institutions, environmental organizations, or any other approved institution.

The internship provides practical exposure to industrial practices, research methodologies, laboratory techniques, professional ethics, and workplace skills. The UG scheme includes a **4-credit internship of 4-6 weeks duration** as prescribed under NEP-2020 guidelines.

Multiple Entry and Exit

The programme shall follow the Multiple Entry and Exit provisions of NEP-2020 and University regulations.

- **Exit after First Year:** Award of Undergraduate Certificate, subject to fulfilment of prescribed credit requirements.
- **Exit after Second Year:** Award of Undergraduate Diploma, subject to fulfilment of prescribed credit requirements.
- **Completion of Three Years:** Award of Bachelor of Science (B.Sc.) in Environmental Sciences.
- **Four-Year Undergraduate Programme (where applicable):** Provision for Honours/Honours with Research as per NEP-2020 and University guidelines.

Evaluation Scheme

The evaluation shall consist of:

- Continuous Internal Assessment
- End Semester Examination
- Practical/Laboratory Examination
- Seminar Presentation
- Internship Evaluation
- Project Evaluation (where applicable)
- Viva-Voce Examination (where applicable)

The evaluation, grading system, promotion, examination, and award of degree shall be governed by the University Ordinances, Examination Regulations, CBCS/LOCF, CCFUGP, and NEP-2020 guidelines, as amended from time to time.

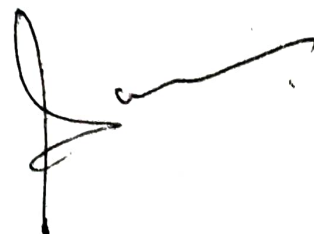
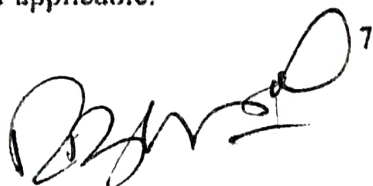
General Instructions

1. The programme shall be governed by the Academic Ordinances, Examination Regulations, CBCS/LOCF, CCFUGP, and NEP-2020 guidelines of Indira Gandhi University, Meerpur-Rewari, as amended from time to time.
2. The Department reserves the right to revise the curriculum, practical exercises, field activities, and evaluation methods according to academic advancements and emerging Environmental Science developments.
3. Laboratory practical training, industrial visits, educational tours, seminars, workshops, conferences, expert lectures, and extension activities shall form an integral part of the programme.
4. The list of practical exercises may be modified depending upon laboratory facilities, emerging technologies, and academic requirements.
5. The medium of instruction and examination shall ordinarily be English.
6. Credits shall be awarded only after successful completion of prescribed academic requirements.
7. The programme promotes multidisciplinary learning, scientific temper, innovation, entrepreneurship, ethical practices, and sustainable development in alignment with NEP-2020 objectives.

Passing Criteria

A student shall be considered to have passed a course only if he/she secures:

- Minimum passing marks (40%) in the End Semester Examination as prescribed by the University.
- Minimum required aggregate marks combining Internal Assessment and End Semester Examination.
- Minimum passing marks in Practical/Practicum, Internship, Seminar, Project Work, and Viva-Voce wherever applicable.



The award of SGPA, CGPA, promotion, reappear examinations, improvement, division, and degree shall be governed by University Ordinances and NEP-2020 regulations.

A student shall be awarded the **Bachelor of Science (B.Sc.) in Environmental Sciences** upon successful completion of all prescribed credits and programme requirements.

Eligibility for Examination

A student shall be eligible to appear in the End Semester Examination only if he/she:

- Fulfills the minimum attendance requirement prescribed by the University and UGC.
- Completes all academic requirements including internal assessment, practical work, and other prescribed components.
- Satisfies all conditions prescribed under University Examination Regulations.

Promotion and Award of Degree

Promotion from one semester to the next and award of the degree shall be governed by the Academic Ordinances and Examination Regulations of Indira Gandhi University, Meerpur-Rewari.

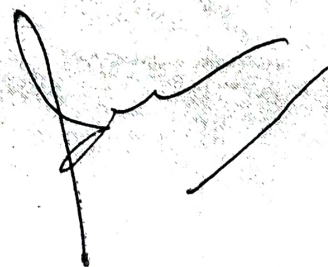
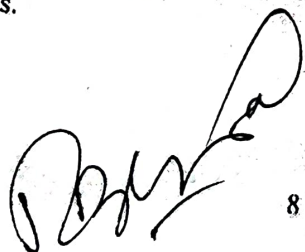
A student shall be awarded the **Bachelor of Science (B.Sc.) in Environmental Sciences** upon successful completion of all prescribed credits, examinations, practical requirements, internship/project work, and other academic requirements in accordance with University regulations.

MINIMUM ELIGIBILITY CRITERIA

Minimum Eligibility Criteria for Admission to B.Sc. Environmental Sciences Admission to the B.Sc. Environmental Sciences programme shall be made in accordance with the rules and regulations of Indira Gandhi University, Meerpur- Rewari, as amended from time to time.

A candidate seeking admission to the programme must fulfil the following eligibility conditions:

1. The candidate must have passed the **Senior Secondary Examination (10+2)** or equivalent examination from a recognized Board.
2. The candidate must have studied **Biology/Environmental Sciences** as one of the subjects at the senior secondary level.
3. Candidates with Science stream (PCB or equivalent) shall be eligible for admission.
4. The candidate must have secured the minimum qualifying marks prescribed by the University. Relaxation for reserved categories shall be applicable as per Haryana Government and University norms.

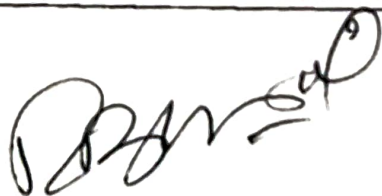


PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1	Core Competence & Practical Application Graduates will actively contribute to scientific, industrial, or educational sectors by applying their foundational knowledge, technical data management skills, and practical lab techniques to support ongoing projects and resolve standard operational challenges.
PEO 2	Continued Education & Professional Growth Graduates will continue to build upon their undergraduate foundation by successfully pursuing higher education (such as Master's or professional degree programs), specialized certifications, or continuous workplace training.
PEO 3	Teamwork & Technical Communication Graduates will function effectively as collaborative and dependable team members in diverse environments, assisting in the execution of technical projects and clearly communicating scientific results to peers and supervisors.
PEO 4	Professional Ethics & Social Awareness Graduates will uphold ethical standards and professional integrity in their daily tasks, maintaining an awareness of how their scientific practices and technical contributions impact the environment and local communities.

PROGRAMME OUTCOMES (POs)

PLO 1	Disciplinary Knowledge: Apply fundamental concepts, principles, and theories of the discipline to understand phenomena and their applications.
PLO2	Effective Communication: Communicate ideas, methods, and results effectively through oral, written, graphical, and digital formats.
PLO3	Teamwork & Collaboration: Function effectively as an individual, team member, or leader in multidisciplinary and collaborative environments.



PLO4	Social Responsibility & Ethical Awareness: Apply methods and reasoning appropriate to the discipline to assess issues related to society and the consequent responsibilities relevant to professional practice.
PLO5	Lifelong Learning: Engage in self-directed learning and adapt to emerging knowledge, technologies, and professional demands throughout life.
PLO6	Integrity & Professional Ethics: Demonstrate integrity, ethical conduct, and professional responsibility in academic, research/practice, and professional activities.
PLO7	Scientific Inquiry and Research Skills: Apply the scientific method to identify problems, conduct experiments or theoretical investigations, collect and analyze data, and interpret results using appropriate scientific approaches.
PLO8	Problem Solving: Identify, analyze, and solve scientific problems using logical reasoning, quantitative methods, and appropriate scientific tools and techniques.
PLO9	Critical and Analytical Thinking: Evaluate scientific information critically, interpret experimental data, and draw evidence-based conclusions using analytical reasoning.
PLO10	Laboratory Skills and Scientific Tools: Demonstrate proficiency in the safe and effective use of laboratory techniques, scientific instruments, and modern tools relevant to life sciences.
PLO11	Application of Life Sciences Knowledge: Apply principles of life sciences to understand biological systems, address environmental and health-related challenges, and undertake basic project-based or field-based investigations.

PROGRAMME SPECIFIC OUTCOMES (PSOs) (If applicable)

PSO 1	Apply ecological principles and scientific knowledge to evaluate environmental systems, biodiversity, natural resources and ecosystem services for sustainable management.
PSO 2	Assess environmental pollution and employ appropriate monitoring, analytical techniques and pollution control technologies for air, water, soil and waste management.
PSO 3	Utilize modern environmental tools including GIS, Remote Sensing, environmental modelling, data analytics, molecular techniques and laboratory instrumentation for environmental analysis and research.
PSO 4	Develop sustainable solutions through environmental planning, climate change adaptation, environmental legislation, impact assessment, environmental auditing and policy implementation.

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Part A – Introduction			
Name of the Programme	B.Sc. Environmental Science		
Semester	SEMESTER-1		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	EARTH AND ENVIRONMENT		
Course Code	26L4.5-EVS 101		
Course Type	CC-1, MCC-1		
Course Level	100-199		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Explain the origin, structure, and dynamic processes of the Earth, including plate tectonics, atmospheric processes, Earth's energy balance, and their role in shaping the environment..	
	CLO ₂	Analyze geological resources, natural hazards, land degradation processes, and weather systems, and evaluate disaster mitigation and sustainable land management strategies.	
	CLO ₃	Evaluate the physical and chemical characteristics of oceans, marine processes, water resource management practices, and the environmental impacts of invasive species for sustainable ecosystem management.	
	CLO ₄	Apply field and laboratory techniques to investigate geological, atmospheric, and aquatic environmental systems through data collection, analysis, interpretation, mapping, and preparation of scientific reports.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1			

question from the each of the three units.

Instructions for Practical Examiner

Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.

	Topics	CLO/s Attempt	Contact Hours
Unit-I	Origin of the Earth, Earth's orbit and Kepler's laws of planetary motion. Structure of the Earth: Geosphere, Atmosphere and Hydrosphere. Theory of Plate Tectonics: Wegener's theory of continental drift, Holmes' theory of convection in the mantle, Hess' theory of sea-floor spreading, Vine and Matthews' theory of magnetic reversals, and Glomar Challenger evidence for the age of oceanic floors. Role of energy in Earth's processes: convection currents, photosynthesis and the water cycle. Chemical composition of the atmosphere, lapse rate and atmospheric stability. Cloud formation and precipitation processes, air-sea interactions. Insolation, Earth's heat budget, and general circulation of the atmosphere and oceans.	CLO1	15
Unit-II	Non-renewable geological resources: minerals, fossil fuels and ores of economic significance. Geological disasters: earthquakes, landslides, cyclones and volcanic eruptions. Impact of human activities on the frequency and magnitude of natural disasters including droughts, floods, forest fires and landslides. Mitigation of geological disasters through building codes, early-warning systems and environmental education. General weather systems of India: monsoon system, cyclones, jet streams and western disturbances. Human impacts on land: salinization, soil erosion and soil contamination; rehabilitation of salinity-affected areas and methods of soil erosion prevention.	CLO2	15
Unit-III	Physical and chemical properties of seawater and their spatial variations. Residence time of elements in seawater. Ocean currents, waves, tides and major water masses of the world's oceans. Impact of human activities on water resources. Reuse of industrial wastewater, sewage and stormwater; concept of Zero Liquid Discharge (ZLD). Effects of introduced (invasive) species on the environment: biotic and abiotic effects, decline or extinction of native species, economic impacts, and control and mitigation methods.	CLO3	15
Practical	1. Investigate evidence for the structure of the Earth using meteorite evidence to demonstrate its composition. 2. Investigate the locations and extraction methods of the geological resources—open-pit mining, underground mining methods, offshore and onshore drilling.	CLO4	30

	3. Investigate the zero-waste discharge from a residential area.		
	4. Investigate their habilitation of salinity-affected area by preparing a case study.		
	5. *Investigate volcanic eruption that has had a significant effect on the biosphere and atmosphere and assess its impact by preparing a case study.		
Total Contact Hours			75
Evaluation Methods			
Internal Assessment:30	TH-25	PR-5	End Term Examination: 70
Class Participation:	5	0	Lab record
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination
Mid-Term Exam:	15	NA	Write-up and execution of the practical
Part C-Learning Resources			
Recommended Books/Journals/ e-resources/ Learning Management Systems (LMS):			
Recommended Books/e-resources/LMS:			
- Botkin, D. B. and Keller E. A (2004). <i>Environment Science: Earth as a Living Planet</i>. John Wiley & Sons Inc., New York. - Francisco B., Frances S. H., Juno H., Gerhard K. and Stephen A. L. (2007). <i>Earth Science: Geology, the Environment, and the Universe</i>. Glencoe/McGraw-Hill. - Steffen, W., Sanderson, A., Tyson, P.D., Jager, J., Matson, P.M., Moore, III, B., Oldfield, F., Richardson, K., Schnellhuber, H.J., Turner, II, B.L. and Wasson. R.J (2004). <i>Global change and the Earth System: A Planet under Pressure</i>. Springer-Verlag, New York, USA Reference books.			

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs) & Program Specific Outcomes (PSOs)

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PSO1	PSO2
CLO1	3	3	2	2	1	1	2	1	1	1	1	3	1
CLO2	2	3	3	3	2	1	3	2	2	1	1	3	2
CLO3	2	3	3	3	3	2	3	2		1	1	3	3
CLO4	2	3	2	3	2	2	3	3	2	1	1	2	3

Content Mapping with NEP thrust areas

Field	Hours Devoted
Employability	8
Entrepreneurship	3
Skill Enhancement	15
Communication Development	3
Indian Knowledge System	3
Environmental Awareness / SDGs	20
Current Issues & Social Awareness	10
Gender Issues	2
Public Policies	6
Any Other (Case studies/Practicals)	5

Part A – Introduction			
Name of the Programme	B.Sc. Environmental Science		
Semester	SEMESTER-1		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	NATURAL RESOURCES		
Course Code	26L4.5-EVS 102		
Course Type	MCC-2		
Course Level	100-199		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Explain the concepts, classification, availability, distribution, and sustainable utilization of natural resources, including land resources, soil, and food resources, and evaluate the impacts of human activities on resource management.	
	CLO ₂	Analyze the characteristics, utilization, conservation, and management of water and forest resources, and assess their ecological, economic, and social significance for sustainable development.	
	CLO ₃	Evaluate the distribution, utilization, and environmental implications of energy and mineral resources, and recommend sustainable strategies for resource conservation and management.	
	CLO ₄	Apply field and laboratory techniques to assess natural resources through resource surveys, soil and water quality analysis, mapping, data interpretation, and preparation of reports for sustainable resource management.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08			

marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.

