Savitribai Phule Pune University

(Formerly University of Pune)

Undergraduate Degree Program in Environmental Science
(B.Sc. Environmental Science)
(Faculty of Science & Technology)

Revised Syllabi as per National Education Policy (2020) for S.Y.B.Sc.

Environmental Science (Semester-III and IV)

(For Colleges Affiliated to Savitribai Phule Pune University, Pune)

To Be Implemented From

Academic Year 2025-26

Formed by

BOARD OF STUDIES IN ENVIRONMENTAL SCIENCE (Adhoc)
Savitribai Phule Pune University, Pune
Ganeshkhind, Pune – 7

Credit Framework for Undergraduate (UG) B.Sc. Environmental Science (2024-2025) Subject Code: EVS

Level/Difficulty	Sem.	Credits Related to Major				Minor	GE/OE	SEC	IKS	AEC	VEC	CC	Total
		Major Core	Major Elective	VSC	FP/OJT/CEP								
5.0/ 200	III	**EVS 201 MJ** Ecology and Ecosystem [2T] **EVS 202 MJ** Natural Resource Conservation [2T] **EVS 203 MJP** Practical Based on EVS201MJ and EVS MJ202 [2P]		**(Select any one of the following)** **EVS 221 VSC** Water Quality Analysis [2T] ***OR*** **EVS 222 VSC** Soil Quality Analysis [2 T]	**EVS 231 FP** Field Project and Report Writing [2 FP]	**EVS 241 MN** Environmental Microbiology [2 T] **EVS 242 MNP** Practical Based on EVS241MN [2 P]	**(Select any one of the following)** **OE 201 EVS** Natural Calamities [2 T] ***OR*** **OE 202EVS** Ecotourism [2 T]	--	**IKS 201- T EVS** India Culture Environment [2 T]	2 (T)	-	**2**	**22**
	IV	**EVS 251 MJ** Biodiversity Conservation [2 T] **EVS 252 MJ** Pollution Control Technology [2 T] **EVS 252 MJP** Practical's Based on EVS251MJ and EVS252MJ [2 P]		**(Select any one of the following)** **EVS 271 VSC** Practical Water Quality Analysis [2 P] ***OR*** **EVS 272 VSC** Practical Soil Quality Analysis [2 P]	**EVS 281 CEP** Community Engagement and Services [2 CEP]	**EVS 291 MN** Solid Waste Management [2 T] **EVS 292 MNP** Practical EVS291MN [2 P]	**OE 251EVS** Water Conservation [2 P]	**SEC 251 EVS** Practical in Water conservation [2 P]	-	2 (T)	-	**2**	**22**

S.Y.B.Sc. Environmental Science (Semester-III)

Course Category: Major Core Theory

Course Code – EVS201MJ

Course Title: Ecology and Ecosystem

[No. of Credits: 2 C] **[No. of Lectures: 30 L]**

Objectives:

1. To understand the fundamental principles of ecology and their relevance to environmental science.
2. To analyse the structure and function of ecosystems at various levels of organisation.
3. To evaluate the impact of human activities on ecosystems and develop strategies for sustainable management.
4. To apply ecological concepts to real-world environmental problems and challenges.
5. To develop critical thinking and problem-solving skills in the context of ecology.

Course Outcome:

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

1. Students will be able to define community ecology and its key characteristics.
2. Students will be able to analyse the structure of a community using analytical and synthetic characters.
3. Students will be able to explain the concept of interspecific and intraspecific relationships.
4. Students will be able to understand the causes and types of succession.
5. Students will be able to analyse the mechanisms of succession and their implications.
6. Students will be able to understand different models of succession and their significance.

Unit No.	Name of theUnit	Contents	No. of Lectures
1	Ecology	• Introduction & Interdisciplinary Nature of Ecology. • Levels of Organisation – a) Biological / Ecological Spectrum. b) Ecological Hierarchy by Barett et al. • Ecological Classification based on – a) Taxonomic Affinity (From Kingdom to Species Level Ecology). b) Habitat Types (Terrestrial & Aquatic Ecology). c) Levels of Organisation (Autecology & Synecology – Population, Community, Biome & Ecosystem Ecology)	06
2	Ecosystem Structure & Function – Energy Flow	• Concept of the Ecosystem. • Macro & Micro-ecosystems …etc. • Ecosystem Structure – Abiotic & Biotic Components. • Ecosystem Function: Functional attributes a) Food Chain – Grazing & Detritus. b) Food Web & Ecosystem Stability c) Ecological Energetics – i) Energy Input, ii) Energy Flow – Single Channel & Y shaped models. d) Productivity of Ecosystem – i) Primary Production – GPP & NPP, ii) Secondary Production, iii) Standing Crop (Biomass).	06

		e) Ecological Pyramids – of Number, Biomass & Energy with examples	
3	Ecosystem Function and Nutrient Cycling	• Concept of – a) Macro & Micro-nutrients, deficiency syndrome, Functions b) Nutrient Cycling-- Biogeochemical Cycles – • Gaseous Cycles – Hydrological, Carbon & Nitrogen Cycles. • Sedimentary Cycles – Phosphorus & Sulphur Cycles. • Human Impact on Biogeochemical Cycles. • Ecosystem Nutrient Cycling Model – Intra-system Cycling & • Extra-system Transfers. • a) Nutrient Inputs. • b) Biotic Accumulation of Nutrient. • c) Nutrient Outputs.	06
4	Population Ecology	• Introduction & Basic Concepts. • Population Characteristics – a) Size & Density, b) Dispersion – Random, Aggregate & Uniform, c) Natality (Potential & Realised), d) Fecundity, e) Mortality (Potential & Realised). • f) Survivorship Curves, g) Age & Sex Structure, h) Life Table and Viability analysis • The Concept of Carrying Capacity. • Population Growth – a) Growth Curves – Exponential & Logistic. b) Population Fluctuation, c) Biotic Potential & Environmental Resistance.	06
5	Community Ecology and Succession	• Characteristics of Community - Species Diversity, Growth form & Structure, Dominance, Succession, Trophic Structure, • Ecological Niche, Ecotone & Edge Effect. • Characters used in Community Structure: a) Analytical Characters – i) Quantitative, ii) Qualitative, b) Synthetic Characters. • Inter-specific & Intra-specific Relationships. • Causes of Succession. • Basic Types – Primary, Secondary, Autogenic, Allogenic …etc. • Mechanism of Succession – a) Nudation, b) Invasion, c) Competition, Co-action & Reaction, d) Stabilisation (Climax). • Models of succession – a) Hydrosere, b) Lithosere	06

References:

1. Dash, M.C., Fundamentals of Ecology, Tata McGraw-Hill Publishing Company, New Delhi, India, Latest Edition.
2. Sharma, P.D., Ecology and Environment, Rastogi Publications, Meerut, India, Latest Edition.
3. Kotpal, R.L., Principles of Ecology, Rastogi Publications, Meerut, India, Latest Edition.
4. Odum, E.P., Adapted by Indian Publishers, Fundamentals of Ecology (Indian Edition), Cengage Learning India Pvt. Ltd., New Delhi, India.
5. Rana, S.V.S., Essentials of Ecology and Environmental Science, PHI Learning Pvt. Ltd., New Delhi, India, Latest Edition.
6. Rajagopalan, R., Environmental Studies: From Crisis to Cure, Oxford University Press, New Delhi, India, Latest Edition.
7. Anand, Vaishali, Environment and Ecology, McGraw Hill Education (India) Pvt. Ltd., New Delhi, India, Latest Edition.

S.Y.B.Sc. Environmental Science (Semester-III)

Course Category: Major Core Theory

Course Code – EVS 202 MJ

Course Title: Natural Resources Conservation

[No. of Credits: 2 C] **[No. of Lectures: 30 L]**

Objectives:

Course:

1. To understand the concept of natural resources and their significance in human life.
2. To analyse the classification and distribution of natural resources.
3. To evaluate the sustainable use and management of natural resources.
4. To explore the environmental impacts of resource exploitation and conservation measures.
5. To develop strategies for sustainable development and resource conservation.

Outcome

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

1. Students will be able to define natural resources and explain their importance in human society.
2. Students can classify natural resources based on their origin, renewability, and distribution.
3. Students will be able to evaluate the sustainable use and management of various natural resources, such as forests, water, minerals, and energy.
4. Students will be able to analyse the environmental impacts of resource exploitation and conservation measures, including deforestation, pollution, and biodiversity loss.
5. Students can develop sustainable development and resource conservation strategies, considering economic, social, and environmental factors.

Unit No.	Name of theUnit	Contents	No. of Lectures
1	Resources	• Meaning and Definition • Classification of Resources 1. Based on Origin: Biotic & Abiotic 2. Based on recovery rate: Renewable and Non Renewable 3. Natural and Artificial Resources 4. Material and Energy Resources • Importance and Scope of Resources • Nature of Resources: Regenerative and Assimilative Capacity of Earth • Man's Interaction with Natural Resources: • 1. a vital resource • 2. A waste sink 3. Cultural Significance • Problems associated with Natural Resources	06
2	Forest and Mineral Resources	A. Forest Resources : • The function of Forest : Protective, Productive, Regulative and Accessory • Importance of Forest: Ecological and Economical • Human Interaction with Forest: Overexploitation, Deforestation (Causes and Effects) • Forest Management in India—JFM, EDP, Protected Areas	06

		• Case studies on Timber extraction, Dam construction and its effect on tribal people B. Mineral Resources • Origin of Mineral Resources with examples • Need of Mineral Resources • Overexploitation of Mineral Resources • Effects of Mining on Ecosystem with Case Studies. • Conservation of Mineral resources and its importance	
3	Food Resources	World Food Problems: a) Increasing World Food Demand. b) Nutritional deficiency in food. c) Food Distribution. • The Green Revolution in India- Concept, Its Impacts in India. • Introduction of Hybrid Varieties-HYV and Genetically Modified Crops. • Effects of Modern Agriculture technologies • Genetically Modified Crops & Regulations in India • Fertilizer-Pesticide Problems –NPK Fertilizers	06
4	Water Resources	• Use and over-utilization of surface and groundwater, • Under-ground water pollution • Water Crisis--- the reasons • Conflicts over water ---World and India • Conservation & Management a) Traditional Methods. b) Rainwater Harvesting & Ground Water Recharge. c) Watershed Management– the concept. d) Flood and floodplain management	06
5	Land Resources	Traditional & Modern Agricultural Systems • Major causes of soil degradation: Soil erosion, Pollution, Use of fertilisers, pesticides, heavy metals, Plastic pollution • Consequences of soil erosion a) Decline of soil fertility b) Waterlogging c) Salinity d) Shifting / jhum cultivation • Soil conservation methods • Sustainable Agriculture Methods	06

References:

1. Asthana, D.K. and Asthana, Meera, Environment: Problems and Solutions, S. Chand and Company Pvt. Ltd., New Delhi, India, Latest Edition.
2. Gurunathan, A., Watershed Management: A Complete Manual, New India Publishing Agency, New Delhi, India.
3. Kaushik, A. and Kaushik, C.P., Perspectives in Environmental Studies, New Age International Publishers, New Delhi, India, Latest Edition.
4. Miller, G.T. Jr., Environmental Science: Working with the Earth, Brooks/Cole Publishing, Belmont, California, USA.
5. Rajagopalan, R., Environmental Studies: From Crisis to Cure, Oxford University Press, New Delhi, India, Latest Edition.
6. Rao, M.N. and Rao, H.V.N., Air Pollution, Tata McGraw-Hill Education, New Delhi, India.
7. Sharma, P.D., Ecology and Environment, Rastogi Publications, Meerut, India, Latest Edition.
8. Shukla, R.S. and Chandel, P.S., Plant Ecology and Soil Science, S. Chand and Company Pvt. Ltd., New Delhi, India.

9. Singh, J.S., Singh, S.P. and Gupta, S.R., Ecology, Environment and Resource Conservation, Anamaya Publishers, New Delhi, India.

S.Y.B.Sc. Environmental Science (Semester-III)

Course Category: Major Core Practical

Course Code – EVS 203 MJP

Course Title: Practicals based on EVS 201 MJ and EVS MJ 202

[No. of Credits: 2 C] **[No. of Lectures: 60 L]**

Objectives

- To provide students with a comprehensive understanding of various types of environmental pollution, their sources, and their impacts on ecosystems and human health.
- To create awareness among students about the seriousness of environmental pollution and the need for sustainable development.
- To develop the ability to analyse and assess environmental pollution issues using scientific principles and data.
- To introduce students to environmental policies, regulations, and management strategies aimed at controlling and mitigating pollution.
- To equip students with the knowledge and skills necessary to propose and evaluate solutions to pollution problems.

Outcomes:

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

- Identify different types of environmental pollution (air, water, soil, noise, etc.) and describe their sources and effects.
- Analyse environmental data and evaluate the extent and severity of pollution in various ecological contexts.
- Understand the impacts of pollution on ecosystems, biodiversity, and human health, and discuss case studies illustrating these impacts.
- Demonstrate knowledge of environmental laws, policies, and regulatory frameworks aimed at controlling pollution.
- Propose and assess potential solutions and strategies for pollution prevention and control, considering technical and policy-oriented approaches.
- Advocate for sustainable practices and engage in informed discussions about environmental issues, contributing to community and societal well-being.

Sr. No.	Description	Practical Sessions
1.	Measurement of Primary Productivity of Grassland by Harvest Method	01
2.	Estimation of Total Chlorophyll from Plants in a Clean & Polluted Environment.	01
3.	Calculate energy transfer efficiency between trophic levels using data on primary production, secondary production, and biomass.	01
4.	Determination of minimum area and number of quadrates for vegetation	01
5.	Study of grassland vegetation by List Count Quadrat Method to determine the Frequency, Density & Abundance.	01
6.	Determination of Frequency & Abundance of species across terrestrial – aquatic transitional zone, by Line Transect Method	01
7.	Determination of Density of species across terrestrial–aquatic transitional zone by Belt Transect Method	01
8.	Construct ecological pyramids of number, biomass, and energy based on field studies or simulations data.	01
9.	Collect and press plant specimens to create a herbarium, labelling each specimen with its scientific name, common name, and habitat.	01
10.	Construct population growth curves based on laboratory data or field	01

	observations.	
11.	Calculate species diversity indices (e.g., Simpson's index, Shannon-Wiener index) for different communities.	01
12.	Explore properties of minerals: Hardness test, Streak test, lustre test, cleavage and fracture test.	
13.	Compare traditional and modern agricultural practices regarding their environmental impacts and productivity.	01
14.	Identify and draw relief features shown as contour lines on a topographic sheet and correlate them with watersheds	01
15.	Study of types of drainage patterns and their geomorphological significance	01
16.	Determination of the rooftop rainwater harvesting potential of a college campus building	01
17.	Determination of density and water-holding capacity of soil samples	01
18.	Determination of soil salinity of collected soil samples	01
19.	Visit the Nature Interpretation / Information Centre.	01
20.	Visit the National Park / Wildlife Sanctuary to study Wildlife & various interspecific & Intraspecific Relations.	01

Note: Conduct any 15 practicals from the above list

S.Y.B.Sc. Environmental Science (Semester-III)
Option 1
Course Category: Vocational Skill Courses (VSC)
Course Code – EVS 221 VSC
Course Title: Water Quality Analysis

[No. of Credits: 2 C] **[No. of Lectures: 30 L**

Objectives:

1. To understand the fundamental concepts of water quality, its importance, and its impact on human health and the ecosystem.
2. To learn techniques for water sampling, preservation, and maintaining sample integrity during analysis.
3. To gain knowledge of physical and chemical water quality parameters and their analysis methods.
4. To explore biological indicators and microbiological techniques used for water quality assessment.
5. To examine national and international water quality standards and their role in ensuring water safety and sustainability.

Course Outcome:

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

1. Identify and explain the various aspects of water quality, including physical, chemical, and biological parameters.
2. Demonstrate proficiency in water sampling techniques and preservation methods to ensure accurate analysis.
3. Analyse and interpret water quality data using appropriate physical, chemical, and biological assessment techniques.
4. Evaluate the significance of microbiological indicators and apply enumeration methods for detecting contamination.
5. In real-world scenarios, compare and apply national (BIS) and international (WHO, US EPA) water quality standards.

Sr.No.	Name of Unit	Content	Lecture
1	**Introduction to Water Quality**	• **Basic Concepts:** Definition of water quality, its importance, and significance in human health and ecosystem well-being, Physical, chemical and biological aspects of water quality • **Water Sources:** Water cycle, Surface Water (Ocean, Sea, Lakes, Rivers, Streams), Ground Water (Aquifers, Wells, Springs), Glaciers and Ice Caps • **Water Use and Contamination:** Drinking, industrial, agricultural, and recreational uses, Sources of water pollution (point and non-point sources)	06
2	**Sampling and Preservation of Water Samples**	• **Sampling Techniques:** Collecting water samples from different sources (surface water, groundwater, and wastewater). • **Sample Preservation:** Proper handling, storage, and preservation methods to maintain sample integrity. • **Sample Containers**: Types of containers used for different water parameters. • **Chain of Custody:** Documentation and maintenance of	06

		the chain of custody to ensure sample authenticity.	
3	**Physical and Chemical Analysis of Water**	**Physical Parameters**: Temperature, colour, and odour of water Turbidity and its measurement (Nephelometric and Jackson methods), Electrical conductivity (EC) and total dissolved solids (TDS) **pH and Alkalinity:** Concept of pH and its Significance, Measurement technique, types and estimation of alkalinity **DO and Hardness**: importance of DO, Factors affecting, Estimation; Types of hardness, estimation and effects on domestic and industrial use Chloride, sulfates, nitrates and Phosphates: Significance, methods of determination, importance and environmental impacts, **Heavy Metals:** sources effects of heavy metals (lead, mercury, arsenic etc.,) method of analysis (AAS, ICP-MS, Colorimetric	08
4	**Biological Analysis of Water**	Overview of microbiological and biological indicators, sources of contamination, importance of biological analysis Concept of indicator, total coliform, faecal coliform and Escherichia coli, sampling, storage and handling of water samples, Enumeration methods: MPN, Spread plate and pure plate technique.	5
5	**Water Quality Standards and Regulations**	Definition and importance of water quality standards, categories of water quality: drinking, industrial, agricultural and recreational use, global and regional perspective Major Organization and Guidelines: World Health Organization (WHO), United States Environmental Protection Agency (US EPA), Bureau of Indian Standards (BIS) Comparison of international and national water quality standards	5

References:

1. Standard Methods for the Examination of Water and Wastewater" by APHA, AWWA, WEF
2. Garg, S. K. (2008). Water supply engineering. Khanna Publishers.
3. Bureau of Indian Standards (BIS). (2012). IS 10500:2012 – Drinking water specification.
4. Central Pollution Control Board (CPCB). (2017). Water quality criteria. Ministry of Environment, Forest and Climate Change.
5. Central Pollution Control Board (CPCB). (2017). Water quality criteria. Ministry of Environment, Forest and Climate Change. Retrieved from https://cpcb.nic.in/water-quality-criteria/
6. Ministry of Environment, Forest and Climate Change (MoEF&CC). (1986). The Environment (Protection) Rules, 1986. Retrieved from http://moef.gov.in

S.Y.B.Sc. Environmental Science (Semester-III)
Option 2
Course Category: Vocational Skill Courses (VSC)
Course Code – EVS 222 VSC
Course Title: Soil Quality Analysis

[No. of Credits: 2 C] **[No. of Lectures: 30 L]**

Objectives:

1. To Understand soil quality, indicators, and their impact on soil health.
2. To Master soil sampling methods.
3. To Analyze soil physical properties and their impact on quality.
4. To Analyze soil chemical properties for quality assessment.
5. To Evaluate soil biological health through microbial activity and biodiversity.