Instructions for Practical Examiner

Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.

	Topics	CLO/s Attempt	Contact Hours
Unit-I	Natural resources: definition, resource availability and factors affecting their availability; major types of natural resources; renewable and non-renewable resources; economic classification of resources; interaction of humans with natural resources. Land as a resource, types of land, importance, ecological significance and economic importance of soil, effects of land-use changes. Food resources, Green Revolution, effects of modern agriculture, world food problems and food security.	1	15
Unit-II	Water resources: status, availability, demand and utilization in domestic, industrial and agricultural sectors; hydrological cycle; global water resources; surface and groundwater resources; interlinking of rivers; water resources in India and their importance. Forest resources: forest types, primary and secondary forest products, utilization and economic importance; forests and tribal communities; forest resources of India.	2	15
Unit-III	Energy resources: types, renewable energy resources (solar, wind, hydropower and biomass) and non-renewable energy resources (coal, petroleum and natural gas). Mineral resources: types, availability, distribution, utilization and global consumption patterns.	3	15
Practical	1. To identify and study some important minerals. 2. To study and map different soil types in India. 3. To study and map different forest in India. 4. To study and map different water resources in India. 5. To plot energy consumption scenario in pi-diagram in Indian context.		30
Total Contact Hours			75

Evaluation Methods

Internal Assessment:30	TH-25	PR-5	End Term Examination: 70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India.

- Singh, J.S., Singh, S.P. and Gupta, S.R. (2015). *Ecology, Environment and Resource Conservation*, S. Chand Publishing, New Delhi.
- Owen, O. S. & Chiras, D. D. (1990). *Natural resource conservation: an ecological approach* (No. Ed.5). Macmillan Publishing Company.
- Holechek, J. L., Cole, R. A., Fisher, J. T. & Valdez, R. (2000). *Natural resources: ecology, economics, and policy* (No. HC85. N37 2003.). Upper Saddle River, NJ: Prentice Hall.
- Owen, O. S. & Chiras, D. D. (1995). *Natural resource conservation: management for a sustainable future* (No. Ed. 6). Prentice-Hall International, Inc.
- Craig, J. R., Vaughan, D. J. & Skinner, B.J. 1996. *Resources of the Earth: Origin, use, and environmental impact* (2nd edition). Prentice Hall, New Jersey.
- Klee, G. A. 1991. *Conservation of Natural Resources*. Prentice Hall Publication.
- Miller, T. G. 2012. *Environmental Science*. Wadsworth Publishing Co.
- Ramakrishna, P. S., A. N. Purohit, K. G. Saxena, K. S. Rao & R. K. Maikhuri (1996) *Conservation and management of biological resources in Himalaya*, Oxford & IBH Publishing, New Delhi.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs) & Program Specific Outcomes (PSOs)

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PSO1	PSO2
CLO1	3	3	2	2			3					3	2
CLO2	2	3	3	3	2		3	2	2			3	2
CLO3	2	3	3	3	3	2	3	2	1			3	3
CLO4	2	3	3	3	3	2	3	2	2	1		3	3

Content Mapping with NEP thrust areas

Field	Hours Devoted
Employability	8
Entrepreneurship	4
Skill Enhancement	15
Communication Development	3
Indian Knowledge System	4
Environmental Awareness / SDGs	18
Current Issues & Social Awareness	10
Gender Issues	2
Public Policies	7
Any Other (Mapping/Practicals)	4

Part A – Introduction			
Name of the Programme	B.Sc. Environmental Science		
Semester	SEMESTER-1		
Nature of Course/Course Composition	Theory & Practical		
Name of the Course	ENVIRONMENT AND SOCIAL ISSUES		
Course Code	26L4.5-EVS-103		
Course Level	100-199		
Course Type	CC-M 1		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Analyze the social, cultural, ethical, legal, and policy dimensions of environmental issues, and evaluate the role of sustainable development, environmental governance, resource management, environmental movements, and community participation in environmental conservation.	
	CLO ₂	Apply field-based and analytical approaches to assess environmental issues through case studies, environmental impact assessment, socio-environmental surveys, data interpretation, and preparation of reports on sustainable development and environmental management.	
	Theory	Practical	Total
Credits	1	1	2
Teaching hours per week	1	2	3
Internal Assessment Marks	05	05	10
End Term Exam Marks	20	20	40
Max. Marks	25	25	50
Examination Duration (in Hours)	02	02	
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 4 questions from unit 01 with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 6 short answer type questions carrying one mark each (total 06 marks). The remaining questions will be carrying 07 marks each. Examinees will be required to attempt three questions: the compulsory question no. 1 and 02 questions from other 03 questions.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.			
Topics		CLO Attempt	Contact Hours
Unit-I	Social and cultural dimensions of the environment; historical and contemporary perspectives of environmental thought; environmental education and ethics;	1	15

	environmental justice; Article 48A of the Constitution of India; role of the National Green Tribunal (NGT); poverty and environment; and environment-tribal community interactions. Resource inequality, ecological degradation, environmental pollution, development-induced displacement, and global climate change. Impacts of industrialization, urbanization and technological development on the environment; sustainability, ecological footprint, environmental governance and policies; ecotourism and green urbanism. Community participation and sustainable development initiatives; role of NGOs and corporate environmental responsibility; eco-restoration; case studies of environmental movements (Chipko Movement, Appiko Movement, Narmada Bachao Andolan and Namami Gange); major environmental disasters (Bhopal Gas Tragedy and Fukushima Disaster); and national and international environmental awards.				
Practical	1. To study the importance of NGT through case study 2. To study the importance of Article-48A through case study. 3. To study the impact of man-made hazard on environment through case study. 4. To compare the ecological footprints of different countries. 5. To study the importance of community participation in environment protection through case study.	2	30		
Total Contact Hours			45		
Suggested Evaluation Methods					
Internal Assessment:10	TH-05	PR-05	End Term Examination: 40	TH-20	PR-20
Class Participation	5	0	Lab record	NA	5
Seminar/presentation/assignment/quiz/class test etc.	0	NA	Viva-Voce	NA	5
Seminar/Demonstration/Viva-voce/Lab records etc.	NA	5	Written Examination	20	NA
Mid-Term Exam	NA	NA	Write-up and execution of the practical	NA	10
Part C-Learning Resources					
Recommended Books/Journals/ e-resources/ Learning Management Systems (LMS):					
• Chokkan, K. B., Pandya, H. & Raghunathan, H. (eds). 2004. Understanding Environment. Sagar					

Publication India Pvt. Ltd., New Delhi.

- Elliot, D. 2003. Energy, Society and Environment, Technology for a Sustainable Future. Routledge Press.
- Singh, J. S., Singh, S. P. and Gupta, S. R. (2015). Ecology, Environment and Resource Conservation, S. Chand Publishing, New Delhi.
- National Research Council (NRC). 1996. Linking Science and Technology to Society's Environmental Goals. National Academy Press.

**Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs)
& Program Specific Outcomes (PSOs)**

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PSO1	PSO2
CLO1	3	3	2	2		2	3	3	2			2	2
CLO2	2	3	3	3	2	2	3	2	2	1		3	2

Content Mapping with NEP thrust areas

Field	Hours Devoted
Employability	4
Entrepreneurship	2
Skill Enhancement	7
Communication Development	3
Indian Knowledge System	3
Environmental Awareness / SDGs	11
Current Issues & Social Awareness	7
Gender Issues	2
Public Policies	4
Any Other (Case studies, Environmental Movements, Field Reports)	2

Part A – Introduction			
Name of the Programme	B.Sc. Environmental Science		
Semester	SEMESTER-2		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	FUNDAMENTALS OF ECOLOGY		
Course Code	26L4.5-EVS-201		
Course Type	CC-2 MCC-3		
Course Level	100-199		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Explain the fundamental principles of ecology, environmental factors, ecological laws, and population characteristics governing the distribution and adaptation of organisms.	
	CLO ₂	Analyze ecosystem structure, energy flow, trophic organization, biogeochemical cycles, and factors influencing ecosystem stability and functioning.	
	CLO ₃	Evaluate community organization, ecological interactions, vegetation analysis, and ecological succession in relation to ecosystem development and conservation.	
	CLO ₄	Apply ecological field and laboratory techniques to assess populations, communities, ecosystems, and environmental parameters through sampling, data analysis, interpretation, and scientific report preparation.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the			

external examiner, with consideration given to the Course Learning Outcomes.

	Topics	CLO/s Attempt	Contact Hours
Unit-I	Definition, scope and basic principles of ecology and environment. Biological levels of organization. Climatic, edaphic and topographical factors; habitat and ecological niche. Laws of limiting factors, Liebig's Law of the Minimum and Shelford's Law of Tolerance. Population ecology: basic concepts, population characteristics (density, natality, mortality, age structure and population growth), ecological niche and habitat, and positive and negative population interactions including competition, predation, parasitism and mutualism.	CLO1	15
Unit-II	The ecosystem concept, structure and functions of ecosystems. Trophic levels, food chains and food webs. Ecological pyramids. Energy flow in ecosystems and ecological efficiencies. Biogeochemical cycles. Ecosystem stability, resistance and resilience. Ecotypes, ecads and ecoclines.	CLO2	15
Unit-III	Community structure and organization, keystone species, ecotone and edge effect. Methods of plant community analysis. Ecological succession: concept, types, trends in succession, climax and ecosystem stability.	CLO3	15
Practical	1. To study different method of plant community analysis 2. To determine minimum size of quadrat to study herbaceous vegetation. 3. To determine minimum number of quadrats to study herbaceous vegetation. 4. To study different components of an ecosystem 5. To prepare a checklist of invasive species	CLO4	30

Total Contact Hours

75

Evaluation Methods

Internal Assessment:30	TH-25	PR-5	End Term Examination: 70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10

Part C-Learning Resources

Recommended Books/e-resources/LMS:

- Odum, E. P. (1983). *Basic Ecology*. Sanders, Philadelphia.
- Odum, E. P. (1971). *Fundamentals of Ecology*. W. B. Saunders.
- Robert, R. (2001). *The Ecology of Nature*. Fifth Edition. W. H. Freeman and Company.
- Smith, R. L. (1996). *Ecology and Field Biology*. Harper Collins, New York.
- Botkin, D. B. & Keller, E. A. (2000). *Environmental Science: Earth as a living planet*. Third

Edition. John Wiley and Sons Inc.

- Singh, J. S., Singh, S. P. & Gupta, S. R. (2006). *Ecology, Environment and Resource Conservation*. Anamaya Publications.

**Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs)
& Program Specific Outcomes (PSOs)**

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PSO1	PSO2
CLO1	3	3	2	2			3					3	2
CLO2	2	3	3	3	2		3	2	1			3	3
CLO3	2	3	3	3	3	2	3	2	2	1		3	3
CLO4	2	3	3	3	3	2	3	3	2	2	1	3	3

Content Mapping with NEP thrust areas

Field	Hours Devoted
Employability	7
Entrepreneurship	3
Skill Enhancement	17
Communication Development	4
Indian Knowledge System	3
Environmental Awareness / SDGs	19
Current Issues & Social Awareness	9
Gender Issues	2
Public Policies	7
Any Other (Field ecology/Practicals)	4

Part A – Introduction			
Name of the Programme	B.Sc. Environmental Science		
Semester	SEMESTER-2		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	TECHNIQUES OF ENVIRONMENTAL ANALYSIS		
Course Code	26L4.5-EVS-202		
Course Type	DSEC-1		
Course Level	200-299		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Explain the principles, methodologies, and significance of physical, chemical, biological, and microbiological analyses used for the assessment of soil quality and soil health.	
	CLO ₂	Analyze the physicochemical and microbiological characteristics of water using standard analytical methods, and evaluate water quality for environmental monitoring and management.	
	CLO ₃	Evaluate the principles, methods, and instrumentation used for ambient air quality and environmental noise monitoring, and interpret analytical data with reference to environmental quality standards.	
	CLO ₄	Apply standard laboratory and field techniques to collect, analyze, interpret, and report soil, water, air, and noise quality data using appropriate analytical instruments, quality control procedures, and environmental monitoring protocols.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with			

consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.

Instructions for Practical Examiner

Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.

	Topics	CLO/s Attempt	Contact Hours
Unit-I	Analysis of physical properties of soil: soil texture by particle size distribution (hydrometer method), soil pH, bulk density, porosity, temperature, colour and resistivity. Analysis of soil organic matter by wet dichromate acid oxidation (Walkley–Black method). Analysis of soil nutrients: nitrogen (Kjeldahl method), phosphorus (molybdate-blue method) and potassium (spectroscopic method). Soil microbial activity analysis: enumeration and isolation of soil microorganisms by plate count and Most Probable Number (MPN) techniques. Measurement of soil enzyme activity using spectrophotometric and titrimetric methods.	CLO1	15
Unit-II	Physicochemical analysis of water samples: dissolved oxygen (DO meter/Winkler modified method), biochemical oxygen demand (BOD), chemical oxygen demand (COD), electrical conductivity, pH, carbonate and bicarbonate (titrimetric method), turbidity, sodium and potassium (flame photometry), calcium and magnesium (EDTA titration), chloride (argentometric titration), fluoride (ion meter/colorimetry), phosphate, nitrogen, nitrate and nitrite (colorimetric methods). Microbiological analysis of water using membrane filtration, MPN and presence–absence tests.	CLO2	15
Unit-III	Analysis of ambient air quality parameters: sulphur dioxide (West and Gaeke method), nitrogen dioxide (Jacob and Hochheiser modified method), particulate matter (PM _{2.5} and PM ₁₀ by gravimetric and TEOM methods), ammonia (chemiluminescence), and heavy metals (As, Ni and Pb by AAS/ICP methods). Noise monitoring using sound level meter, ambient noise monitoring system and monitoring stations; analysis and interpretation of daily, monthly and annual ambient noise data.	CLO3	15

Practical	1. Investigate the physical properties of the givens oil sample. 2. Investigate the DO and BOD of the given water sample for drinking purpose. 3. Investigate the particulate matter (PM 2.5 and PM10) in ambient air on monthly basis using a case study data.	CLO 4	30		
	4. Investigate the ambient noise monitoring on monthly basis using a case study data. 5. To enumeration the soil microbes from a givens oil sample using plate count method.				
Total Contact Hours			75		
Evaluation Methods					
Internal Assessment:30	TH-25	PR-5	End Term Examination: 70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10
Part C-Learning Resources					
Recommended Books/e-resources/LMS:					
- Chaudhery, M. H. and Rustem, K. (2019). <i>Modern Environmental Analysis Techniques for Pollutants</i>. Elsevier. - Patnaik, P. (2017). <i>Handbook of Environmental Analysis</i>. CRC Press. - Gupta, P. K. (2000). <i>Methods in Environmental Analysis: Water Soil and Air</i>. Agrobios (India) Publications.					