Course Outcome:

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

1. Identify key soil health indicators: physical, chemical, biological.
2. Apply proper soil sampling methods.
3. Evaluate soil physical properties and their effects.
4. Analyze soil chemical properties and interpret results.
5. Assess biological health using microbial activity and biodiversity.

Unit No.	Name of the Unit	Contents	No. of Lectures
1	Introduction to Soil Quality	• Definition and Importance of Soil Quality • Components of Soil and Their Role in Quality • Indicators of Soil Health: Physical, Chemical, and Biological • Soil Degradation and Its Impact on Ecosystems • Overview of Sustainable Soil Management Practices	06
2	Soil Sampling and Preparation	• Methods of Soil Sampling: Random, Grid, and Systematic Sampling • Tools and Techniques for Soil Sample Collection • Soil Sample Preparation: Drying, Grinding, and Sieving • Sampling for Specific Analyses: Nutrient, Contaminant, and Biological Testing • Sources of Errors in Soil Sampling and Handling	06
3	Soil Physical Properties and Analysis	• Texture, Structure, and Porosity of Soil • Bulk Density and Water Holding Capacity • Soil Compaction and Its Effects on Quality • Measurement of Soil Moisture and Infiltration Rates • Laboratory and Field Techniques for Physical Property Analysis	06

4	Soil Chemical Properties and Analysis	• Soil pH, Electrical Conductivity, and Salinity • Macro and Micronutrients: Nitrogen, Phosphorus, Potassium, and Trace Elements • Cation Exchange Capacity (CEC) and Base Saturation • Soil Organic Matter and Carbon Sequestration • Heavy Metal Contamination and Remediation Strategies	06
5	Soil Biological Properties and Quality Assessment	• Role of Soil Microorganisms in Nutrient Cycling • Microbial Biomass and Activity Indicators • Enzymatic Activities as Soil Health Indicators • Methods for Assessing Soil Biodiversity • Integrated Soil Quality Assessment Frameworks	06

Reference Books -

1. Soil Quality and Sustainable Agriculture by R. Lal and B.A. Stewart
2. Soil Sampling and Methods of Analysis (2nd Edition) edited by M.R. Carter and E.G. Gregorich
3. Soil Chemical Methods: Australasia by George E. Rayment and David J. Lyons
4. Methods of Soil Analysis, Part 3: Chemical Methods by Donald L. Sparks et al.
5. Soil Microbiology, Ecology, and Biochemistry (4th Edition) by Eldor A. Paul
6. The Soil and Its Microbes by Selman A. Waksman
7. Soil Fertility and Fertilizers (8th Edition) by John L. Havlin et al.
8. Soil Physics with Python: Transport in the Soil-Plant-Atmosphere System by Marco Bittelli, Gaylon S. Campbell, and Fausto Tomei

S.Y.B.Sc. Environmental Science (Semester-III)
Course Category: FP/OJT/CEP
Course Code – EVS 231 FP
Course Title: Field Project and Report Writing

[No. of Credits: 2 C] **[No. of Lectures: 30 L]**

Objectives:

1. To provide hands-on experience in applying environmental science knowledge to real-world field settings.
2. To develop skills in planning, executing, and scientifically reporting field-based environmental studies.
3. To enhance skills in scientific observation, data collection, analysis, interpretation, and communication.

Course Outcome:

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

1. Demonstrate the ability to organise and conduct field visits effectively.
2. Analyse and interpret environmental data collected from field visits.
3. Produce detailed, well-structured, and technically sound reports.
4. Apply observational skills to identify environmental challenges and propose solutions.
5. Utilize field visit experiences to evaluate theoretical concepts critically.
6. Communicate findings clearly through professional reporting formats.

Field Project Requirements:

1. **Identification and Planning:** At the beginning of the term, each field project must be identified and planned with detailed information regarding the date, time, location, mode of transportation, and any expenses that students need to bear. Before starting the work, students must submit a field project proposal, mentioning the objectives, site details, methodology, and expected outcomes. This ensures the project work is well-organised and meaningful regarding learning and practical exposure.
2. **Group Formation:** Students will work in groups for the field project. The group size must align with the requirements and scope of the project, and each group should have a minimum of four and a maximum of six students. Group formation will be done based on the nature of the field study to ensure effective teamwork and proper distribution of responsibilities among all members.
3. **Field Work Duration:** Each group must complete either seven full days or fifteen part-time days of fieldwork. The fieldwork can either be independently conducted or carried out at recognized institutions, research centers, NGOs, industries, farms, or government organizations. If conducted in collaboration with an institution, students must submit a certificate of completion or provide photographic evidence as part of their final project report.
4. **Role and Responsibility Documentation:** The project methodology section must clearly define the specific role and contribution of each group member. This will ensure transparency, help in evaluating individual efforts, and encourage accountability within the team. Proper documentation of individual tasks is essential for a fair assessment during the internal and external evaluations.
5. **Project Report Submission:** The comprehensive project report must be prepared systematically, with a minimum word count of 5,000 words, and should be submitted hand written (College Need to provide Project Book) or in printed and bound form.

The report must include appropriate charts, graphs, photographs, tables, maps, and any other relevant material that supports the findings. The submission must adhere to the timeline communicated by the department, and late submissions may not be entertained.

6. **Originality of Work:** It is mandatory that the project work is original and completed using the students' resources and understanding. No part of the project should be plagiarized or copied from existing reports. Students must submit a declaration certificate affirming the originality of their work along with the project report. Any violation of originality norms will lead to the report's rejection and loss of credits.

Structure of Project Report:

- Title Page
- Certificate by Guide/Institution
- Student Declaration Certificate
- Acknowledgment
- Abstract
- Table of Contents
- List of Figures, Tables, and Photographs
- Chapter 1: Introduction: Background, problem statement, objectives, scope of the study.
- Chapter 2: Review of Literature
- Chapter 3: Materials and Methods: Description of field sites, Sampling methods and techniques used, Safety and ethical considerations, team members' roles.
- Chapter 4: Results Presentation of collected data (graphs, tables, images).
- Chapter 5: Discussion, Interpretation, and implications of results.
- Chapter 6: Conclusion and Recommendations: Summary of findings, Suggestions for future work or applications.
- References/Bibliography
- Appendices: Logbook entries, additional photos, fieldwork certificates, etc.

Evaluation Scheme:

Internal Evaluation (15 Marks)

Parameter	Marks
Area/Topic Selection	5
Regular Fieldwork and Follow-up	10

External Evaluation (35 Marks)

Parameter	Marks
Project Report	15
Logbook/Record Book	10
Viva-Voce (Oral Examination)	10

S.Y.B.Sc. Environmental Science (Semester-III)

Course Category: Minor Subject
Course Code – EVS 241 MN
Course Title: Environmental Microbiology
[No. of Credits: 2 C] **[No. of Lectures: 30 L]**

Objectives:

1. To introduce students to the role of microorganisms in the environment.
2. To understand the diversity and classification of environmental microorganisms.
3. To explore the ecological principles underlying microbial communities in various ecosystems.
4. To investigate the significance of microorganisms in biogeochemical cycles.
5. To study the applications of environmental microbiology in waste treatment, bioremediation, and environmental monitoring.
6. To highlight the relationship between human activities and microbial health in the environment.

Course Outcome:

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

1. Students will demonstrate an understanding of the role of microorganisms in environmental processes and ecosystems.
2. Students will identify and classify various microorganisms based on their environmental function.
3. Students will analyze the microbial mechanisms involved in nutrient cycling and waste degradation.
4. Students will evaluate the impact of microorganisms in natural and polluted environments.
5. Students will apply environmental microbiology concepts in real-world contexts such as pollution control, waste management, and bioremediation.
6. Students will develop practical skills in laboratory techniques for studying environmental microbes.

Unit No.	Name of the Unit	Contents	No. of Lectures
1	Introduction to Environmental Microbiology	• Microorganisms in the Environment: Definition, classification, and role of microorganisms in environmental processes. • Microbial Ecology: Microbial habitats, interactions between microorganisms, and environmental factors influencing microbial growth. • The Microbial World: Diversity of microorganisms in air, water, soil, and extreme environments. • Techniques for Studying Environmental Microorganisms: Methods for isolating and identifying microorganisms from environmental samples.	06

		• Tools for Environmental Microbiology: Microscopy, cultivation techniques, molecular methods, and biosensors.	
2	Microorganisms in Biogeochemical Cycles	• Nutrient Cycles: Nitrogen, carbon, sulfur, phosphorus, and oxygen cycles. • Microbial Role in Carbon Cycle: Role of microbes in carbon fixation, fermentation, and respiration. • Nitrogen Cycle and Microbial Involvement: Nitrogen fixation, denitrification, and nitrification processes. • Microbes and the Sulfur Cycle: Sulfur reduction, oxidation, and microbial diversity in the sulfur cycle. • Phosphorus Cycle: Phosphorus mobilization and microbial interactions.	06
3	Microorganisms in Water, Soil, and Air	• Microbial Communities in Water: Freshwater, marine, and wastewater ecosystems. • Soil Microbiology: Soil microbial diversity, rhizosphere microorganisms, and their role in soil fertility. • Airborne Microorganisms: Types of microorganisms in the atmosphere, microbial dispersal, and environmental conditions. • Microorganisms in Extreme Environments: Extremophiles in hot springs, salt flats, deep-sea, and polar regions. • Water Quality and Microbial Indicators: Waterborne diseases, microbial indicators of water quality, and microbial pollution.	06
4	Environmental Pollution and Microbial Solutions	• Types of Environmental Pollution: Air, water, soil, and noise pollution. • Microbial Degradation of Organic Pollutants: Biodegradation of hydrocarbons, pesticides, and industrial wastes. • Bioremediation: Principles of bioremediation, techniques, and applications in soil and water cleanup. • Microorganisms in Wastewater Treatment: Role of microorganisms in wastewater treatment plants and solid waste management. • Environmental Monitoring: Use of microorganisms in monitoring environmental pollution and ecosystem health.	06
5	Applied Environmental Microbiology	• Biotechnology and Environmental Microbiology: Genetic engineering in microbial processes for environmental applications.	06

		• Microbial Fuel Cells and Renewable Energy: Applications in sustainable energy production using microbial processes. • Microbial Ecology in Climate Change: Microbial responses to global warming and their role in carbon sequestration. • Health and Safety in Environmental Microbiology: Safety protocols for working with environmental samples and microbes. • Future Trends in Environmental Microbiology: Nanotechnology, synthetic biology, and emerging areas in environmental microbiology.	

Reference Books -

1. Environmental Microbiology by Ian L. Pepper, Charles P. Gerba, and Terry J. Gentry
2. Environmental Microbiology: From Wastewater Treatment to Bioremediation" by Maulin P. Shah
3. Microbial Ecology: Fundamentals and Applications by Ronald M. Atlas and Richard Bartha
4. Microorganisms and the Environment by K. Subba Rao
5. Introduction to Environmental Microbiology by B. M. Baziuk and V. N. Panteleeva
6. Environmental Microbiology: Methods and Protocols by Maureen S. P. Lantagne and William J. D. Hamilton
7. Applied Microbiology and Environmental Biotechnology by G. N. Babu
8. Environmental Biotechnology: Principles and Applications by Niranjan Karunanidhi

S.Y.B.Sc. Environmental Science (Semester-III)

Course Category: Minor Subject

Course Code – EVS 242 MNP

Course Title: Practical Based on EVS 242 MN

[No. of Credits: 2 C] **[No. of Lectures: 60 L]**

Objectives:

1. To familiarize students with the fundamental techniques of environmental microbiology.
2. To develop practical skills in isolating and identifying microorganisms from different environments.
3. To understand the role of microorganisms in various ecological processes.
4. To enable students to analyze microbial diversity and their ecological interactions.
5. To study the application of microbiological techniques in environmental management.
6. To equip students with skills for conducting microbiological research and analysis.

Course Outcome:

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

1. Perform basic and advanced microbiological techniques relevant to environmental science.
2. Identify and isolate microorganisms from various environmental samples.
3. Analyze microbial interactions in different ecosystems.
4. Evaluate the role of microbes in biodegradation and bioremediation.
5. Apply microbiological methods to study water, air, and soil quality.
6. Demonstrate competence in maintaining and handling microbial cultures.

Sr. No.	Description	Practical Sessions
1.	Introduction to Laboratory Practices and Safety Guidelines in Environmental Microbiology	01
2.	Preparation and Sterilization of Culture Media for Microbial Growth	01
3.	Study of Sterilization Techniques: Autoclaving, Filtration, and Chemical Methods	01
4.	Microscopic Examination of Bacterial Cells	01
5.	Isolation of Microorganisms from Environmental Samples Using Streak Plate, Spread Plate, and Pour Plate Techniques	01
6.	Gram Staining for Differentiation of Gram-Positive and Gram-Negative Bacteria	01
7.	Observation of Bacterial Motility Using the Hanging Drop Technique	01
8.	Enumeration of Microorganisms Using Serial Dilution and Total Viable Count Methods	01
9.	Isolation and Identification of Soil Microflora: Bacteria	01
10.	Analysis of Airborne Microflora Using Air Sampling Techniques	01
11.	Microbiological Analysis of Water Using Most Probable Number (MPN) Technique	01
12.	Effect of pH on Microbial Growth	01
13.	Biochemical Characterization of Bacteria: IMViC Tests	01
14.	Demonstration of the Effect of Salt on Microbial Growth	01

15.	Effect of Temperature on Microbial Growth	01
16.	Study of Biofilm Formation and Its Characteristics Using Environmental Samples	01
17.	Observation of Microbial Degradation of Organic Matter in Composting Processes	01
18.	Role of Microorganisms in Bioremediation: Oil Degradation and Heavy Metal Reduction	01
19.	Study of Microbial Interactions: Symbiosis, Mutualism, and Antagonism	01
20.	Field Sampling and Microbial Analysis of Soil, Water, and Air Samples	01

Reference Books -

1. Pelczar, M.J., Chan, E.C.S., & Krieg, N.R. (1993). Microbiology: Concepts and Applications. McGraw-Hill.
2. Prescott, L.M., Harley, J.P., & Klein, D.A. (2002). Microbiology. McGraw-Hill Education.
3. Atlas, R.M. (1997). Principles of Microbiology. McGraw-Hill.
4. Madigan, M.T., Martinko, J.M., Bender, K.S., Buckley, D.H., & Stahl, D.A. (2015). Brock Biology of Microorganisms. Pearson.
5. Tortora, G.J., Funke, B.R., & Case, C.L. (2013). Microbiology: An Introduction. Pearson.
6. Cappuccino, J.G., & Sherman, N. (2008). Microbiology: A Laboratory Manual. Pearson.
7. Maier, R.M., Pepper, I.L., & Gerba, C.P. (2009). Environmental Microbiology. Academic Press.
8. Willey, J.M., Sherwood, L.M., & Woolverton, C.J. (2017). Prescott's Microbiology. McGraw-Hill.

S.Y.B.Sc. Environmental Science (Semester-III)
Course Category: Generic Elective / Open Elective
Option 1
Course Code – OE 201 EVS
Course Title: Natural Calamities

[No. of Credits: 2 C] **[No. of Lectures: 30 L]**

Objectives:

1. Reduce the risk of natural calamities through infrastructure improvements
2. Minimize environmental degradation to reduce the frequency or severity of events
3. Educate and train communities on disaster readiness and safety protocols.
4. Develop and rehearse emergency response plans.
5. Provide immediate medical care, shelter, and food to victims.
6. Restore livelihoods and local economies.

Course Outcome:

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

1. Understanding Natural Calamities
2. Risk Assessment and Vulnerability Analysis
3. Response and Recovery
4. Policy and Legal Frameworks
5. Community Involvement and Education
6. Technological and Scientific Applications

Unit No.	Name of the Unit	Contents	No. of Lectures
1	**Introduction to Natural Calamities**	• **Overview of Natural Calamities**: Definition, types, and classification (geological, meteorological, hydrological, biological). • **Causes and Impacts:** Natural and anthropogenic causes. Short-term and long-term impacts on human life, infrastructure, economy, and ecosystems. • **Case Studies:** Examples of significant natural disasters (e.g., Indian Ocean Tsunami, Hurricane Katrina, Nepal Earthquake).	06
2	**Disaster Risk Assessment and Vulnerability Analysis**	• **Risk and Vulnerability:** Concepts of hazard, risk, vulnerability, and resilience. Methods for assessing risk and vulnerability in different regions. • **Geographical and Climatic Factors:** Role of geography, climate, and human settlement patterns in disaster risk. • **Tools and Techniques:** GIS, remote sensing, and data analysis for hazard mapping and monitoring	06

3	**Disaster Preparedness and Mitigation Strategies**	• **Preparedness Planning:** Community-based disaster preparedness. Early warning systems and communication. • **Mitigation Measures:** Structural and non-structural measures. Sustainable urban planning and infrastructure development. • **Role of Technology:** Innovations in disaster prediction, monitoring, and management.	06
4	**Response, Recovery, and Rehabilitation**	• **Emergency Response:** Incident response systems, search and rescue operations, and emergency services. Coordination among stakeholders (government, NGOs, and communities). • **Recovery and Rehabilitation:** Post-disaster reconstruction and rehabilitation. Psychological and social aspects of recovery. • **Disaster Financing:** Insurance, aid, and funding mechanisms for disaster recovery.	06
5	**Policies, Ethics, and Global Perspectives**	• **Disaster Management Frameworks:** National and international policies (e.g., Sendai Framework, UNDRR, NDMA guidelines). Role of government and international organizations in disaster management. • **Ethical Considerations:** Equity, inclusiveness, and human rights in disaster management. • **Climate Change and Global Challenges:** Linkages between climate change and the frequency/intensity of disasters. Global efforts to mitigate disaster risks and build resilience.	06

Reference Books -

1. "Natural Disasters" by Patrick L. Abbott
2. "Disaster Management and Preparedness" by Larry Collins
3. "Environmental Hazards: Assessing Risk and Reducing Disaster" by Keith Smith
4. "Introduction to Natural and Man-Made Disasters and Their Effects on Buildings" by Roxanna McDonald
5. "Earthquake Engineering: From Engineering Seismology to Performance-Based Engineering" by Yousef Bozorgnia and Vitelmo V. Bertero
6. "Earthquakes and Geological Discovery" by Bruce A. Bolt
7. "The Physics of Tsunamis" by Fredric Raichlen
8. "Volcanoes: Global Perspectives" by John P. Lockwood and Richard W. Hazlett

S.Y.B.Sc. Environmental Science (Semester-III)
Course Category: Generic Elective / Open Elective
Option 2
Course Code – OE 202 EVS
Course Title: Ecotourism

[No. of Credits: 2 C] **[No. of Lectures: 30 L]**

Objectives:

1. Protect and preserve natural ecosystems, wildlife, and biodiversity.
2. Promote the restoration of degraded natural habitats.
3. Increase awareness and appreciation of natural and cultural heritage among tourists.
4. Educate visitors about environmental conservation and sustainable practices.
5. Encourage responsible behaviour and advocacy for environmental stewardship.
6. Monitor the environmental and social effects of tourism to guide future practices.