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs) & Program Specific Outcomes (PSOs)

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PSO1	PSO2
CLO1	2	3	3	3	3	2	3	2				3	3
CLO2	2	3	3	3	3	2	3	2	1			3	3
CLO3	2	3	3	3	3	2	3	2	2	1		3	3
CLO4	2	3	3	3	3	3	3	3	2	2	1	3	3

Content Mapping with NEP thrust areas

Field	Hours Devoted
Employability	14
Entrepreneurship	3
Skill Enhancement	23
Communication Development	4
Indian Knowledge System	2
Environmental Awareness / SDGs	12
Current Issues & Social Awareness	5
Gender Issues	1
Public Policies	7
Any Other (Laboratory/QA-QC/Projects)	4

Part A – Introduction			
Name of the Programme	B.Sc. Environmental Science		
Semester	SEMESTER-2		
Nature of Course/Course Composition	Theory & Practical		
Name of the Course	Climate Change		
Course Code	26L4.5-EVS-203		
Course Level	100-199		
Course Type	CC-M2		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Analyze the scientific basis of weather, climate, global warming and climate change, evaluate their environmental and ecological impacts, and assess mitigation strategies and international frameworks for climate change management.	
	CLO ₂	Apply climate-related data analysis, interpretation of meteorological parameters, carbon footprint estimation, greenhouse gas assessment, and case study-based evaluation to understand climate change and its mitigation.	
	Theory	Practical	Total
Credits	1	1	2
Teaching hours per week	1	2	3
Internal Assessment Marks	05	05	10
End Term Exam Marks	20	20	40
Max. Marks	25	25	50
Examination Duration (in Hours)	02	02	
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 4 questions from unit 01 with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 6 short answer type questions carrying one mark each (total 06 marks). The remaining questions will be carrying 07 marks each. Examinees will be required to attempt three questions: the compulsory question no. 1 and 02 questions from other 03 questions.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.			
Topics		CLO Attempt	Contact Hours
Unit-I	Introduction to weather and climate; origin, composition, structure and properties of the atmosphere; solar radiation and Earth's energy balance. Global atmospheric temperature, greenhouse gases (sources and emission trends), role of aerosols, ozone and trace gases;	CLO1	15

	global warming, climate change and climate variability in geological history; natural and anthropogenic drivers of climate change. Impacts of climate change including extreme weather events, sea level rise, coral bleaching, melting of snow, ice and glaciers, and extinction risks of temperature-sensitive species. Climate change mitigation strategies including biological and geological carbon sequestration, role of forests in carbon sequestration, and international initiatives such as the Kyoto Protocol and the Intergovernmental Panel on Climate Change (IPCC).				
Practical	1. To plot the decade wise trend of atmospheric CO₂ 2. To draw a well label diagram of different types of radiations. 3. To plot melting trends of Gango triglacier 4. To measure temperatures to learn about the greenhouse effect. 5. To demonstrate how melting ice affects sea levels.	CLO2	30		
Total Contact Hours			45		
Suggested Evaluation Methods					
Internal Assessment:10	TH-05	PR-05	End Term Examination: 40	TH-20	PR-20
Class Participation	5	0	Lab record	NA	5
Seminar/presentation/assignment/quiz/class test etc.	0	NA	Viva-Voce	NA	5
Seminar/Demonstration/Viva-voce/Lab records etc.	NA	5	Written Examination	20	NA
Mid-Term Exam	NA	NA	Write-up and execution of the practical	NA	10
Part C-Learning Resources					
Recommended Books/Journals/ e-resources/ Learning Management Systems (LMS):					
• Singh, J.S., Singh, S.P. and Gupta, S.R. (2015). <i>Ecology, Environment and Resource Conservation</i>, S. Chand Publishing, New Delhi. • Miller Jr., G. T. (1997). <i>Environmental Science: Working With the Earth</i>. Wadsworth Publishing Company, Belmont, California • Botkin, D. B. and E. A. Keller (2004). <i>Environment Science: Earth as a Living Planet</i>, John Wiley & Sons Inc., New York. • Philander, S. G. (ed.) (2008). <i>Encyclopedia of global warming and climate change</i>. 2ndedition, SAGE Publications, Inc., California. • Steffen, W., A. Sanderson, P. D. Tyson, J. Jager, P. M. Matson, B. Moore, III, F. Oldfield, K. Richardson, • H. J. Schnellhuber, B. L. Turner, II, and R. J. Wasson. (2004). <i>Global change and the Earth system: a Planet under Pressure</i>. Springer-Verlag, New York, New York, USA					

**Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs)
& Program Specific Outcomes (PSOs)**

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PSO1	PSO2
CLO1	3	3	2	2		1	3	1	1	1	1	3	2
CLO2	2	3	3	3	2	1	3	2	2	1	1	3	2

Content Mapping with NEP thrust areas

Field	Hours Devoted
Employability	4
Entrepreneurship	2
Skill Enhancement	8
Communication Development	2
Indian Knowledge System	2
Environmental Awareness / SDGs	13
Current Issues & Social Awareness	6
Gender Issues	1
Public Policies	5
Any Other (Climate data analysis, Practicals, Case studies)	2

Session:2026-27			
Part A–Introduction			
Name of the Programme	Environmental Sciences		
Semester	SEMESTER-3		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	Introduction to Biodiversity		
Course Code	26 L5.0-EVS-301		
CourseType	CC/MCC		
Course Level	200-299		
Pre-requisite for the course(if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Explain the concepts, origin, levels, patterns and significance of biodiversity, including species diversity, genetic diversity and ecosystem diversity.	
	CLO ₂	Analyze global, national and regional patterns of biodiversity, biodiversity hotspots, and the status of biodiversity in India, including mangroves, wetlands and coral reef ecosystems.	
	CLO ₃	Evaluate the ecological, economic and social values of biodiversity, identify threats leading to biodiversity loss, and interpret IUCN threat categories and Red Data Books.	
	CLO ₄	Demonstrate knowledge of biodiversity conservation strategies, including <i>in-situ</i> and <i>ex-situ</i> conservation, and apply field and laboratory techniques for biodiversity assessment and vegetation analysis.	
	Theory	Practical	Total
Credits	3	1	4
Teachinghoursperweek	3	2	5
InternalAssessmentMarks	25	05	30
EndTermExamMarks	50	20	70
Max.Marks	75	25	100
Examination Duration (in Hours)	3	2	05
PartB-ContentsoftheCourse			
<u>Instructionsfor TheoryPaper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructionsfor Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.			
	Topics	CLO/s Attempt	Contact Hours
Unit-I	Definition, History and importance of Biodiversity; Concept	1	15

	of species and speciation ; Genetic variations, natural selection, genetic drift and gene flow; Biodiversity, magnitude, global accumulation; levels of biodiversity- species, genetic and Ecosystem diversity; species diversity indices.		
Unit-II	Biodiversity gradient–latitudinal and altitudinal; Biodiversity at global, national and local levels; Concept of hotspot of biodiversity; Criteria for determining hot spots; India as a Mega Diversity Nation. Indian hotspots diversity: Indo-Burma (Eastern Himalaya), Western Ghats, Sri Lanka and Sunda land; Biodiversity of mangroves, wetlands and coral reefs–A General account	2	15
Unit-III	Value of Biodiversity-Intrinsic, consumptive, productive use, social, ethical, aesthetic and option values. Biodiversity uses and ecosystem services. Threats to biodiversity- habitat loss, habitat fragmentation, exotic species and environmental pollution; species extinction. Concept of IUCN threat categories; Concept of Red data book; Endangered and threatened species of India. Approaches for Conservation of Biological diversity. In-situ and ex- situ conservation.	3	15
Practical	1. Determination of requisite size of quadrant for vegetation analysis. 2. Analysis of frequency distribution of plants in a grassland ecosystem by quadrant method 3. To determine basal cover of a tree in a forest ecosystem. 4. Field Survey in your campus for studying plant Species diversity. 5. Preparation of field report based on visit of a wild life sanctuary/zoo/national park/ biosphere reserve. 6. Determination of alpha, beta and gamma biodiversity with help of given data. 7. Any other relevant experiment.	4	30

Total Contact Hours	75
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Evaluation Methods

Internal Assessment: 30	TH-25	PR-5	End Term Examination: 70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/ assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10

Part C-Learning Resources

Suggested Readings:

1. Chandel, K.P.S., Shukla, G. and Sharma, N. (1996). Biodiversity in Medicinal and Aromatic Plants in India Conservation and Utilization, National Bureau of Plant Genetic Resources, New Delhi.
2. Heywood, V. (ed.) (1995). Global Biodiversity Assessment. United Nations Environment Programme, Cambridge University Press, Cambridge, U.K.
3. Gabriel M. (2000) Biodiversity and conservation Oxford and IBH publishing company Pvt. Ltd. New Delhi.
4. Krishna moorthy, K. V (2004) An Advanced textbook on Biodiversity-principles and Practice;

Oxford and IBH publishing company Pvt. Ltd. New Delhi.

5. Maiti, P. K. and Maiti, P. (2023). Biodiversity: perception, peril and preservation. PHI Learning Pvt. Ltd.
6. Huston, M. A. (1994). Biological Diversity: The Coexistence of Species on Changing Landscapes. Cambridge University Press, Cambridge.
7. Singh, J. S., Singh, S. P. and Gupta, S. R. (2015). Ecology, Environment and Resource Conservation, S. Chand Publishing, New Delhi.
8. Soule, M. E.(ed.) (1986): Conservation Biology. The Science of Scarcity and Diversity. Sinauer Associates, Inc., Sunderland, Massachusetts.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs) & Program Specific Outcomes (PSOs)

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PSO1	PSO2	PSO3
CLO1	3	3	2	–	–	–	1	–	3	2	1
CLO2	3	3	2	2	–	–	2	–	3	2	2
CLO3	3	2	3	2	2	1	3	2	3	3	2
CLO4	2	3	3	3	2	2	2	2	2	3	3

Content Mapping with NEP thrust areas

Field	Hours Devoted
Employability	8
Entrepreneurship	3
Skill Enhancement	15
Communication Development	4
Indian Knowledge System	4
Environmental Awareness/SDGs	15
Current Issues and Social Awareness	7
Gender issues	2
Public policies	5
Any Other	12
Total	75

Session:2026-27			
Part A-Introduction			
Name of the Programme	Environmental Sciences		
Semester	SEMESTER-3		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	Disaster Management		
Course Code	26 L5.0-EVS-302		
Course Type	MCC		
Course Level	200-299		
Pre-requisite for the course(if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Explain the concepts of disasters, hazards, vulnerability, risk assessment, and disaster profiles with reference to natural and anthropogenic disasters.	
	CLO ₂	Analyze the causes, characteristics, impacts, and management strategies of major natural disasters and anthropogenic disasters	
	CLO ₃	Evaluate the role of national agencies such as NDMA.	
	CLO ₄	Develop disaster management plans, conduct disaster risk assessments, prepare reports, and apply disaster preparedness and response measures through practical exercises.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	05
Part B-Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.			
	Topics	CLO/s Attempt	Contact Hours
Unit-I	Introduction to disaster: Definition, difference between hazard and disaster, understanding natural and man-made disasters, risk and vulnerability in disaster, reasons of disaster-population growth, urban expansion, pollution, Epidemics, accidents. Disaster profile of India.	1	15

Unit-II	Natural disaster (causes, types and impacts): Earthquake, Floods, landslides, drought, Cyclone and hurricanes, tsunamis Anthropogenic disaster (Types, causes and effects) - Technological hazards, Chemical disasters, biological disasters, Radiological disaster, Nuclear disasters, Sociological hazards-Crime, Terrorism, War.	2	15		
Unit-III	Disaster Preparedness and mitigation: Definition, Disaster management cycle of earthquake, floods, drought, landslides and cyclone: prevention, preparation and mitigation, Disaster Information, Disaster Response: Disaster Rehabilitation, Reconstruction and Recovery. Role of National Disaster Management Authority (NDMA).	3	15		
Practical	1. Preparation of disaster management plan for earthquake and report submission. 2. Preparation of disaster management plan for flood and report submission. 3. Study on national and international disasters in recent year. 4. Report submission on Dos and Do not at individual or House hold levels, during and after a disaster earthquake. 5. Report submission on Dos and Do not at individual or House hold levels, during and after a disaster flood. 6. Any other relevant experiment.	4	30		
Total Contact Hours			75		
Evaluation Methods					
InternalAssessment:30	TH-25	PR-5	EndTermExamination:70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10
Part C-Learning Resources					
Suggested Readings:					
1. Singh V., AleyaL.,SinghM.,and SinghK.K.(2010).Natural Disaster, APH Publishing Corporation New Delhi.					
2. Sahni P., Dhamija, A. and Medury, U.(2011).Disaster Mitigation: Experiences and Reflections PHI; New title edition.					
3. Pandey, M.(2014).Disaster Management, Wiley India Pvt. Ltd.					
4. Rajan C. K. and Pandharinath N. (2009) Earth and Atmospheric Disaster Management: Nature and Manmade S Publication, Hyderabad.					
5. Sharma S.C.(2021).DisasterManagement,KhannaPublishingHouse,2021.					
6. MurthyD.B.N.(2019).DisasterManagement.DeepandDeepPublicationPvt.Ltd. New Delhi.					

**Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs)
& Program Specific Outcomes (PSOs)**

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PSO1	PSO2	PSO3
CLO1	3	3	2	–	–	–	1	–	3	2	1
CLO2	3	3	3	2	–	–	2	1	3	2	2
CLO3	3	2	3	3	2	2	3	2	3	3	2
CLO4	2	3	3	3	3	2	2	3	2	3	3

Content Mapping with NEP Thrust Areas (75 Hours)

Field	Hours Devoted
Employability	8
Entrepreneurship	2
Skill Enhancement	16
Communication Development	5
Indian Knowledge System	3
Environmental Awareness/SDGs	12
Current Issues and Social Awareness	10
Gender Issues	2
Public Policies	7
Any Other (Field-based Learning/Experiential Learning)	10
Total	75

Session:2026-27			
Part A-Introduction			
Name of the Programme	Environmental Sciences		
Semester	SEMESTER-3		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	Natural Resources		
Course Code	26 L4.5-EVS-102		
Course Type	MCC		
Course Level	100-199		
Pre-requisite for the course(if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Explain the concepts, classification, availability, utilization, and sustainable management of natural resources and their interaction with human society.	
	CLO ₂	Analyze land, soil, food, forest and agricultural resources, including land-use changes, food security, and the environmental impacts of modern agricultural practices.	
	CLO ₃	Evaluate the distribution, utilization, and conservation of water, energy, and mineral resources in India and globally from the perspective of sustainable development.	
	CLO ₄	Apply practical skills in the identification, mapping, analysis, and interpretation of natural resources using field and laboratory techniques.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	05
Part B-Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.			
	Topics	CLO/s Attempt	Contact Hours
Unit-I	Natural Resources: definition, resource availability and factors affecting their availability; major types of natural resources, renewable and non-renewable resources; economic categories of resources, interaction of human with natural resources.	1	15
Unit-II	Land as a resource, types of lands, importance, ecological	2	15

	significance and economic importance of soil, effect of land-use changes. Forest resources: forest types, primary and secondary products, utilization and economic importance, forest and tribal people, forest resources of India. Food resources, green revolution, effects of modern agriculture, world food problems, food security.				
Unit-III	Water resources – status, availability, demand, utilization sectors- domestic, industrial, agriculture, hydrological cycle, global water resources, surface and ground water, interlinking of rivers, water resources in India and their importance. Energy resources: types, renewable (solar, wind, hydro and biomass)and non-renewable(coal, petroleum and natural gas) Mineral resources: types, availability, distribution, global Consumption patterns.	3	15		
Practical	1. To identify and study some important minerals. 2. To study and map different soil types in India. 3. To study and map different forest in India. 4. To study and map different water resources in India. 5. To plot energy consumption scenario in pi-diagram in Indian context. 6. Any other relevant experiment.	4	30		
Total Contact Hours			75		
Evaluation Methods					
InternalAssessment:30	TH-25	PR-5	EndTermExamination:70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10
Part C-Learning Resources					
Suggested Readings:					
1. Basu, M., Xavier, S.(2016).Fundamentals of Environmental Studies, Cambridge University Press, India.					
2. Singh, J.S., Singh, S.P. and Gupta, S.R.(2015).Ecology, Environment and Resource Conservation, S. Chand Publishing, New Delhi.					
3. Owen, O. S. & Chiras, D. D. (1990). Natural resource conservation: an ecological approach (No. Ed.5). Macmillan Publishing Company.					
4. Holechek, J. L., Cole, R. A., Fisher, J. T.& Valdez, R. (2000). Natural resources: ecology economics, and policy (No. HC85. N37 2003.). Upper Saddle River, NJ: Prentice Hall.					
5. Owen,O.S.&Chiras,D.D.(1995).Naturalresourceconservation:managementfora sustainable future (No. Ed. 6). Prentice-Hall International, Inc.					
6. Craig,J.R., Vaughan, D. J.& Skinner.B.J.1996. Resources of the Earth: Origin, use, and environmental impact (2nd edition). Prentice Hall, New Jersey.					
7. Klee, G.A. 1991.ConservationofNaturalResources.PrenticeHallPublication.					
8. Miller, T.G. 2012.EnvironmentalScience.WadsworthPublishingCo.					
9. Ramakrishna, P. S., A. N. Purohit, K. G. Saxena, K. S. Rao & R. K. Maikhuri (1996)					

10. Conservation and management of biological resources in Himalaya, Oxford & IBH Publishing, New Delhi.

Mapping of Course Learning Outcomes (CLOs) to Programme Learning Outcomes (PLOs) & Programme Specific Outcomes (PSOs)

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PSO1	PSO2	PSO3
CLO1	3	3	2	–	–	–	2	–	3	2	1
CLO2	3	3	3	2	2	–	2	1	3	3	2
CLO3	3	3	3	3	2	2	3	2	3	3	3
CLO4	2	3	3	3	3	2	2	3	2	3	3

Content Mapping with NEP Thrust Areas (75 Hours)

Field	Hours Devoted
Employability	8
Entrepreneurship	4
Skill Enhancement	14
Communication Development	4
Indian Knowledge System	4
Environmental Awareness/SDGs	16
Current Issues and Social Awareness	7
Gender Issues	2
Public Policies	6
Any Other (Field-based Learning/Experiential Learning)	10
Total	75

Session:2026-27			
Part A-Introduction			
Name of the Programme	Environmental Sciences		
Semester	SEMESTER-4		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	Environmental Pollution and Management		
Course Code	26 L5.0-EVS-401		
Course Type	CC/MCC		
Course Level	200-299		
Pre-requisite for the course(if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Explain the sources, classification, characteristics, impacts, standards, and control measures of air, water, soil, noise, and radioactive pollution.	
	CLO ₂	Analyze pollution monitoring techniques, water and air quality parameters, environmental standards, and the effects of pollutants on ecosystems and human health.	
	CLO ₃	Evaluate conventional and advanced pollution control technologies, biological treatment processes, wastewater treatment systems, and environmental management strategies.	
	CLO ₄	Apply practical skills in pollution monitoring, wastewater analysis, treatment plant studies, environmental quality assessment, and interpretation of pollution control case studies.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	05
Part B-Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.			
	Topics	CLO/s	Contact Attempt Hours
Unit-I	Air Pollution: Sources, classification (primary and secondary)	1	15

	and properties of air pollutants, indoor air pollution, effects of air pollution on human health, Air Quality index, Air quality standards, Remedial measures to control Air pollution -Air scrubbers, Electrostatic Precipitators, Bag house filters, Impingers, Case study: implementation of CNG., Noise pollution: sources frequency, intensity and permissible ambient noise levels; impacts on living organisms and humans, measures to control noise pollution.				
Unit-II	Water Pollution: Sources, consequences of water pollution by Agriculture , Pesticides, and Sanitation, water quality parameters and standards. Remedial measures to control water pollution. Marine pollution- sources and effects, Thermal pollution and its effects. Soil Pollution: Sources, consequences of soil pollution and control measures, Radioactive material and sources of Radioactive pollution; effect of radiation on human health.	2	15		
Unit-III	Air sparging, Land farming, Phyto-remediation, bioremediation; Biological mediated pollution control. Activated Sludge Process (ASP), Trickling Filters, oxidation ponds, membrane bioreactor, ETP sludge management; up flow anaerobic sludge blanket reactor, hybrid reactors, bio scrubbers, bio trickling filters; regulatory framework for pollution monitoring and control, Coastal area management; existing challenges and management techniques. Case study: Ganga Action Plan; Yamuna Action Plan.	3	15		
Practical	1. Identification and listing of different types of air, water and soil pollutants in the locality. 2. Enlist the measures to control noise pollution in homes and industries. 3. Study the functioning of water treatment or sewage treatment plant-Case study. 4. To study about the pH, EC and salinity of wastewater and contaminated soil 5. To study about the BOD and COD of the waste water. 6. Any other relevant experiment.	4	30		
Total Contact Hours			75		
Evaluation Methods					
InternalAssessment:30	TH-25	PR-5	EndTermExamination:70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10
Part C-Learning Resources					
Suggested Readings:					
1. Gurjar,B.R.,Molina,L.T.&OjhaC.S.P.(2010).AirPollution:HealthandEnvironmental Impacts. CRC Press Taylor & Francis. 2. Park, K. (2015). Park’s Textbook of Preventive and Social Medicine (23rd edition). Banarsidas Bhano Publishers. 3. Gupta, P.K.(2000).Methods in Environmental Analysis: Water Soil and Air. Agrobios (India) Publications. 4. Purohit, S.S. & Ranjan, R. (2007). Ecology, Environment &Pollution. Agrobios Publications.					

5. Singh, J.S., Singh, S.P.& Gupta, S.R.(2015).Ecology, Environment and Resource Conservation, S. Chand Publishing, New Delhi.

Mapping of Course Learning Outcomes (CLOs) to Programme Learning Outcomes (PLOs) & Programme Specific Outcomes (PSOs)

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PSO1	PSO2	PSO3
CLO1	3	3	2	–	–	–	2	1	3	2	1
CLO2	3	3	3	2	2	1	2	2	3	3	2
CLO3	3	3	3	3	3	2	3	2	3	3	3
CLO4	2	3	3	3	3	2	2	3	2	3	3

Content Mapping with NEP Thrust Areas (75 Hours)

Field	Hours Devoted
Employability	9
Entrepreneurship	4
Skill Enhancement	15
Communication Development	4
Indian Knowledge System	3
Environmental Awareness/SDGs	15
Current Issues and Social Awareness	7
Gender Issues	2
Public Policies	6
Any Other (Industrial Visit/Field-based Learning/Case Studies)	10
Total	75

Session:2026-27			
Part A-Introduction			
Name of the Programme	Environmental Sciences		
Semester	SEMESTER-4		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	Land Degradation and Management		
Course Code	26 L5.0-EVS-402		
Course Type	MCC		
Course Level	200-299		
Pre-requisite for the course(if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Explain the fundamentals of soil science, soil properties, soil biodiversity, nutrient dynamics, and the role of soil as a natural resource.	
	CLO ₂	Analyze the causes, processes, and types of land degradation, including soil erosion, desertification, salinization, mining, and unsustainable land-use practices , and implementation of soil conservation and land restoration measures.	
	CLO ₃	Evaluate the indicators, ecological impacts, and socio-economic consequences of land degradation and recommend sustainable land management strategies.	
	CLO ₄	Apply practical techniques for soil analysis, assessment of degraded lands	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	05
Part B-Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.			
	Topics	CLO/s Attempt	Contact Hours
Unit-I	Basics of soil science: Soil as a resource; soil formation; soil profile; classification of soil; Properties of soil: soil texture, alkalinity and acidity, soil moisture, soil salinity, soil temperature, water holding potential; soil organic matter; nutrients in soil; decomposition and mulching, soil Biodiversity.	1	15

Unit-II	Land degradation: Definition; Causes of land degradation- deforestation; fertilizers and pesticides; unsustainable agricultural practices; urban expansion; overgrazing; salinization; soil acidification; water logging; nutrient depletion; soil pollution; mining; soil erosion; desertification. Land degradation Management: Integrated soil fertility management; sustainable land use management; Irrigation system management; maintenance of soil productive capacity; reclamation of mining affected areas; waste management; afforestation; reclamation of chemically degraded soil;	2	15
Unit-III	Indicators and Impacts of land degradation: Indicators of degraded land: development of rills, gullies, pedestals and armour Layer, tree root exposure and tree mound; Impacts on agriculture; impacts on biodiversity; reduction in productivity; loss of ecosystem services; impacts on nutrient cycles; impacts on environment. community- based education and awareness.	3	15
Practical	1. Determination of physical properties (pH, EC etc.)of soil 2. Analysis of texture (pore size)of soil 3. Measurement of water holding capacity in soil 4. Case study of a degraded land 5. Identification of different grasses used for soil conservation. 6. Any other relevant experiment.	4	30

Total Contact Hours

75

Evaluation Methods

InternalAssessment:30	TH-25	PR-5	EndTermExamination:70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10

Part C-Learning Resources

Suggested Readings:

1. Brady, N. C., Weil, R. R. and Weil, R. R. 2008. The nature and properties of soils(Vol.13). Upper Saddle River, NJ: Prentice Hall.
2. Bhattacharyya, R., Ghosh, B. N., Mishra, P. K., Mandal, B., Rao, C. S., Sarkar, D., Das, K., Anil, K. S., Lalitha, M., Hati, K. M. and Franzluebbbers, A. J. 2015. Soil degradation in India: Challenges and potential solutions. Sustainability, 7(4), pp.3528-3570.
3. Gadgil, M. 1993. Biodiversity and India's degraded lands. Ambio 22:167-172.
4. Johnson, D.L. 2006. Land Degradation (2nd edition). Rowman & Little field Publishers.
5. Marsh, W. M. & Dozier, J. 1983. Landscape Planning: Environmental Applications. John Wiley and Sons.
6. Oldeman, L. R. 1994. The global extent of soil degradation. Soil resilience and sustainable land use, 9. (http://library.wur.nl/isric/fulltext/isricu_i26803_001.pdf).
7. Mishra, P.K., Rai, A., Abdelrahman, K., Rai, S.C. and Tiwari, A. 2022. Land degradation, over land flow, soil erosion, and nutrient loss in the Eastern Himalayas, India. Land, 11(2), p.179.
8. Peterson, G. D., Cumming, G. S. & Carpenter, S. R. 2003. Scenario planning: a tool for conservation in an uncertain world. Conservation Biology 17: 358-366.
9. Scherr, S.J. 1999. Soil degradation: A threat to developing-country food security by 2020? Vol.27). International Food Policy Research Institute.

Mapping of Course Learning Outcomes (CLOs) to Programme Learning Outcomes (PLOs) & Programme Specific Outcomes (PSOs)

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PSO1	PSO2	PSO3
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CLO1	3	3	2	—	—	—	2	—	3	2	1
CLO2	3	3	3	2	2	1	2	1	3	3	2
CLO3	3	3	3	3	2	2	3	2	3	3	3
CLO4	2	3	3	3	3	2	2	3	2	3	3

Content Mapping with NEP Thrust Areas (75 Hours)

Field	Hours Devoted
Employability	8
Entrepreneurship	3
Skill Enhancement	16
Communication Development	4
Indian Knowledge System	4
Environmental Awareness/SDGs	15
Current Issues and Social Awareness	7
Gender Issues	2
Public Policies	6
Any Other (Field-based Learning/Case Studies/Experiential Learning)	10
Total	75

Session:2026-27			
Part A-Introduction			
Name of the Programme	Environmental Sciences		
Semester	SEMESTER-4		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	Environmental Chemistry		
Course Code	26 L5.0-EVS-403		
Course Type	MCC		
Course Level	200-299		
Pre-requisite for the course(if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Explain the fundamental principles of aquatic, atmospheric, and soil chemistry and their significance and impacts of toxic metals	
	CLO ₂	Analyze the chemical processes governing water quality, atmospheric pollution in the environment.	
	CLO ₃	Analyze the chemical processes governing soil chemistry, and nutrient cycling in the environment.	
	CLO ₄	Apply analytical techniques for the assessment of environmental parameters and interpret environmental chemistry data related to water, soil, and atmospheric systems.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	05
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.			
	Topics	CLO/s Attempt	Contact Hours
Unit-I	Fundamentals of aquatic chemistry: acid-base, solubility, oxidation-reduction, and complexation reactions. Basic principles of sedimentation, coagulation, filtration and absorption. Gases in water. Fate of metals and organic chemicals in environment: Lead, mercury, arsenic, cadmium. Dioxins, PCBs. Sources of hydrocarbons. Persistent organic	1	15

	pollutants.				
Unit-II	The atmospheric chemistry: Composition of atmosphere; photochemical reactions in atmosphere; smog formation, types of smog (sulphur smog and photochemical smog), aerosols; chemistry of acid rain. Ozone layer depletion, role of CFCs in ozone depletion.	2	15		
Unit-III	Soil chemistry: Structure and Properties of Minerals, Types of minerals and rocks, Soil composition; relation between organic carbon and organic matter, inorganic and organic components in soil; soil humus; cation and anion exchange reactions in soil; nitrogen, phosphorus and potassium in soil.	3	15		
Practical	1. To analyze pH and EC in given water samples. 2. To analyze pH and EC in soil samples. 3. To measure soil temperature and moisture. 4. To study the relationship between population growth and CO ₂ concentration in atmosphere. 5. To study the relationship between CO ₂ concentration in atmosphere and mean earth temperature. 6. Any other relevant experiment.	4	30		
Total Contact Hours			75		
Evaluation Methods					
InternalAssessment:30	TH-25	PR-5	EndTermExamination:70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10
Part C-Learning Resources					
Suggested Readings:					
1. K. De(2019).EnvironmentalChemistry.NewAgeInternationalPublishers,Publisher					
2. Botkin, D. B. and Keller E. A (2004). Environment Science: Earth as a Living Plant. John Wiley & Sons Inc., New York.					
3. Manahan, S. E. (2000).Environmental Chemistry. Seventh Edition. Lewis Publishers, New York					
4. Mitsch, W. J. and Jorgensen, S. E. (eds.) (1989). Ecological Engineering: An Introduction to Eco technology. John Wiley and Sons, New York					
5. Pierzynski, G.M., Sims, J.T. and Vance, G.F.(2000). Soils and Environmental Quality. Second Edition. CRC press, New York.					

Mapping of Course Learning Outcomes (CLOs) to Programme Learning Outcomes (PLOs) & Programme Specific Outcomes (PSOs)

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PSO1	PSO2	PSO3
CLO1	3	3	2	—	—	—	2	—	3	2	1
CLO2	3	3	3	2	2	1	2	1	3	3	2
CLO3	3	3	3	3	2	2	3	2	3	3	3
CLO4	2	3	3	3	3	2	2	3	2	3	3

Content Mapping with NEP Thrust Areas (75 Hours)

Field	Hours Devoted
Employability	8
Entrepreneurship	3
Skill Enhancement	16

Communication Development	4
Indian Knowledge System	3
Environmental Awareness/SDGs	15
Current Issues and Social Awareness	8
Gender Issues	2
Public Policies	6
Any Other (Laboratory Work/Case Studies/Experiential Learning)	10
Total	75

Session:2026-27			
Part A-Introduction			
Name of the Programme	Environmental Sciences		
Semester	SEMESTER-4		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	Solid Waste Management		
Course Code	26 L5.0-EVS-404		
Course Type	DSE		
Course Level	200-299		
Pre-requisite for the course(if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Explain the concepts, classification, characteristics, sources, and environmental impacts of different types of solid waste.	
	CLO ₂	Analyze the methods of waste segregation, storage, collection, transportation, and processing, including the role of stakeholders in solid waste management.	
	CLO ₃	Evaluate integrated solid waste management practices, and national policies for sustainable waste management.	
	CLO ₄	Apply practical skills in waste characterization, segregation, waste auditing, field surveys, and assessment of waste management systems for sustainable environmental management.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	05
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.			
	Topics	CLO/s Attempt	Contact Hours
Unit-I	Introduction to solid waste: Definition; types of solid waste: Domestic Waste, commercial waste, industrial waste, agricultural waste, biomedical waste, E-waste, hazardous waste, institutional waste, construction and demolition waste.	1	15

	Classification of solid waste-hazardous and non-hazardous, Degradable and non-degradable.				
Unit-II	Processing of solid waste: Storage, Collection and Transportation of solid waste: waste segregation and storage, Collection methods of solid waste- tools and equipment, transportation of waste-types of vehicles, role of rag pickers And their utility for society. Disposal of Municipal solid waste: 5-Rs and their benefits: Refuse, Reduces, Reuse, Repurpose and Recycle; methods of waste disposal: composting, an aerobic digestion, incineration, pyrolysis, gasification and landfills	2	15		
Unit-III	Integrated waste management and Policies: Impact of solid waste on environment, human and plant health. Integrated waste management: concept and importance; waste management hierarchy; Solid Waste Management Rules 2016; SwachhBharatMission2014; Vocational aspects of waste management.	3	15		
Practical	1. Estimate the moisture content and specific weight of solid waste sample. 2. Collection, segregation and measurement of waste into biodegradable and non-biodegradable waste 3. Classification of household waste into different components. 4. Survey your locality and identify different methods of handling, separation and storage household solid waste. 5. Survey your locality and identify different methods of waste disposal. 6. Any other relevant experiment.	4	30		
Total Contact Hours			75		
Evaluation Methods					
InternalAssessment:30	TH-25	PR-5	EndTermExamination:70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10
Part C-Learning Resources					
Suggested Readings:					
1. Kumar, S.(2009).Solid Waste Management, Northern Book Centre, New Delhi.					
2. Ramchandra,T.V.(2009),ManagementofMunicipalSolidWaste,TERIPress,the Energy and Resource Institute, Lodhi Road New Delhi.					
3. SinghJ.andRamanathanA.L.(2010).SolidWasteManagement:PresentandFuture Challenges, International Publishing House Pvt. Ltd. New Delhi.					
4. MuthuramanL.andRamaswamyS.(2018).SolidWasteManagement,MJPPublishers, Chennai.					

Mapping of Course Learning Outcomes (CLOs) to Programme Learning Outcomes (PLOs) & Programme Specific Outcomes (PSOs)

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PSO1	PSO2	PSO3
CLO1	3	3	2	—	—	—	2	—	3	2	1
CLO2	3	3	3	2	2	1	2	1	3	3	2
CLO3	3	3	3	3	3	2	3	2	3	3	3

CLO4	2	3	3	3	3	2	2	3	2	3	3
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Content Mapping with NEP Thrust Areas (75 Hours)

Field	Hours Devoted
Employability	8
Entrepreneurship	5
Skill Enhancement	15
Communication Development	4
Indian Knowledge System	3
Environmental Awareness/SDGs	15
Current Issues and Social Awareness	7
Gender Issues	2
Public Policies	6
Any Other (Field Survey/Experiential Learning/Case Studies)	10
Total	75

Session:2026-27			
Part A-Introduction			
Name of the Programme	Environmental Sciences		
Semester	SEMESTER-4		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	Liquid Waste Management		
Course Code	26 L5.0-EVS-405		
Course Type	DSE		
Course Level	200-299		
Pre-requisite for the course(if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Explain the sources, characteristics, collection systems, and health impacts of liquid waste and wastewater and analyze wastewater collection, conveyance systems, wastewater characteristics,	
	CLO ₂	National standards for wastewater and industrial effluent discharge and conventional and advanced wastewater treatment technologies	
	CLO ₃	Evaluate sludge management practices, storm-water management, and wastewater management strategies in disaster situations.	
	CLO ₄	Apply laboratory and field techniques for wastewater quality assessment, treatment efficiency evaluation, and sustainable liquid waste management.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	05
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.			
	Topics	CLO/s	Contact Attempt Hours
Unit-I	Sources, types and quantities of liquid waste; health importance of liquid waste: diseases associated to excreta and	1	15

	their transmission; characteristics of wastewater and sewage. Wastewater collection: Septic tanks, Seepage pits, Cesspools. Conveyance of liquid wastes: small bore grey water drainage system, simplified sewer system conventional piped sewer system, and septage transport		
Unit-II	ISI tolerance limits for discharging treated waste water and treated sewage water and industrial effluents in to surface water, into public sewers and onto land for irrigation; Liquid waste treatment: Primary treatment: sedimentation, coagulation and flocculation, filtration; Secondary treatment: aerobic and anaerobic treatment; activated sludge process, rotating biological filters; Tertiary treatment: nitrification and de-nitrification processes, phosphorous removal.	2	15
Unit-III	Advanced wastewater treatment: ion exchange, electro-dialysis, reverse osmosis, and ultra filtration. Disinfection of water: different types of disinfectants. Sludge management: dewatering, sludge stabilization, and sludge drying beds. Storm water management. Excreta and wastewater Management in disaster situations. Gobar Dhan scheme.	3	15
Practical	1. To analyze the pH and EC of in let sewage water samples. 2. To analyze the pH and EC of outlet sewage water samples. 3. To analyze the BOD of in let sewage water samples. 4. To analyze the BOD of out let sewage water samples. 5. To calculate the efficiency of sewage treatment plant based on given data. 6. Any other relevant experiment.	4	30

Total Contact Hours

75

Evaluation Methods

InternalAssessment:30	TH-25	PR-5	EndTermExamination:70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10

Part C-Learning Resources

Suggested Readings:

1. Metcalf and Eddy. (1995). Wastewater Engineering Collection, Treatment, Disposal and Reuse. McGraw Hill Pub. Co.
2. Rao, M.N.& Dutta, A.K.(1982).Wastewater Treatment. 3rdEdition,I BH Publishers,
3. A.K.De.(2019).EnvironmentalChemistry.NewAgeInternationalPublishers,Publisher
4. Manahan, S.E.(2000).Environmental Chemistry. Seventh Edition. Lewis Publishers, New York..

Mapping of Course Learning Outcomes (CLOs) to Programme Learning Outcomes (PLOs) & Programme Specific Outcomes (PSOs)

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PSO1	PSO2	PSO3
CLO1	3	3	2	—	—	—	2	—	3	2	1
CLO2	3	3	3	2	2	1	2	1	3	3	2
CLO3	3	3	3	3	3	2	3	2	3	3	3
CLO4	2	3	3	3	3	2	2	3	2	3	3

Content Mapping with NEP Thrust Areas (75 Hours)

Field	Hours Devoted
Employability	9
Entrepreneurship	4
Skill Enhancement	15
Communication Development	4
Indian Knowledge System	3
Environmental Awareness/SDGs	15
Current Issues and Social Awareness	6
Gender Issues	2
Public Policies	7
Any Other (Laboratory Work/Field Visit/Experiential Learning)	10
Total	75

Part A – Introduction			
Name of the Programme	B.Sc. Environmental Sciences		
Semester	SEMESTER-5		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	Environmental Biotechnology		
Course Code	26L5.5-EVS-501		
Course Type	CC-5 MCC-9		
Course Level	300-399		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Understand the fundamental concepts of environmental biotechnology and explore its role in environment conservation	
	CLO ₂	Understand the production of transgenic plants and the bioethical considerations associated with them.	
	CLO ₃	To acquire knowledge about modern fuels and the role of microorganisms in the enrichment of ores and Apply the knowledge to real-world challenges in environment management.	
	CLO ₄	To have practical knowledge about the plant tissue culture and the working of different instruments.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.			
	Topics	CLO/s Attempt	Contact Hours
Unit-I	Fundamentals of Environmental Biotechnology: Scope and importance, modalities and local influences; Integrated approach in environmental biotechnology. Transgenic plants: Production, Micropropagation; Types of GM Plants and their	1	15

	products, Biopharming, Safety of transgenic crops; Bioethics: Definition and importance of ethics in biology.				
Unit-II	Biotechnology & modern fuels, their environmental impact. Bioremediation-in situ and ex-situ methods. Role of microorganisms in ore-enrichment.	2	15		
Unit-III	Biotechnology in Waste Management: Phytoremediation. Treatment of municipal waste and Industrial effluents: Biological processes, Activated Sludge Process; Bio-fertilizers.	3	15		
Practical	Practical's 1. To study about the principles and applications of instruments used in Environmental laboratory. 2. To study about the steps of micro- propagation. 3. Qualitative estimation of Carbohydrates and Proteins in the given sample. 4. Qualitative estimation of Amino acids and Fats and oils in the given sample. Hands-on training on spectrophotometer.	4	30		
Total Contact Hours			75		
Evaluation Methods					
Internal Assessment:30	TH-25	PR-5	End Term Examination: 70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10
Part C-Learning Resources					
Recommended Books/Journals/ e-resources/ Learning Management Systems (LMS):					
1. Environmental Biotechnology (2007) Bimal Bhattachraya and Ritu Banerjee, Oxford university press					
2. Environmental Biotechnology Concept and application (2004) 1st edition, edited by Hans-Joachim Jördening and Josef Winter. Wiley VCH Verlag GmbH & Co. KGaA.					
3. Handbook of Methods in Environmental Studies: Vol 1: Water and Wastewater Analysis(2001) S. K. Maiti. ABD Publishers.					
4. Environmental Biotechnology (2013) Pradipta Kumar Mohapatra I.K. International Publishing House Pvt Limited					

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs) & Program Specific Outcomes (PSOs)