Course Outcome:

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

1. Define and explain the core principles and concepts of ecotourism, differentiating it from other forms of tourism.
2. Analyze the historical development and current trends in ecotourism at a global scale.
3. Evaluate the role of ecotourism in biodiversity conservation and environmental sustainability.
4. Develop ethical strategies to ensure responsible behavior by stakeholders.
5. Conduct carrying capacity analyses and propose sustainable tourism development plans.
6. Participate in field visits and apply theoretical knowledge to real-world ecotourism settings.

Unit No.	Name of the Unit	Contents	No. of Lectures
1	Introduction to Ecotourism	• **Definition and Concepts** Ecotourism vs. Mass Tourism, Principles of Ecotourism, Sustainable Tourism Framework • **Historical Development** Evolution of Ecotourism, Global Trends and Growth • **Key Stakeholders** Governments, NGOs, Communities, and Tourists • **Benefits and Challenges** Environmental, Social, and Economic Dimensions	06
2	Environmental Aspects of Ecotourism	• **Biodiversity and Conservation** Role of Ecotourism in Biodiversity Protection, Conservation Areas and National Parks • **Environmental Impact Assessment (EIA)** Tools and Techniques for Minimizing Impact Carbon Footprint of Tourism Activities	06

		• **Eco-friendly Practices** Renewable Energy, Waste Management, and Green Infrastructure	
3	Socio-Cultural Dimensions of Ecotourism	• **Community Involvement** Empowerment and Participation of Local Communities, Capacity Building and Skill Development • **Cultural Preservation** Protecting Indigenous Cultures and Traditions Avoiding Cultural Commodification • **Ethics in Ecotourism** Responsible Behaviour of Tourists and Operators, Codes of Conduct	06
4	Ecotourism Planning and Management	• **Planning and Development** Destination Planning and Zoning, Carrying Capacity Analysis • **Marketing and Promotion** Branding and Positioning of Ecotourism Destinations, Role of Digital Media in Ecotourism Promotion • **Policy and Governance** International Guidelines and Standards (e.g., UNWTO, GSTC), Local Policies and Regulations	06
5	Case Studies and Emerging Trends	• **Global Case Studies** Successful Ecotourism Destinations (e.g., Costa Rica, Bhutan, Kenya), Lessons from Failed Ecotourism Projects • **Emerging Trends** Adventure Ecotourism, Wellness and Agro-tourism, Climate Change and Ecotourism Adaptation • **Future of Ecotourism** Technology Integration (e.g., Virtual Tours, AI in Tourism) Balancing Growth with Sustainability.	06

Reference Books -

9. "Ecotourism: Principles and Practices" by David A. Fennell
10. "Ecotourism and Sustainable Development: Who Owns Paradise?" by Martha Honey
11. "Sustainable Tourism: A Global Perspective" by Rob Harris, Tony Griffin, and Peter Williams

12. "The Business of Ecotourism" by Carol Patterson.
13. "Tourism and Sustainability: Development, Globalisation and New Tourism in the Third World" by Martin Mowforth and Ian Munt
14. "Managing Sustainable Tourism: A Legacy for the Future" by David L. Edgell Sr.
15. "The Practice of Sustainable Tourism: Resolving the Paradox" by Michael Hughes, David Weaver, and Christof Pforr.

S.Y.B.Sc. Environmental Science (Semester-III)
Course Category: Indian Knowledge System
Course Code – IKS 201 EVS
Course Title: Indian Culture and Environment

[No. of Credits: 2 C] **[No. of Lectures: 30 L]**

Objectives:

1. To understand the relationship between Indian culture and the environment.
2. To explore traditional ecological knowledge and practices in Indian culture.
3. To critically analyze the role of Indian philosophies, religions, and lifestyles in environmental conservation.
4. To examine how Indian rituals, festivals, and art forms contribute to environmental awareness.
5. To explore the sustainable practices embedded in Indian culture.
6. To provide students with a deeper understanding of Indian heritage in relation to contemporary environmental challenges.

Course Outcome:

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

1. Identify key components of Indian culture that impact environmental sustainability.
2. Explain the traditional ecological knowledge systems prevalent in Indian society.
3. Understand the role of Indian philosophies like Hinduism, Buddhism, Jainism, and others in shaping environmental values.
4. Evaluate the significance of Indian rituals and festivals in fostering environmental consciousness.
5. Discuss the challenges of integrating traditional cultural practices with modern environmental management strategies.
6. Propose solutions inspired by Indian cultural values to address current environmental issues.

Unit No.	Name of the Unit	Contents	No. of Lectures
1	Introduction to Indian Culture and Environment	• Concept of Indian Culture: Philosophy, Religion, Art, and Society. • The link between culture and environment in Indian society. • Indian worldview on nature: Harmony, Interconnectedness, and Sustainability. • Case studies: Traditional ecological knowledge systems.	06
2	Traditional Ecological Knowledge and Practices	• Indigenous practices for resource management in agriculture, water conservation, and forest management. • Role of indigenous communities in maintaining biodiversity. • Sacred groves, sacred rivers, and their environmental significance. • Forest and wildlife protection systems in Indian	06

		traditions.	
3	Environmental Values in Indian Religions and Philosophies	• Hinduism: Reverence for nature, sacred places, animals, and rivers. • Buddhism: Environmental ethics and the principle of Ahimsa (non-violence). • Jainism: Ecological consciousness and the practice of non-harm in nature. • Sikhism and Islam: Environmental consciousness in their teachings. • Comparison and integration of these religious perspectives on the environment.	06
4	Festivals, Rituals, and Environmental Awareness	• Significance of Indian festivals like Diwali, Ganesh Chaturthi, and Makar Sankranti in relation to the environment. • Rituals and customs promoting environmental conservation (planting trees, water conservation, etc.). • Eco-friendly practices in traditional Indian lifestyles. • Impact of modernization on traditional practices.	06
5	Contemporary Issues and Sustainable Solutions Inspired by Indian Culture	• Modern environmental challenges: Urbanization, pollution, and resource depletion. • Sustainable models for urban living, based on traditional Indian wisdom. • Integrating cultural practices with modern environmental management strategies. • Case studies: Successful environmental projects based on Indian cultural practices.	06

Reference Books -

1. K. K. Aziz, The Indian Environment: A Study of Ecology and Culture
2. A. K. Sharma, Traditional Knowledge for Environmental Conservation in India
3. R. K. P. Ghosh, Indian Culture and Environmental Issues
4. S. C. Bhatt, Indian Religions and Environmental Ethics
5. S. R. Das, Indian Environmental Philosophy
6. N. R. Narayan, Sustainable Development in Indian Context
7. K. S. Katiyar, Cultural Heritage of India and Its Environmental Impact
8. P. R. Trivedi, Eco-Friendly Practices in Indian Rituals

S.Y.B.Sc. Environmental Science (Semester-IV)

Course Category: Major Core Theory

Course Code – EVS 251 MJ

Course Title: Biodiversity Conservation

[No. of Credits: 2 C] **[No. of Lectures: 30 L]**

Objectives:

1. Understand the richness of biodiversity globally and in India.
2. Understand the importance and types of biodiversity.
3. Analyse threats to biodiversity and formulate conservation strategies.
4. Apply modern biotechnology tools to conserve genetic resources.
5. Engage communities in sustainable resource use and conservation.
6. Enhance awareness and public participation in biodiversity protection

Course Outcome:

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

1. Identifying and assessing biodiversity richness.
2. Develop skills to restore and manage degraded ecosystems.
3. Knowledge of implementing conservation policies.
4. Ability to integrate biotechnological innovations in conservation efforts.
5. Capacity to conduct biodiversity-related education and outreach.
6. Understand the

Unit No.	Name of the Unit	Contents	No. of Lectures
1	**Introduction to Biodiversity**	• Concepts and definitions: Genetic, species, and ecosystem diversity • Mapping of global and national biodiversity hotspots and biogeographical zones globally and nationally. • Importance of biodiversity in ecosystems • Key challenges and threats to biodiversity due to anthropogenic activities.	06
2	**Conservation Strategies and Policies**	• **In-situ conservation**: Protected areas, national parks, biosphere reserves • **Ex-situ conservation:** Gene banks, botanical gardens, zoos • International and national conservation policies and laws mitigation policies to combat climate change. • Role of organizations like IUCN, WWF, UNEP	06
3	**Ecosystem Restoration and Management**	• Principles and practices of ecosystem restoration • Case studies on successful ecosystem recovery • Community participation in biodiversity management • Study species migration and habitat shifts. • Techniques for habitat restoration	06

4	**Role of Biotechnology in Biodiversity Conservation**	• Genetic modification and biodiversity • Conservation of genetic resources through modern techniques. • Applications in agriculture and conservation biology. • Identify traditional practices that enhance conservation.	06
5	Education and Public Awareness	• Environmental education and biodiversity awareness campaigns. • Community-based conservation initiatives. • Role of media and NGOs in promoting conservation. • Describe the linkage between climate change and biodiversity loss. • Formulate strategies for climate adaptation in ecosystems.	06

Reference Books -

1. Primack, R.B. Essentials of Conservation Biology.
2. Sharma, P.D. Ecology and Environmental Science.
3. Wilson, E.O. The Diversity of Life.
4. Krishnamurthy, K.V. Textbook on Biodiversity.
5. An, S., & Verhoeven, J.T. Wetlands: Ecosystem Services, Restoration, and Wise Use.
6. Santra S. C. Environmental Science.