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PSO1	PSO2
CLO1	3	2	1	2	2	2	3	2	2	1	2	3	2
CLO2	3	2	2	3	2	3	3	3	2	2	2	3	3
CLO3	3	2	2	3	3	3	3	3	3	2	3	3	3
CLO4	3	3	3	2	3	3	3	3	2	3	3	3	3

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	10
Entrepreneurship	5
Skill Enhancement	15
Communication Development	5
Indian Knowledge System	5
Environmental Awareness/SDGs	15
Current Issues and Social Awareness	7
Gender issues	2
Public policies	3
Any Other	8

Part A – Introduction			
Name of the Programme	B.Sc. Environmental Sciences		
Semester	SEMESTER-5		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	Water Resource and Management		
Course Code	26L5.5-EVS-502		
Course Type	MCC-10		
Course Level	300-399		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	To acquire knowledge of water resources in India.	
	CLO ₂	To have knowledge about the properties and importance of water.	
	CLO ₃	To describes various water conservation and management practices	
	CLO ₄	Demonstrate practical skills in mapping major dams, analysing calcium, sodium, fluoride and dissolved oxygen in water, and evaluating the efficiency of a water treatment plant.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.			
	Topics	CLO/s Attempt	Contact Hours
Unit-I	Introduction to water: Structure of water, unique properties of the water, importance and uses of water, distribution of Earth's water, hydrological cycle.	1	15
Unit-II	Water resources in India: precipitation, glaciers, oceans, estuaries, rivers, lakes and wetlands, mangroves, manmade reservoirs and dams, and groundwater	2	15
Unit-III	Physical, chemical, and biological parameters of water quality. Water quality standards. Wastewater treatment .Water conservation and management practices. Watershed management, cloud seeding, drip and sprinkler irrigation method, desalinization.	3	15

Practical	1. To map major dams in India. 2. To analyze calcium and sodium content in water. 3. To estimate fluoride content in water. 4. To estimate DO in water. 5. To study the working of a water treatment plant and to calculate its efficiency by using data.	4	30
Total Contact Hours			75
Evaluation Methods			
Internal Assessment:30	TH-25	PR-5	End Term Examination: 70
Class Participation:	5	0	Lab record
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination
Mid-Term Exam:	15	NA	Write-up and execution of the practical
Part C-Learning Resources			
Recommended Books/Journals/ e-resources/ Learning Management Systems (LMS):			
1. Singh, J.S., Singh, S.P. and Gupta, S.R. (2015). Ecology, Environment and Resource Conservation, S. Chand Publishing, New Delhi.			
2. Manahan, S.E. (2000). Environmental Chemistry. 7th Edition. Lewis Publishers, New York.			
3. Patnaik, P. (2017). Handbook of Environmental Analysis.CRC Press.			
4. Perspectives in Environmental Studies (2002). 7th Edition. New Age International Publishers. New Delhi.			
5. Sharma, H. R. (2018). Water-General Introduction. Module prepared for ePG Pathshala (a MHRD Project) for Environmental Sciences subject, paper Water Resources and Management, Module ID: EVS/WRM-V/1, pp: 16, 2018. Available at: http://epgp.inflibnet.ac.in/view_s.php?category=275			
6. Sharma, H. R. (2018). Water Resources of India. Module prepared for ePG Pathshala (a MHRD Project) for Environmental Sciences subject, paper Water Resources and Management, Module ID: EVS/WRM-V/2, pp: 20, 2018. Available at: http://epgp.inflibnet.ac.in/view_s.php?category=275			

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs) & Program Specific Outcomes (PSOs)

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PSO1	PSO2
CLO1	3	2	1	2	2	2	2	2	2	1	2	3	2
CLO2	3	2	1	2	2	2	3	2	2	1	2	3	3
CLO3	3	2	2	3	3	3	3	3	3	2	3	3	3
CLO4	3	3	3	3	3	3	3	3	2	3	3	3	3

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	10
Entrepreneurship	4
Skill Enhancement	15
Communication Development	5
Indian Knowledge System	4
Environmental Awareness/SDGs	15
Current Issues and Social Awareness	7
Gender issues	2
Public policies	5
Any Other	8
Total	75

Part A – Introduction			
Name of the Programme	B.Sc. Environmental Sciences		
Semester	SEMESTER-5		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	Agroforestry And Agroecology		
Course Code	26L5.5-EVS-503		
Course Type	DSE-2		
Course Level	300-399		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Know about the scope of global and national needs for Agroforestry with its practices.	
	CLO ₂	To equip students with advanced knowledge and techniques for effective plant management strategies	
	CLO ₃	Understand the principle of Agroecology and its role in ecological agriculture and applications of agroecological principles	
	CLO ₄	To gain practical experience in agroforestry systems, soil analysis, biodiversity monitoring, and documentation of traditional agroecological practices	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.			
	Topics	CLO/s Attempt	Contact Hours
Unit-I	Agroforestry: Concept, Definition, Benefits and Limitations, An overview: Shifting cultivation, Taungya cultivation, shelterbelts and windbreaks, energy plantation and homestead gardens.	1	15
Unit-II	Advanced Agroforestry Practices: Plant management strategies. Tree-crop interactions, Allelopathy and its implications, Integration of organic farming principles.	2	15

Unit-III	Fundamentals of Agroecology: Principles, Concepts, Structure and Functions, Sustainable agriculture practices, Applied Agroecology: Ecological Pest Management, Water Management in Agroecosystems	3	15		
Practical	1. Visit and collect information on various trees and crops near agroforestry. 2. Collection and processing of soil samples for physicochemical parameters analysis. 3. To monitor and document biodiversity (flora and fauna) in a selected agroecosystem over time. 4. To compare crop productivity between organic and conventional farming systems. To document and understand traditional agroecological practices followed by local farmers through field surveys	4	30		
Total Contact Hours			75		
Evaluation Methods					
Internal Assessment:30	TH-25	PR-5	End Term Examination: 70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10
Part C-Learning Resources					
Recommended Books/Journals/ e-resources/ Learning Management Systems (LMS):					
1. Singh, J.S., Singh, S.P. and Gupta, S.R. (2015). Ecology, Environment and Resource Conservation, S. Chand Publishing, New Delhi.					
2. Méndez, V. E., Bacon, C. M., Cohen, R., & Gliessman, S. R. (Eds.). (2015). Agroecology: A transdisciplinary, participatory and action-oriented approach. CRC press.					
3. Newton, Paul C.D., Carran R.A., Edwards, G.R. and Niklaus, P.A. (2007). Agroecosystems in a Changing Climate. Advances in Agroecology Vol.12 CRC/Taylor & Francis.					
4. Kumar, B.M. and Nair P.K.R. (eds.) (2006). Tropical Homegardens: A Time-Tested Example of Sustainable Agroforestry. Series, Advances in Agroforestry, Vol. 3. Kluwer Academic Publishers, Dordrecht, the Netherlands.					
5. Nair, P.K.R. 1989. Agroforestry Systems in the Tropics, Kluwer, Netherlands.					
6. Nair, P.K.R. 1993. An Introduction to Agroforestry. Kluwer Academic Publishers, Dordrecht, the Netherlands.					
7. Gliessman, S. R. 2002. Agroecosystem Sustainability: Developing Practical Strategies. CRC Press					
8. Lynggaard, K. 2006. The Common Agricultural Policy and Organic Farming: An Institutional Perspective on Continuity & Change. CAB International.					

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs) & Program Specific Outcomes (PSOs)

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁	PSO ₁	PSO ₂
CLO1	3	2	1	2	2	2	2	2	2	1	2	3	2
CLO2	3	2	2	2	3	2	3	3	2	2	2	3	3
CLO3	3	2	2	3	3	3	3	3	3	2	3	3	3
CLO4	3	3	3	3	3	3	3	3	2	3	3	3	3

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	10
Entrepreneurship	5
Skill Enhancement	15
Communication Development	5
Indian Knowledge System	5
Environmental Awareness/SDGs	15
Current Issues and Social Awareness	7
Gender issues	2
Public policies	3
Any Other	8
Total	75

Part A – Introduction			
Name of the Programme	B.Sc. Environmental Sciences		
Semester	SEMESTER-5		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	Ecological Restoration		
Course Code	26L5.5-EVS-504		
Course Type	DSE-2		
Course Level	300-399		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Understand the concepts of ecological restoration, including the history, scope, and importance of restoration efforts in environmental conservation	
	CLO ₂	Gain practical skills in various ecological restoration techniques for both terrestrial and aquatic ecosystems.	
	CLO ₃	Identify and analyze the socio-economic factors and emerging technologies affecting restoration practices.	
	CLO ₄	To Apply theoretical knowledge to practical scenarios related to ecological restoration.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.			
	Topics	CLO/s Attempt	Contact Hours
Unit-I	Introduction to Ecological Restoration: Definition, concepts. History and scope of restoration. Importance of ecological restoration in environmental conservation, Case studies showcasing successful ecological restoration projects.	1	15
Unit-II	Ecological Principles and Processes - Ecological succession and its relevance to restoration ecology, Biodiversity conservation and its role in restoration, Ecosystem services and their restoration implications. Techniques and Methods in Ecological Restoration- Terrestrial and Aquatic Ecosystem	2	15
Unit-III	Challenges and Future Directions in Ecological Restoration: Tools of restoration. Socio-economic factors influencing	2	15

	restoration efforts, Indigenous knowledge and community involvement in restoration projects, Emerging technologies and innovations in ecological restoration.				
Practical	1. Soil sampling and analysis for soil health indicators such as pH, nutrient levels, and organic matter content of degraded sites 2. Case study of Sukhomajri watershed management project. 3. Identify the parameters to be declared a land as salt-affected land 4. To study the degraded site and make a report suggesting mitigation measures. 5. Case study of ecological restoration of Yamuna biodiversity park, Delhi.	4	30		
Total Contact Hours			75		
Evaluation Methods					
Internal Assessment:30	TH-25	PR-5	End Term Examination: 70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10
Part C-Learning Resources					
Recommended Books/Journals/ e-resources/ Learning Management Systems (LMS):					
1. Kay, J. J., & Bishop, J. G. (Year). Principles of Ecological Restoration. Publisher.					
2. Falk, D. A., Palmer, M. A., & Zedler, J. B. (Year). Foundations of Restoration Ecology. Publisher.					
3. Apfelbaum, S. I., & Haney, A. (Year). Restoring Ecological Health to Your Land. Publisher					

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs) & Program Specific Outcomes (PSOs)

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PSO1	PSO2
CLO1	3	2	1	3	2	2	2	3	2	1	2	3	2
CLO2	3	2	2	3	3	3	3	3	3	2	3	3	3
CLO3	3	2	2	3	3	3	3	3	3	3	3	3	3
CLO4	3	3	3	3	3	3	3	3	3	3	3	3	3

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	10
Entrepreneurship	5
Skill Enhancement	15
Communication Development	5
Indian Knowledge System	5
Environmental Awareness/SDGs	5
Current Issues and Social Awareness	7
Gender issues	2
Public policies	3
Any Other	8

Part A – Introduction			
Name of the Programme	B.Sc. Environmental Sciences		
Semester	SEMESTER-5		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	Biomedical and E-Waste Management		
Course Code	26L5.5-EVS-505		
Course Type	DSE-3		
Course Level	300-399		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	To acquire knowledge about biomedical wastes.	
	CLO ₂	To describe about the collection and disposal of e-wastes.	
	CLO ₃	To explore different methods and technologies for e-waste reduction and recycling. To apply the knowledge after studying various aspects of biomedical and e-wastes treatment and disposal and resolving present day waste issues	
	CLO ₄	Demonstrate practical skills in identifying biomedical and e-waste management practices through field-based observation of waste segregation, disposal practices, e-waste generation and disposal, and analysis of Extended Producer Responsibility (EPR) in the Indian context.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.			
	Topics	CLO/s Attempt	Contact Hours
Unit-I	Bio-Medical Waste: sources, classification. Steps in biomedical waste management – segregation, collection, color coding of bins, storage, transfer and treatment. Health impacts of bio-medical waste. Infection prevention.	1	15
Unit-II	Biomedical waste treatment - autoclave, hydroclave and microwave	2	15

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	10
Entrepreneurship	5
Skill Enhancement	15
Communication Development	5
Indian Knowledge System	5
Environmental Awareness/SDGs	15
Current Issues and Social Awareness	7
Gender issues	2
Public policies	3
Any Other	8

Part A – Introduction			
Name of the Programme	B.Sc. Environmental Sciences		
Semester	SEMESTER-5		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	Hazardous Waste Management		
Course Code	26L5.5-EVS-506		
Course Type	DSE-3		
Course Level	300-399		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Explain the concepts, sources, properties, types, environmental fate and transport of hazardous waste and describe the need for its safe collection, transportation, treatment, storage and disposal.	
	CLO ₂	Describe the guidelines for storage and transportation of hazardous waste and explain physical and chemical treatment processes including filtration, separation, chemical precipitation, oxidation, solidification, stabilization, evaporation and ozonation.	
	CLO ₃	Explain biological and thermal treatment processes, bioremediation, bio-reclamation, hazardous waste disposal methods and the regulatory framework for hazardous waste management.	
	CLO ₄	Demonstrate practical skills in identifying and characterizing hazardous wastes and evaluating hazardous-waste management practices through case studies and field-based reports on secure landfills, radioactive-waste accidents, biomedical waste and battery disposal.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1			

will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.

Instructions for Practical Examiner

Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.