S.Y.B.Sc. Environmental Science (Semester-IV)

Course Category: Major Core Practical

Course Code – EVS 253 MJP

Course Title: Pollution Control Technology

[No. of Credits: 2 C] **[No. of Lectures: 30 L]**

Objectives:

1. To understand the principles and practices of pollution control in various environmental media.
2. To study the sources, types, and impacts of environmental pollutants.
3. To analyze the design and operation of pollution control technologies.
4. To explore regulatory frameworks and their role in pollution management.
5. To assess monitoring methods for air, water, soil, and noise pollution.
6. To develop sustainable and innovative solutions for pollution control.

Course Outcome:

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

1. Demonstrate an understanding of pollution control technologies and their applications.
2. Identify sources and impacts of pollutants on the environment and human health.
3. Apply scientific methods for pollution monitoring and assessment.
4. Design and evaluate systems for waste and pollution management.
5. Advocate for sustainable practices and policy compliance in pollution control.
6. Utilize modern tools and technologies to innovate solutions for environmental challenges.
7.

Unit No.	Name of the Unit	Contents	No. of Lectures
1	**Fundamentals of Pollution and Its Control**	• Definitions, sources, and types of pollution: air, water, soil, noise, and hazardous waste. • Impacts of pollution on ecosystems, biodiversity, and human health. • Basic concepts of environmental chemistry and pollution pathways. • Overview of integrated pollution control and management strategies. • Historical perspectives and the evolution of pollution control technologies.	06
2	**Air and Noise Pollution Control**	• Air pollutants: sources, effects, and atmospheric reactions (e.g., smog, acid rain). • Technologies for air pollution control: scrubbers, filters, electrostatic precipitators, and biofilters. • Noise pollution: sources, effects, and regulatory standards. • Techniques for noise control: barriers, insulation, and urban planning.	06

		Case studies on air and noise pollution mitigation	
3	**Water and Wastewater Management**	• Sources and characteristics of water pollution. • Techniques for water treatment: sedimentation, filtration, aeration, and adsorption. • Biological treatment of wastewater: activated sludge, trickling filters, and anaerobic digesters. • Advanced water treatment technologies: membrane filtration, reverse osmosis, and UV disinfection. • Case studies on wastewater management and reuse.	06
4	**Solid and Hazardous Waste Management**	• Classification and sources of solid and hazardous waste. • Waste management hierarchy: reduce, reuse, recycle. • Technologies for waste treatment: composting, incineration, and landfill management. • Hazardous waste treatment: stabilization, solidification, and secure landfill design. • Case studies on integrated waste management systems.	06
5	**Environmental Impact Assessment and Risk Management**	• Principles and processes of Environmental Impact Assessment (EIA). • Components of EIA: screening, scoping, and impact prediction. • Risk assessment for ecological and human health impacts of pollution. • Environmental Management Plans (EMP) and ISO 14001 standards. • Role of public participation in environmental decision-making	06

Reference Books -

1. Tchobanoglous, G., et al. (2003). Wastewater Engineering: Treatment and Reuse. McGraw-Hill.
2. Metcalf & Eddy. (2013). Water and Wastewater Engineering. Tata McGraw-Hill.
3. Masters, G.M. (2003). Introduction to Environmental Engineering and Science. Prentice Hall.
4. Kreith, F., & Tchobanoglous, G. (2002). Handbook of Solid Waste Management. McGraw-Hill.
5. Canter, L.W. (1996). Environmental Impact Assessment. McGraw-Hill.
6. de Nevers, N. (2000). Air Pollution Control Engineering. McGraw-Hill.

S.Y.B.Sc. Environmental Science (Semester-IV)

Course Category: Major Core Practical

Course Code – EVS 253 MJP

Course Title: Practical Based on EVS 251 MJ and EVS 252 MJ

[No. of Credits: 2 C] **[No. of Lectures: 60 L]**

Objectives:

1. To develop skills in biodiversity assessment
2. To understand pollution analysis techniques
3. To familiarize students with environmental impact assessment methodologies
4. To introduce sustainable practices
5. To enhance technical proficiency
6. To install an interdisciplinary approach

Course Outcome:

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

1. Aquent well with Biodiversity Monitoring:
2. Pollution analysis skill
3. Impact analysis and mitigation
4. Hands on field and lab techniques
5. Environmental data mapping and analysis
6. Sustainable environmental practices.

Sr. No.	Description	Practical Sessions
1.	To study the Tree Canopy Surveys of urban region	01
2.	Study migratory bird populations in wetlands (Visit)	01(1 day)
3.	Conduct the green audit of the campus	01
4.	To study the plant invasive species in lentic and lotic water bodies	01
5.	To study the wildlife corridors around your region (Visit)	01(1day)
6.	Study of zooplankton and phytoplankton in river water	01
7.	Study economy based on local fishery market.	01
8.	Species identification using morphological indices	01
9.	Flora and Fauna survey at an ecological site (visit)	01
10.	Assess the biodiversity of a project site and predict the potential impact of human activities.	01
11.	Study of the indoor air microflora	01
12.	Using a high-volume air sampler measure PM10 and PM2.5 concentrations.	01
13.	noise levels at different times and locations to create a noise map for an urban area.	01
14.	Study leachate from landfills for toxic chemicals and its impact on nearby soil and water.	01
15.	Estimation of organic matter in agricultural soil	01
16.	Extract and measure oil and grease levels in water samples using gravimetric analysis.	01
17.	Estimation of TS,TDS, TSS of given water sample	01
18.	Estimation of dust fall using collectors in different locations to measure the deposition rate of airborne particulate matter	01
19.	Mapping of air pollution index of given region	01
20.	Extraction heavy metals using acid digestion and analyze them with AAS	01

Reference Books -

1. Bombay Natural History Society (BNHS). (n.d.). Bombay Natural History Society: Conservation of nature since 1883.

2. Ministry of Environment, Forest and Climate Change (MoEFCC). (n.d.). Government of India: Ministry of Environment, Forest and Climate Change.
3. Central Pollution Control Board (CPCB). (n.d.). Central Pollution Control Board, Government of India.
4. National Biodiversity Authority (NBA). (n.d.). National Biodiversity Authority: Conserving India's biodiversity.
5. Indian Council of Agricultural Research (ICAR). (n.d.). Indian Council of Agricultural Research.
6. Sharma, P. D. (n.d.). *Ecology and Environment*. Rastogi Publications.
7. Rao,C.S. (n.d.) *Environmental Pollution Control Engineering*, New Age International Publication.
8.

S.Y.B.Sc. Environmental Science (Semester-IV)
Option 1
Course Category: Vocational Skill Courses (VSC)
Course Code – EVS 271 VSC
Course Title: Practicals Based on Water Quality Analysis

[No. of Credits: 2 C] **[No. of Lectures: 60 L]**

Objectives:

1. Understand key water quality parameters (physical, chemical, biological).
2. Develop hands-on skills in performing water quality tests.
3. Learn standard analytical methods (titration, spectrophotometry).
4. Master microbiological testing techniques for water contamination.
5. Gain proficiency in using instruments like pH meters, nephelometers, etc

Course Outcome:

1. Students will conduct tests for various water parameters like turbidity, pH, DO, and microbial contamination accurately.
2. Students will analyse test results and compare them to those of national and international water quality students. Students will operate instruments like pH meters, spectrophotometers, and AAS to accurately measure water quality parameters, which are safety and compliance standards.
3. Students will use microbiological methods such as MPN and spread plate techniques to identify and quantify pathogens in water.
4. Students will identify water contaminants and understand relevant water quality standards for health and environmental protection.

Sr. No.	Description	Practical Sessions
1.	Measure the temperature of water samples using a thermometer or digital probe.	01
2.	Determine turbidity using Nephelometric and Jackson Candle methods	01
3.	A conductivity meter will be used to calculate TDS in water samples.	01
4.	Measure pH using pH paper, a pH meter, or an indicator.	01
5.	Determine types of alkalinity (carbonate and bicarbonate) through titration.	01
6.	Use the Winkler method to estimate DO in water samples.	01
7.	Estimate calcium and magnesium hardness using the EDTA titration method.	01
8.	Perform argentometric titration to measure chloride concentration.	01
9.	Use the gravimetric or turbidimetric method to analyse sulfate levels.	01
10.	Analyse nitrate levels using UV spectrophotometry or the cadmium reduction method.	01
11.	Perform colourimetric analysis of phosphate using ammonium molybdate.	01
12.	Extract and quantify oil and grease using solvent extraction and gravimetry.	
13.	Analyse H□S levels using the methylene blue colourimetric method.	01
14.	Differentiate between volatile and non-volatile solids using the gravimetric method.	01
15.	Preparation of Water Samples for Atomic Absorption Spectroscopy (AAS)	01
16.	Perform spread plate technique to count heterotrophic bacteria in water samples.	01
17.	Use the Most Probable Number (MPN) method to estimate coliform bacteria.	01
18.	Collect and identify phytoplankton and zooplankton from water samples.	01
19.	Identify and quantify algae in eutrophic water samples.	01
20.		01

Note: Conduct any 15 practicals from the above list

Reference Books -

16. Standard Methods for the Examination of Water and Wastewater" by APHA, AWWA, WEF
17. Garg, S. K. (2008). Water supply engineering. Khanna Publishers.

18. Bureau of Indian Standards (BIS). (2012). IS 10500:2012 – Drinking water specification.
19. Central Pollution Control Board (CPCB). (2017). Water quality criteria. Ministry of Environment, Forest and Climate Change.
20. Central Pollution Control Board (CPCB). (2017). Water quality criteria. Ministry of Environment, Forest and Climate Change. Retrieved from https://cpcb.nic.in/water-quality-criteria/
21. Ministry of Environment, Forest and Climate Change (MoEF&CC). (1986). The Environment (Protection) Rules, 1986. Retrieved from http://moef.gov.in

S.Y.B.Sc. Environmental Science (Semester-IV)
Option 2
Course Category: Vocational Skill Courses (VSC)
Course Code – EVS 272 VSC
Course Title: Practical's based Soil Quality Analysis

[No. of Credits: 2 C] **[No. of Lectures: 30 L]**

Objectives:

1. Understand Soil Properties
2. Evaluate Soil Fertility
3. detect contamination, erosion risks, and degradation.
4. Identify nutrient deficiencies and support plant growth.
5. Learn soil testing methods and data interpretation.
6. Recommend improvements, suitable crops, and conservation practices.

Course Outcome:

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

1. Acquire practical skills in using tools and techniques for soil analysis.
2. Identify soil pollution and degradation, contributing to sustainable land-use practices.
3. Interpret soil analysis data to make informed decisions in agriculture, forestry, and environmental management.
4. Gain proficiency in laboratory and field methods for real-world applications.
5. Develop the ability to recommend soil amendments and sustainable practices based on test results.

Sr. No.	Description	Practical Sessions
1.	Determination of soil texture	01
2.	Measurement of bulk density and porosity.	01
3.	Assessment of soil water-holding capacity and permeability.	01
4.	Measurement of soil pH using a pH meter.	01
5.	Determination of soil electrical conductivity (salinity).	01
6.	Estimation of organic matter content using the Walkley-Black method.	01
7.	Determination of available nitrogen using the Kjeldahl method.	01
8.	Analysis of available phosphorus using the Olsen or Bray method.	01
9.	Estimation of available potassium using flame photometry.	01
10.	Assessment of cation exchange capacity (CEC) and base saturation.	01
11.	Detection of soil carbonate and bicarbonate content.	01
12.	Measurement of soil organic carbon content.	01
13.	Detection of heavy metals (e.g., lead, cadmium, arsenic) using atomic absorption spectroscopy (AAS).	01
14.	Collect and prepare soil samples for laboratory analysis.	01
15.	Testing for micronutrients (e.g., zinc, iron, manganese, copper) using spectrophotometry.	01
16.	Determination of aggregate stability using wet sieving.	01
17.	Measuring temperature at different depths using soil thermometers.	01
18.	Determination of Soil Color by Using Munsell Soil Colour Charts to classify soil.	01
19.	Field measurement of soil moisture using tensiometers or gravimetric methods.	01
20.	Detection of heavy metals (e.g., lead, cadmium, arsenic) using atomic absorption spectroscopy (AAS).	01

Reference Books -

22. Methods for Assessing Soil Quality (macy Ramy, stiffen mack)
23. Soil Science: Practical Methods Manual (.R. Petrenko and Ye.M. Berezhnyak,)
24. Manual on Practical Soil Physics (M. Madhan Mohan and P. Prabhu Prasadini)

25. Laboratory Methods for Soil Health Analysis
26. Soil and Plant Analysis: Practical Manual (ICAR)

S.Y.B.Sc. Environmental Science (Semester-IV)
Course Category: FP/OJT/CEP
Course Code – EVS 281 CPE
Course Title: Community Engagement Programme

[No. of Credits: 2 C] **[No. of Lectures: 30 L]**

Objectives:

1. To enhance awareness of rural and peri-urban environmental challenges.
2. To develop practical skills in addressing environmental issues through community engagement.
3. To understand the role of local communities in resource management and sustainability.
4. To foster empathy and social responsibility among students.
5. To apply classroom knowledge to solving environmental and socio-economic problems.
6. To promote the development of locally sustainable environmental practices.

Course Outcome:

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

1. Analyse the interplay between environmental and socio-economic factors in rural communities.
2. Develop practical solutions for community-based environmental challenges.
3. Understand the importance of local knowledge in environmental conservation.
4. Conduct environmental assessments within community contexts, including water, soil, and waste analysis.
5. Plan and execute projects that contribute to rural environmental sustainability.
6. Document findings and present actionable recommendations to stakeholders.

Instructions:

The Community Engagement Project (CEP) must be identified and finalised at the beginning of the term. It should include detailed information about the date, time, locations, means of transportation, and any fees for which students are responsible.

Students must submit a comprehensive project report based on their CEP activities, which will be evaluated as part of their credit requirements. The project report is considered the final output of the CEP course. The Comprehensive Project Report carries 2 credits and is assessed for 50 marks, divided into Internal Evaluation (15 marks) and External Evaluation (35 marks).

Two examiners will evaluate the report — one Internal Examiner (subject teacher) and one External Examiner (subject expert from outside the college). A Viva-voce examination will be conducted by a panel comprising both examiners.

General Guidelines for CEP Implementation:

1. Implementation Mechanism: The method of implementing the CEP course will be determined by the Department of Environmental Science. The department will centrally plan and supervise.

2. Collaborations and Tie-ups: The department should establish collaborations or tie-ups (via MoUs/LoIs) with relevant industries, environmental organisations, government agencies, NGOS, or research institutions, depending on the nature of the project work.

3. Involvement of Community Experts: Local experts such as environmental activists, rural farmers, forest officers, waste management entrepreneurs, tribal leaders, and community organisers should be involved as co-teachers or field resource persons. Their contributions must be acknowledged, compensated, and respected for their real-world expertise.

4. Departmental Coordination: CEP work must be strictly coordinated through the department. Students are not allowed to contact NGOS or organisations individually directly. All external communications must pass through the department for uniformity and official record-keeping.

5. Document Maintenance: The department should maintain comprehensive documentation for every batch of students, including:

a) Attendance records
b) Project proposals
c) CEP diaries/logbooks
d) Copies of MoUs/LoIs
e) Certificates of participation/completion
f) All correspondence related to project activities

Rules for CEP Work:

1. Group Formation and Size: Students will be assigned to groups based on the project theme. Each group should consist of a minimum of 4 students and a maximum of 6 students, depending on the nature and scope of the project.

2. Community Engagement Work Requirement: Each group must complete 7 full days or 15 part-time days of active community engagement work. Students must submit certificates of completion or photographic evidence in the final report if the fieldwork is conducted at a recognised institution or organisation.

3. Project Report Submission: Students must submit a printed and bound report with a minimum of 5,000 words. The report should be neatly organised and include charts, graphs, photographs, maps, and other relevant illustrations.

4. Role and Responsibility Documentation: The methodology section of the report must clearly outline the roles and responsibilities undertaken by each group member during the project.

5. Originality of Work: The CEP project must be completely original and based on the student group's work and analysis. Along with the project report, each group must submit a declaration certificate confirming that the work is original and has not been copied from other sources.

Sample Community Engagement Themes for Environmental Science:

a) Community-based solid waste management projects.
b) Awareness drives for water conservation and rainwater harvesting.
c) Biodiversity surveys and conservation education programs.
d) Tree plantation and survival monitoring projects.
e) Study and promotion of eco-friendly farming practices.
f) Urban composting and home waste segregation initiatives.
g) Energy conservation and solar energy adoption awareness in villages.

Evaluation Scheme:
Internal Evaluation (15 Marks)

Parameter	Marks
Area/Topic Selection	5
Regular Fieldwork and Follow-up	10

External Evaluation (35 Marks)

Parameter	Marks
Project Report	15
Logbook/Record Book	10
Viva-Voce (Oral Examination)	10

S.Y.B.Sc. Environmental Science (Semester-IV)
Option 1
Course Category:
Course Code – EVS 291 MN Solid Waste Management
Course Title: Solid Waste Management

[No. of Credits: 2 C] **[No. of Lectures: 30 L]**

Objectives:

1. To understand basic concepts of solid waste and its impacts on the environment and human health.
2. To study challenges and issues in the management of solid waste
3. To explore different waste management strategies to preserve the quality of the environment.
4. To understand the concept of waste-to-energy.

Course Outcome:

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

1. To identify various sources of solid waste
2. To be aware of the collection and transportation methods for solid waste
3. To analyse the impacts of solid waste disposal
4. To be mindful of the 4 R concept followed in everyday life.