	Topics	CLO/s Attempt	Contact Hours
Unit-I	Introduction to hazardous waste- definition, sources, properties, and types (nuclear wastes, biomedical waste, nuclear waste-lead acid batteries, electronic wastes, etc.) of hazardous waste, Fate and transport of hazardous waste in the Environment; Collection, Transportation, Treatment, Storage, and Disposal Need for hazardous waste management, Impact of hazardous waste on human health	1	15
Unit-II	Storage and transportation of Hazardous waste- Guidelines, Compatibility of waste, Modes of Transportation of Hazardous Waste. Hazardous waste treatment (Physical and Chemical)- Physical waste treatment processes, Chemical waste treatment processes, Filtration & Separation, Chemical Precipitation, Chemical Oxidation, solidification & stabilization, Evaporation, and Ozonation.	2	15
Unit-III	Hazardous waste treatment -biological waste treatment processes-Aerobic and Anaerobic treatment, Thermal waste treatment processes-Incineration, Pyrolysis, Bioremediation, Bio-reclamation, Hazardous waste disposal: Deep Well Injection, secure landfills, underground storage tank. Environmental regulation for waste management: Hazardous Waste (management and handling) Rules, 2016.	3	15
Practical	1. Study of source and composition of different types of hazardous waste. 2. Case study of a secure landfill site. 3. Case study of accident due to radioactive waste. 4. Prepare a report on the biomedical waste disposal method adopted in your area. 5. Prepare a report on the method used/outdated battery disposal in university.	4	30
Total Contact Hours			75

Evaluation Methods

Internal Assessment:30	TH-25	PR-5	End Term Examination: 70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10

Part C-Learning Resources

Recommended Books/Journals/ e-resources/ Learning Management Systems (LMS):

1. LaGrega, M. D., Buckingham, P. L., & Evans, J. C. (2010). *Hazardous waste management* (2nd ed.). Waveland Press.

2. Freeman, H. M. (Ed.). (1998). *Standard handbook of hazardous waste treatment and disposal* (2nd ed.). McGraw-Hill.
3. Blackman, W. C. (2001). *Basic hazardous waste management* (3rd ed.). CRC Press.
4. Christensen, T. H. (Ed.). (2011). *Solid waste technology & management*. Wiley.
5. Tchobanoglous, G., Theisen, H., & Vigil, S. A. (1993). *Integrated solid waste management: Engineering principles and management issues*. McGraw-Hill.
6. Manahan, S. E. (2017). *Environmental chemistry* (10th ed.). CRC Press.
7. Singh, J. S., Singh, S. P., & Gupta, S. R. (2015). *Ecology, environment and resource conservation*. S. Chand Publishing.
8. Patnaik, P. (2017). *Handbook of environmental analysis: Chemical pollutants in air, water, soil, and solid wastes*. CRC Press.
9. United States Environmental Protection Agency. (n.d.). *Hazardous waste management*. U.S. EPA.
10. Ministry of Environment, Forest and Climate Change. (2016). *Hazardous and other wastes (Management and Transboundary Movement) Rules, 2016*. Government of India.
11. Central Pollution Control Board. (n.d.). *Hazardous waste management*. Government of India.
12. SWAYAM. (n.d.). *Environmental science and waste management related courses*. Ministry of Education, Government of India.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs) & Program Specific Outcomes (PSOs)

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PSO1	PSO2
CLO1	3	2	1	3	2	2	3	3	3	1	2	3	3
CLO2	3	2	2	3	2	3	3	3	3	2	2	3	3
CLO3	3	2	2	3	3	3	3	3	3	3	3	3	3
CLO4	3	3	3	3	3	3	3	3	3	3	3	3	3

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	10
Entrepreneurship	5
Skill Enhancement	15
Communication Development	5
Indian Knowledge System	5
Environmental Awareness/SDGs	15
Current Issues and Social Awareness	7
Gender issues	2
Public policies	5
Any Other	6
Total	75

Part A – Introduction			
Name of the Programme	B.Sc. Environmental Sciences		
Semester	SEMESTER-6		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	Basics of Remote Sensing and GIS		
Course Code	26L5.5-EVS-601		
Course Type	CC-6/MCC-11		
Course Level	300-399		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Explain the fundamental principles, history, scope and applications of remote sensing, different types of satellites, remote sensing data platforms and emerging developments in remote sensing.	
	CLO ₂	Differentiate between active and passive remote sensing systems and explain remote sensing platforms, sensors, image colour composites, image types, sensor resolutions and basic image interpretation techniques.	
	CLO ₃	Explain the fundamental concepts, data types, architecture and workflow of Geographic Information Systems (GIS), including GIS data input, storage, conversion, exchange, output and integration with remote sensing.	
	CLO ₄	Demonstrate practical skills in accessing open remote sensing data platforms, examining future remote sensing mission requirements, analysing spatial-data crowdsourcing initiatives, designing conceptual GIS architecture and applying GIS querying and selection operations.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u>			

Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.					
	Topics			CLO/s Attempt	Contact Hours
Unit-I	Foundations: history and scope of remote sensing; Basic principle of remote sensing. Types of satellites: Earth observation, meteorological, navigation. Remote sensing data: open access platforms. Future development.			1	15
Unit-II	Remote Sensing: Active and Passive Remote Sensing; remote sensing platform and sensors. Color composite models of images: RGS, IHS and YMC; Digital and analog images; Sensor resolution: spatial, spectral, radiometric, temporal and angular. Basic elements of image interpretation.			2	15
Unit-III	Geographical information system (GIS): introduction, roots of GIS, overview of information system. GIS data types: raster and vector. GIS architecture: components of GIS, GIS workflow. Integration of remote sensing and GIS. GIS data input methods. GIS data exchange, conversion and output. 4Aspatial component of GIS data. GIS data storage and file format.			3	15
Practical	1. Investigate different online open access platforms to use remote sensing data. 2. To investigate societal need for designing future remote sensing missions. 3. Investigate the Govt. initiated spatial data crowd-sourcing campaign as a case study. 4. Design an application-oriented conceptual GIS architecture. 5. Investigate different type of querying and selection operators.				30
Total Contact Hours					75
Evaluation Methods					
Internal Assessment:30	TH-25	PR-5	End Term Examination: 70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10
Part C-Learning Resources					
Recommended Books/Journals/ e-resources/ Learning Management Systems (LMS):					
1. Lillesand, T. M., Kiefer, R. W., & Chipman, J. W. (2015). <i>Remote sensing and image interpretation</i> (7th ed.). John Wiley & Sons.					
2. Campbell, J. B., & Wynne, R. H. (2011). <i>Introduction to remote sensing</i> (5th ed.). Guilford Press.					
3. Jensen, J. R. (2015). <i>Introductory digital image processing: A remote sensing perspective</i> (4th ed.). Pearson.					
4. Jensen, J. R. (2016). <i>Remote sensing of the environment: An earth resource perspective</i> (2nd ed.). Pearson.					
5. Sabins, F. F., & Ellis, J. M. (2020). <i>Remote sensing: Principles and interpretation</i> (4th ed.). Waveland Press.					

6. Chang, K. T. (2019). *Introduction to geographic information systems* (9th ed.). McGraw-Hill Education.
7. Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. (2015). *Geographic information science and systems* (4th ed.). Wiley.
8. Burrough, P. A., McDonnell, R. A., & Lloyd, C. D. (2015). *Principles of geographical information systems* (3rd ed.). Oxford University Press.
9. DeMers, M. N. (2009). *Fundamentals of geographic information systems* (4th ed.). Wiley.
10. Wolf, P. R., Dewitt, B. A., & Wilkinson, B. E. (2014). *Elements of photogrammetry with applications in GIS* (4th ed.). McGraw-Hill Education.

E-Resources / LMS

11. Indian Space Research Organisation (ISRO). *Bhuvan – Indian Geo-Platform of ISRO*. Government of India.
12. National Remote Sensing Centre (NRSC). *India-WRIS and remote sensing data resources*. Government of India.
13. United States Geological Survey (USGS). *EarthExplorer and Earth observation data resources*. U.S. Department of the Interior.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs) & Program Specific Outcomes (PSOs)

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PSO1	PSO2
CLO1	3	2	1	2	2	2	3	3	2	2	2	3	3
CLO2	3	2	2	3	3	2	3	3	3	2	3	3	3
CLO3	3	2	2	3	3	3	3	3	3	3	3	3	3
CLO4	3	3	3	3	3	3	3	3	3	3	3	3	3

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	10
Entrepreneurship	5
Skill Enhancement	15
Communication Development	5
Indian Knowledge System	5
Environmental Awareness/SDGs	15
Current Issues and Social Awareness	7
Gender issues	2
Public policies	3
Any Other	8

Part A – Introduction			
Name of the Programme	B.Sc. Environmental Sciences		
Semester	SEMESTER-6		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	WASTE MANAGEMENT		
Course Code	26L5.5-EVS-602		
Course Type	MCC-12		
Course Level	300-399		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Explain the major types and classification of wastes, functional elements of waste management systems, and the environmental and health impacts associated with improper waste disposal.	
	CLO ₂	Describe the characteristics and disposal methods of liquid waste and explain advanced wastewater treatment technologies including ion exchange, electrodialysis, reverse osmosis and ultrafiltration.	
	CLO ₃	Explain the treatment and disposal of biomedical, hazardous and electronic wastes and evaluate waste reduction, reuse and recycling practices for sustainable waste management.	
	CLO ₄	Demonstrate practical skills in waste classification, assessment of waste-disposal sites, biomedical waste segregation, and determination of BOD and COD in treated and untreated sewage water.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.			
	Topics	CLO/s Attempt	Contact Hours
Unit-I	Types of waste: solid, liquid, biomedical, hazardous and e-waste. Classification of wastes. Functional elements of waste management system. Environmental and health impacts of improper waste disposal.	1	15

Unit-II	Liquid waste: characteristics and disposal methods- septic tanks, seepage pits, cesspools. Advance waste water treatment: ion exchange, electro-dialysis, reverse osmosis, and ultra filtration.	2	15
Unit-III	Biomedical waste: colour coding and treatment, Hazardous waste: properties, physical, chemical and biological treatment. E-waste: sources, generation, treatment and disposal. E-waste pollutants. Different methods of waste disposal, Reduction, reuse and recycling of wastes.	3	15
Practical	1. To classify household waste of your home. 2. To study the status of waste disposal site of your area. 3. To study the use of different color dustbins in a nearby hospital or clinic. 4. To analyze the BOD of a treated and untreated sewage water. 5. To analyze the COD of a treated and untreated sewage water	4	30

Total Contact Hours

75

Evaluation Methods

Internal Assessment:30	TH-25	PR-5	End Term Examination: 70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10

Part C-Learning Resources

Recommended Books/Journals/ e-resources/ Learning Management Systems (LMS):

1. Tchobanoglous, G., Theisen, H., & Vigil, S. A. (1993). *Integrated solid waste management: Engineering principles and management issues*. McGraw-Hill.
2. Tchobanoglous, G., Burton, F. L., & Stensel, H. D. (2003). *Wastewater engineering: Treatment and reuse* (4th ed.). McGraw-Hill.
3. Metcalf & Eddy, Inc., Aecom. (2014). *Wastewater engineering: Treatment and resource recovery* (5th ed.). McGraw-Hill Education.
4. Peavy, H. S., Rowe, D. R., & Tchobanoglous, G. (1985). *Environmental engineering*. McGraw-Hill.
5. Rao, M. N., & Sultana, R. (2012). *Solid and hazardous waste management*. PHI Learning.
6. George, T. G., & Kreith, F. (2002). *Handbook of solid waste management* (2nd ed.). McGraw-Hill.
7. Manahan, S. E. (2017). *Environmental chemistry* (10th ed.). CRC Press.
8. Davis, M. L. (2010). *Water and wastewater engineering: Design principles and practice*. McGraw-Hill.
9. Vesilind, P. A., Worrell, W., & Reinhart, D. (2002). *Solid waste engineering*. Brooks/Cole.
10. Singh, J. S., Singh, S. P., & Gupta, S. R. (2015). *Ecology, environment and resource conservation*. S. Chand Publishing.

E-Resources / LMS

11. Central Pollution Control Board (CPCB). *Waste management resources and guidelines*. Government of India.

12. Ministry of Environment, Forest and Climate Change (MoEFCC). *Waste management rules and regulatory resources*. Government of India.
13. SWAYAM. *Environmental science and waste-management courses*. Ministry of Education, Government of India.
14. National Programme on Technology Enhanced Learning (NPTEL). *Environmental engineering and wastewater treatment courses*.
15. United States Environmental Protection Agency (U.S. EPA). *Sustainable materials management and wastewater resources*.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs) & Program Specific Outcomes (PSOs)

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PSO1	PSO2
CLO1	3	2	1	3	2	2	2	3	3	2	2	3	3
CLO2	3	2	2	3	3	2	3	3	3	2	3	3	3
CLO3	3	2	2	3	3	3	3	3	3	3	3	3	3
CLO4	3	3	3	3	3	3	3	3	3	3	3	3	3

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	10
Entrepreneurship	5
Skill Enhancement	15
Communication Development	5
Indian Knowledge System	5
Environmental Awareness/SDGs	15
Current Issues and Social Awareness	7
Gender issues	2
Public policies	5
Any Other	6

Part A – Introduction			
Name of the Programme	B.Sc. Environmental Sciences		
Semester	SEMESTER-6		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	Environmental Legislation		
Course Code	26L5.5-EVS-603		
Course Type	DSE-4		
Course Level	300-399		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Explain constitutional provisions, environmental laws and regulatory mechanisms in India.	
	CLO ₂	Explain wildlife, forest legislation and major international environmental conferences.	
	CLO ₃	Analyze international environmental agencies, treaties and agreements.	
	CLO ₄	Apply environmental laws and international agreements through case studies and practical exercises.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.			
	Topics	CLO/s Attempt	Contact Hours
Unit-I	Introduction to Environmental Law in India: Constitutional Perspective: Relevant Provisions- 48-A, 51-A(g), fundamental rights, Human Rights and Environment, Public interest litigation, Polluter pays principle, Indian Penal Code, National Green Tribunal. Legislation for environment protection in India: The Water (Prevention and Control of Pollution) Act, 1974 and amendments, The Air (Prevention and Control of Pollution) Act, 1981 and amendments, Central & State pollution control boards and its powers and functions- offenses and penalties		15
Unit-II	Wildlife Protection Act, 1972 and amendments, Forest		15

	(Conservation) Act, 1980 and amendments. Introduction to International Environmental Treaties: United Nations Conference on Human Environment, 1972 (Stockholm Conference)-Aims and Objectives of the Conference, Rio Conference, 1992-Aims and Objectives, Johannesburg Conference 2002-Major outcomes.		
Unit-III	Role of International Environmental Agencies-UNEP (United Nations Environment Programme), UNFCCC (United Nations Framework Convention on Climate Change), and IPCC (Intergovernmental Panel on Climate Change). International agreements on environmental issues: Conference of Parties, Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES); Convention on Biological Diversity (CBD), Kyoto Protocol, Montreal Protocol.		15
Practical	1) Study different wildlife-related projects under the Wildlife Protection Act 1972. 2) Case study related to the Air (Prevention and Control of Pollution) Act, 1981. 3) Case Study of climate change under UNFCCC. 4) Case study under The National Green Tribunal Act, 2010. 5) Study of drawbacks in environmental legislation and difficulties in its enforcement.		30
Total Contact Hours			75
Evaluation Methods			
Internal Assessment:30	TH-25	PR-5	End Term Examination: 70
Class Participation:	5	0	Lab record
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination
Mid-Term Exam:	15	NA	Write-up and execution of the practical
Part C-Learning Resources			
1. Sahasranaman P B, 2008 Handbook of Environmental Law in India, Oxford University Press (India). 2. Singh Gurdip, 2004, Environmental Law in India, Mcmillan & Co. 3. Shastri S C, 2008, Environmental Law, (2nd Edn.), Eastern Book Company, Lucknow 4. Vig, N.J. and Axelrod R.S. (Eds) (1999). The Global Environment: Institutions, Law and Policy. Earthscan London. 5. Divan S. and Rosencranz A. (2002). Environmental law and policy in India: cases, materials and statutes. Oxford University Press. 6. Ferrey S. (2004). Environmental Law: Examples and Explanations. Aspen Law & Business. Springer-Verlag New York, LLC.			