Unit No.	Name of the Unit	Contents	No. of Lectures
1	Introduction to solid waste management	• Basic concepts and definitions • Types/ classification of solid waste – Commercial, Industrial, agricultural, municipal, Biomedical waste, institutional waste, Hazardous waste, E-waste • Sources of solid waste • Chemical composition of solid waste • Characteristics of solid waste – Physical, Chemical, Biological • General techniques for waste management	06
2	Impacts of solid waste	• Effects on Human health, environment, plants and animals. • Effect of solid waste disposal on aquatic life and water quality • Impact of E-Waste disposal on air, water and soil • Effects on soil quality and characteristics, groundwater pollution due to landfill leachate, surface water pollution	06
3	Collection and transportation of solid waste	• Methods for the collection of solid waste, tools, and equipment • Storage and segregation of solid waste • Different ways for the transportation of solid waste • Challenges and issues for the collection and transportation of solid waste • Role and responsibilities for society and public involvement	04

4	Disposal of solid waste	• Various techniques for disposal • Composting- principles, factors affecting composting, • Methods for composting – Manual composting (Bangalore and Indore method), Mechanical composting and vermicomposting • Landfill – Area method. Trench method, ramp method, sanitary landfill, advantages and disadvantages of landfills. • Thermal treatment – Incineration, pyrolysis • Products of the incineration process, advantages and disadvantages of thermal treatment.	08
5	Energy recovery from solid waste	• Waste-to-energy concept • Refuse-derived fuel (RDF); different WTE processes: combustion, pyrolysis, landfill gas (LFG) recovery, anaerobic digestion, gasification • Concept of Integrated Waste Management • 4 R strategies • Role of the Central Pollution Control Board and the Maharashtra Pollution Control Board for solid waste management.	06

Reference Books -

1. Blackman, W.C. 2001. Basic Hazardous Waste Management. CRC Press.
2. Zhu, D., Asnani, P.U., Zurbrugg, C., Anapolsky, S. & Mani, S. 2008. Improving Municipal Solid Waste Management in India. The World Bank, Washington D.C.
3. White, P.R., Franke, M. &Hindle P. 1995. Integrated Solid Waste Management: A Lifecycle Inventory. Blackie Academic & Professionals.
4. Prospects and perspectives of solid waste management, Hosetti B.B., New Age International Publisher, 2006, New Delhi.
5. Environmental Pollution Control Engineering, Rao C. S. , New Age International, 2006, New Delhi

S.Y.B.Sc. Environmental Science (Semester-IV)

Course Category: Major Core Practical

Course Code – EVS 292 MNP

Course Title: EVS 292 MNP Practical EVS291MN [2 P]

[No. of Credits: 2 C] **[No. of Lectures: 60 L]**

Objectives:

1. To Understand and Categorise Waste
2. To Apply Waste Reduction Techniques
3. To Design Waste Management Systems
4. To Conduct Field Studies
5. To promote sustainable practices

Course Outcome:

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

1. Students can identify and classify different types of solid waste (e.g., organic, recyclable, hazardous) based on their characteristics and sources.
2. Students will design and implement small-scale waste management systems, including collection, segregation, and disposal strategies.
3. Students will perform field surveys to evaluate existing solid waste management practices and propose improvements.
4. Students will assess the environmental and health impacts of improper waste management practices.
5. Students will develop and present strategies for community engagement to promote sustainable waste management practices.

Sr. No.	Description	Practical Sessions
1.	Segregation of solid waste into different components and their percentage	01
2.	To determine the moisture content of solid waste	01
3.	Analysis of the combustible components of municipal solid waste	01
4.	To study relevant techniques for the management of solid waste in the given area	01
5.	Prepare the organisation chart required to manage solid waste for the given village/ town/ city/locality	01
6.	Prepare the design criteria/ plan to be adopted to execute vermicomposting for the given area, with justification.	01
7.	Visit the solid waste management site	01
8.	Visit the composting site	01
9.	To study the ill effects on the health of workers handling the solid waste	01
10.	To prepare compost fertiliser by vermicomposting in your house/on campus	01
11.	To determine pH and conductivity of the soil near the solid waste disposal site	01
12.	To determine the organic matter content of a soil sample from a solid waste disposal site	01
13.	To identify solid waste sources in the given area (field visit)	01
14.	Interpret the Solid Waste Management Rule, 2016 by using relevant ICT tools.	01
15.	To determine nitrate and phosphate content in a groundwater sample collected from a solid waste disposal site.	02
16.	Waste Audit of an area- analyse the quantity and types of waste generated in a household, school or community	01
17.	Recycling of paper from waste paper (develop a paper from waste paper and understanding of the methodology)	01

18.	Explore the possibilities and challenges of recycling plastic. Field visit the recycling centre.	01
19.	Study e-waste collection and management (Field Visit)	01
20.		

References

1. Jain, S. K. (2012). Solid waste management. Tata McGraw-Hill Education.
2. Kumar, A., & Goel, S. (2019). Solid and hazardous waste management. Springer.
3. Garg, P., Gupta, R., & Yadav, A. (2006). Vermicomposting for sustainable agriculture. Agrobios.
4. Sridhar, M. K. C., & Adeoye, G. O. (Eds.). (2013). E-waste management in developing countries. Elsevier.

S.Y.B.Sc. Environmental Science (Semester-IV)

Course Category: Generic Elective / Open Elective

Course Code – OE 251 EVS

Course Title: Water Conservation

[No. of Credits: 2 C] **[No. of Lectures: 30 L]**

Objectives:

1. Understand the importance of water conservation and its impact on global and local ecosystems.
2. Learn methods and techniques for sustainable water use.
3. Develop strategies to implement water conservation in daily life, industries, and agriculture.

Course Outcome:

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

1. Understand the Importance of Water Conservation
2. Analyse Water Consumption and Scarcity Issues
3. Develop strategies to reduce, reuse, and recycle water in domestic, agricultural, and industrial settings.
4. Recommend practical water-saving techniques for urban areas, such as leak detection, smart metering, and water-efficient appliances.
5. Suggest sustainable agricultural practices, including drip irrigation, soil moisture conservation, and water-efficient crop choices.

Unit No.	Name of the Unit	Contents	No. of Lectures
1	Introduction to water resources	• Various sources of water • Surface water, groundwater, forms of precipitation, and the hydrological cycle • Distribution and use of water resources • Threats to water resources • Physical, chemical and biological properties of water • Case studies: Areas severely affected by water scarcity	06
2	Urban Water conservation techniques	• Various methods for water conservation - Rainwater harvesting, grey water management, drip irrigation, watershed management • Smart water metering and leakage prevention technologies • water crises at the global, national, and regional levels	06
3	Watershed management	• Concept and definition of watershed • Objectives of watershed management • Classification of a watershed • Importance of watershed management in water conservation • Social aspects of watershed management • Use of modern techniques in watershed management –GIS and Remote sensing • Case studies related to watershed management	06

4	Agricultural water conservation – Irrigation water management	• Use of water for irrigation in India • Management of irrigation water • Methods of irrigation for water, its advantages and disadvantages, and groundwater depletion • Socio-economic aspects of irrigation water management. • Soil moisture conservation techniques, • Sustainable farming practices to minimise water wastage	06
5	Need and awareness	• Necessity for water conservation • Social, commercial and domestic aspects of water conservation • Water audit • Emerging technologies in water conservation • Climate change resilience and water management strategies • Role of governments, NGOS, and communities in water conservation	06

Reference Books –

1. Water Harvesting and Sustainable Supply in India by RN Athavale Centre for Environment Education ISBN: 8170337526
2. Watershed Hydrology by Peter Black; Lewis Publishers: ISBN 1575040271
3. Soil and water conservation engineering by R. Suresh – Standard Publishers and Distributors ISBN 8180140008
4. SinghRajVir.2003.WatershedManagement.SecondEdition, Yash Publishing, Bikaner.
5. Mahnot SC, Singh PK and Chaplot PC. 2011. Soil and Water Conservation and Watershed Management. Apex Publishing House, Udaipur

S.Y.B.Sc. Environmental Science (Semester-IV)
Course Category: Skill Enhancement Course (SEC)
Course Code – EVS 251 SEC
Course Title: Practical-based Water Conservation

[No. of Credits: 2 C] **[No. of Lectures: 30 L]**

Objectives:

1. Understand the importance of water conservation and its role in sustainable development.
2. To know about water audit and its usage
3. Practical Implementation of Conservation Techniques
4. Innovation and Problem-Solving

Course Outcome:

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

1. To conduct a water audit to evaluate water usage in households, schools, or communities.
2. Students can evaluate the impact of water-saving methods through data collection and reporting.
3. To understand low-cost methods for preventing water wastage in households.
4. To assess the impact of water conservation

Sr. No.	Description	Practical Sessions
1.	To conduct Water Audits in Homes or on the campus	01
2.	Design a rainwater harvesting system for a specific building (e.g., a house, school, or community centre).	01
3.	To design a grey water recycling system for a household or a small building	01
4.	To assess the potential benefits and challenges of grey water reuse in a specific context.	01
5.	To analyse data from smart water meters to identify water consumption patterns	01
6.	To demonstrate different methods for detecting water leaks in a plumbing system.	01
7.	To learn how to delineate a watershed boundary on a topographic map.	02
8.	To assess the key characteristics of a chosen watershed.	01
9.	To classify watersheds based on different criteria.	01
10.	Formulate specific, measurable, achievable, relevant, and time-bound (SMART) objectives for managing a watershed.	01
11.	To understand the distribution and types of irrigation used across different regions of India.	01
12.	To compare the water use efficiency and suitability of different irrigation methods.	01
13.	To learn and compare different methods for measuring soil moisture content.	01
14.	To create a comprehensive water-efficient irrigation plan for a hypothetical farm.	01
15.	To calculate the water footprint of individuals, products, or processes.	01
16.	Visit to Local Water Treatment Plant	01
17.	Visit to Rainwater Harvesting Site	01
18.	Visit to Wastewater Treatment Plant	01
19.	Visit to an agricultural farm to study irrigation systems.	01
20.	Visit an NGO that works on water resource management issues	01