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs) & Program Specific Outcomes (PSOs)

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PSO1	PSO2
CLO1	3	3	1	2	3	1	3	3	2	2	3	3	3
CLO2	3	3	2	1	3	1	3	3	2	2	3	3	2
CLO3	3	3	1	2	3	2	3	3	2	2	3	3	3
CLO4	2	3	3	3	3	2	3	3	3	3	3	3	3

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	12
Entrepreneurship	6
Skill Enhancement	15
Communication Development	8
Indian Knowledge System	5
Environmental Awareness/SDGs	15
Current Issues and Social Awareness	12
Gender issues	4
Public policies	15
Any Other	0

Part A – Introduction			
Name of the Programme	B.Sc. Environmental Sciences		
Semester	SEMESTER-6		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	Environmental Management System and Standards		
Course Code	26L5.5-EVS-604		
Course Type	DSE-4		
Course Level	300-399		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Explain environmental management, sustainability and environmental performance indicators.	
	CLO ₂	Apply EMS principles, components and PDCA approaches in environmental management.	
	CLO ₃	Explain ISO 14001, certification procedures, LCA and waste minimization practices.	
	CLO ₄	Evaluate environmental management practices through field visits, EMPs and case studies.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.			
	Topics	CLO/s Attempt	Contact Hours
Unit-I	Basic concept of Environmental Management: Environmental sustainability, Environmental performance indicators, environmentally responsible organization, identification and study of environmental aspects and environmental impacts, Importance of sustainable development.		15
Unit-II	Environmental Management Systems (EMS): origin, scope, key elements, and components of an EMS, Plan Do Check Act (PDCA) model, Environmental management systems in India.		15
Unit-III	Environmental Standards: ISO-Introduction, origin and functions, ISO 14001: Overview, significance Other		15

	relevant standards. Case studies of ISO in Environment management. Introduction to Certification: concept, types and procedures in India. Life Cycle Assessment and waste minimization				
Practical	1. To evaluate recent guidelines and framework for implementation of EMS in India. 2. Visit local industries, waste treatment plants, or natural ecosystems to observe environmental management practices. 3. Study or discuss EMP of a building or facility and collect data. 4. Case studies related to the successful implementation of EMS and Environmental standards. 5. Study of ISO-14000 family standards.		30		
Total Contact Hours			75		
Evaluation Methods					
Internal Assessment:30	TH-25	PR-5	End Term Examination: 70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10
Part C-Learning Resources					
1) Welford, R. (2016). Corporate environmental management 1: systems and strategies. Routledge. 2) Mitchell, B. (2013). Resource and environmental management. Routledge. 3) Edwards, A. J. (2003). ISO 14001 Environmental certification step by step: Revised Edition. Elsevier. 4) Dentch, M. P. (2016). The ISO 14001: 2015 Implementation Handbook. Quality Press. 5) Morris, A. S. (2004). ISO 14000 environmental management standards: Engineering and financial aspects. John Wiley & Sons. 6) Sheldon, C., & Yoxon, M. (2012). Environmental management systems: a step-by-step guide to implementation and maintenance. Routledge. 7) Çalıyurt, K., & Yüksel, Ü. (Eds.). (2017). Sustainability and management: An international perspective. Taylor & Francis. 8) Will, M., Brauweiler, J., & Zenker-Hoffmann, A. (2021). Environmental Management Systems According to ISO 14001. In Industry, Innovation and Infrastructure (pp. 335-353). Cham: Springer International Publishing. 9) Kulkarni, V., & Ramachandra, T. V. (2006). Environmental management. The Energy and Resources Institute (TERI).					

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs) & Program Specific Outcomes (PSOs)

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PSO1	PSO2
CLO1	3	3	2	2	3	2	2	3	2	2	3	3	3
CLO2	3	3	2	2	3	2	3	3	2	2	3	3	3
CLO3	3	3	2	3	3	3	3	3	2	2	3	3	3
CLO4	2	3	3	3	3	2	3	3	3	3	3	3	3

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	15
Entrepreneurship	8
Skill Enhancement	18
Communication Development	8
Indian Knowledge System	5
Environmental Awareness/SDGs	15
Current Issues and Social Awareness	10
Gender issues	4
Public policies	12
Any Other	-

Part A – Introduction			
Name of the Programme	B.Sc. Environmental Sciences		
Semester	SEMESTER-6		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	Energy and Environment		
Course Code	26L5.5-EVS-605		
Course Type	DSE-5		
Course Level	300-399		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Explain the basic concepts, forms and principles of energy, including energy units, power, exergy, laws of thermodynamics, entropy, energy efficiency and conservation, with reference to environmental concerns.	
	CLO ₂	Classify conventional and non-conventional energy resources and evaluate their availability, present status, advantages, limitations and associated challenges.	
	CLO ₃	Explain the environmental consequences of fossil-fuel use, energy-related pollution, energy security, energy conservation, energy-efficient buildings and the relationship between energy use and global climate change.	
	CLO ₄	Demonstrate practical skills in studying solar radiation instruments, energy-security policies, bomb calorimetry, thermal power plants and India's major coal, petroleum and natural-gas reserves through laboratory exercises, field-based studies and case studies.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1			

and 1 question from the each of the three units.

Instructions for Practical Examiner

Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.

	Topics	CLO/s Attempt	Contact Hours
Unit-I	Basics of energy: energy units, energy and power, exergy, energy bill, different forms of energy, laws of thermodynamics, ten percent law, entropy, environmental concerns, energy efficiency and conservation.	CLO1	15
Unit-II	Introduction to energy sources and their classification. Conventional energy resources—coal, oil and natural gas: availability and challenges. Non-conventional energy resources—solar, hydro and wind: advantages and limitations. Humans and energy; environmental consequences of fossil-fuel use; pollution from energy use; atmospheric pollution; energy-security issues; energy conservation and energy-efficient building.	CLO2	15
Unit-III	Energy and global climate change; GHG emissions from various energy sources; Intergovernmental Panel on Climate Change (IPCC); global environmental awareness, including Earth Hour.	CLO3	15
Practical	1. Study of solar spectrum and radiation measuring instruments (Pyranometer and Pyrheliometer). 2. Study of energy-security issues and policies in India. 3. Study and demonstration of bomb calorimeter. 4. Case study of thermal power plant. 5. Study of important energy reserves of India (coal, petroleum and natural gas).	CLO4	30
Total Contact Hours			75

Evaluation Methods

Internal Assessment:30	TH-25	PR-5	End Term Examination: 70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10

Part C-Learning Resources

Recommended Books/Journals/ e-resources/ Learning Management Systems (LMS):

1. Ristinen, R. A., Kraushaar, J. J., & Brack, J. T. (2022). *Energy and the environment*. John Wiley & Sons.
2. Singh, J. S., Singh, S. P., & Gupta, S. R. (2015). *Ecology, environment and resource conservation*. S. Chand Publishing.
3. Wolfson, R. (2011). *Energy, environment, and climate*. W. W. Norton & Company.
4. Goldemberg, J., & Lucon, O. (2009). *Energy, environment and development*. Routledge.
5. Dincer, I., & Rosen, M. A. (2012). *Exergy: Energy, environment and sustainable development*. Newnes.
6. Nersesian, R. L. (2016). *Energy economics: Markets, history and policy*. Routledge.
7. Boyle, G. (Ed.). (2012). *Renewable energy: Power for a sustainable future*. Oxford University Press.

8. Tester, J. W., Drake, E. M., Golay, M. W., Driscoll, M. J., & Peters, W. A. (2012). *Sustainable energy: Choosing among options*. MIT Press.
9. Twidell, J., & Weir, T. (2015). *Renewable energy resources*. Routledge.
10. International Energy Agency. *World Energy Outlook* and related energy and climate resources.
11. Intergovernmental Panel on Climate Change. *Assessment Reports and Climate Change Resources*.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs) & Program Specific Outcomes (PSOs)

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁
CLO ₁	3	2	1	1	2	2	2	3	2	1	2
CLO ₂	3	2	2	2	2	3	3	3	2	2	3
CLO ₃	3	2	2	2	3	3	3	3	3	3	3
CLO ₄	3	3	3	3	3	3	3	3	2	3	3

Content Mapping with NEP thrust areas

Field3	Hours devoted
Employability	10
Entrepreneurship	5
Skill Enhancement	15
Communication Development	5
Indian Knowledge System	5
Environmental Awareness/SDGs	15
Current Issues and Social Awareness	7
Gender issues	2
Public policies	5
Any Other	6

Part A – Introduction			
Name of the Programme	B.Sc. Environmental Sciences		
Semester	SEMESTER-6		
Nature of Course/Course Composition	Theory & Practical		
Nomenclature of the Course	Renewable & New Energy Sources		
Course Code	26L5.5-EVS-606		
Course Type	DSE-5		
Course Level	300-399		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Explain the types, importance and environmental significance of renewable energy resources and compare renewable and non-renewable resources with reference to Indian and international energy scenarios.	
	CLO ₂	Explain the working principles, major components, applications and environmental impacts of hydropower and wind power generation systems.	
	CLO ₃	Describe the principles and applications of solar and nuclear energy, including solar radiation measurement, radioactive decay, nuclear fission and fusion, and nuclear reactors.	
	CLO ₄	Demonstrate practical skills in studying solar photovoltaic systems, solar water heating, renewable-energy technologies, waste-to-energy conversion and biogas-plant operation through laboratory, field and case-study activities.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	05	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.			
<u>Instructions for Practical Examiner</u>			

Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.					
	Topics	CLO/s	Attempt	Contact	Hours
Unit-I	Introduction of renewable energy, types and importance. Comparison of non-renewable and renewable energy resources; present Indian and international energy scenarios.	CLO1		15	
Unit-II	Hydropower: working, components and environmental impacts of hydropower. Wind power: working of wind power plants, wind farms, benefits and environmental impacts. Solar power: solar spectrum, radiation and measuring instruments (Pyranometer and Pyrheliometer), applications.	CLO2		15	
Unit-III	Nuclear energy: isotopes, radioactive decay, half-life, nuclear fission and fusion reaction, nuclear reactors and implications of nuclear energy. Biomass resources, biomass-energy, bioenergy applications, biogas production and factors affecting biogas generation. Energy storage systems and hybrid energy systems.	CLO3		15	
Practical	1. Study the principle of solar photovoltaic systems and different solar energy applications. 2. Demonstration of solar water heater system. 3. Explore and visit nearby renewable energy technologies through case studies. 4. Case study of the potential of waste-to-energy conversion processes. 5. Study the process and working of a biogas plant.	CLO4		30	
Total Contact Hours				75	
Evaluation Methods					
Internal Assessment:30	TH-25	PR-5	End Term Examination: 70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10
Part C-Learning Resources					
Recommended Books/Journals/ e-resources/ Learning Management Systems (LMS):					
1. Kothari, D. P., Ranjan, R., & Singal, K. C. (2021). <i>Renewable energy sources and emerging technologies</i>. 2. Maczulak, A. E. (2010). <i>Renewable energy: Sources and methods</i>. Infobase Publishing. 3. Gross, M., & Mautz, R. (2014). <i>Renewable energies</i>. Routledge. 4. Wengenmayr, R., & Bührke, T. (Eds.). (2013). <i>Renewable energy: Sustainable energy concepts for the energy change</i>. John Wiley & Sons. 5. Rathore, N. S., & Panwar, N. L. (2007). <i>Renewable energy sources for sustainable development</i>. New India Publishing. 6. Ehrlich, R., Geller, H. A., & Cressman, J. R. (2022). <i>Renewable energy: A first course</i>. CRC Press. 7. Da Rosa, A. V., & Ordóñez, J. C. (2021). <i>Fundamentals of renewable energy processes</i>.					

Academic Press.

8. Singh, J. S., Singh, S. P., & Gupta, S. R. (2015). *Ecology, environment and resource conservation*. S. Chand Publishing.
9. Ristinen, R. A., Kraushaar, J. J., & Brack, J. T. (2022). *Energy and the environment*. John Wiley & Sons.
10. Wolfson, R. (2011). *Energy, environment, and climate*. W. W. Norton & Company.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs) & Program Specific Outcomes (PSOs)

CLOs	PLO ₁	PLO ₂	PLO ₃	PLO ₄	PLO ₅	PLO ₆	PLO ₇	PLO ₈	PLO ₉	PLO ₁₀	PLO ₁₁	PSO ₁	PSO ₂
CLO ₁	3	2	1	2	2	2	2	2	2	2	2	3	2
CLO ₂	3	2	2	3	2	3	3	3	2	3	3	3	3
CLO ₃	3	2	2	3	3	3	3	3	3	3	3	3	3
CLO ₄	3	3	3	3	3	3	3	3	2	1	3	3	3

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	10
Entrepreneurship	5
Skill Enhancement	15
Communication Development	5
Indian Knowledge System	15
Environmental Awareness/SDGs	7
Current Issues and Social Awareness	2
Gender issues	5
Public policies	6
Any Other	2