

CLASS-XI

SUBJECT : ENVIRONMENTAL SCIENCE (EVSC)

SEMESTER-I

FULL MARKS:35

CONTACT HOURS :80 HOURS

COURSE CODE : THEORY

Chapter	Subtopics	Contact Hours	Marks
1.Environment Through Ages	1.1 Origin of Earth - The processes and events leading to the formation of Earth. 1.2 Evolution of Earth Lithospheric Evolution: Development and transformation of Earth's crust. Atmospheric Evolution: Changes in Earth's atmosphere over time. Hydrospheric Evolution: Formation and progression of Earth's water systems. - Origin and Evolution of Life - Development of life on Earth before the emergence of humans. - Origin of Human Beings - The appearance and development of humans on Earth. 1.3 Human Interaction with the Environment - Concept of Natural Resources - Definition and Types: Various categories of natural resources and their significance. - Exploitation and Degradation: Human use of natural resources and the resulting environmental impacts.	16	8
2. Concept of Ecology	2.1 Basic Concepts and Definitions - Key terms: Ecology, landscape, habitat, ecological niche, eco-zones, biosphere, ecosystems, ecosystem stability, ecotone, edge effect. - Branches of Ecology: Autecology (individual species) and Synecology (communities). - Overview of major terrestrial biomes. 2.2 Types of Ecosystems Categories: Terrestrial: Forests, grasslands, deserts; Aquatic: Lentic (still water), lotic (flowing water), estuarine, marine, and wetlands.	32	15

	• Structure and Function: Biotic (living) and abiotic (non-living) components. • Metabolism: Primary production and energy flow models. 2.3 Ecosystem Connections • Energy Flow: Food chains, food webs, Lindeman's 10 Percent Energy Law. • Characteristics: Decomposition, ecological efficiencies, ecological pyramids (number, biomass, energy). 2.4 Biogeochemical Cycles and Nutrient Cycles • Key Cycles: Oxygen, carbon, nitrogen, phosphorus, sulfur. • Nutrient Dynamics: Models, inputs, biotic accumulation, and losses.		
3. Biodiversity and Conservation	3.1 Biodiversity • Concept: Biodiversity, Definition, and importance of speciation in biodiversity. • Types: Species, genetic, ecosystem, and domestic diversity. • Importance: Biodiversity's role in ecosystem function. • Highlights: Hotspots of biodiversity, India's mega biodiversity. 3.2 Loss of Biodiversity • Causes and Effects: Factors driving biodiversity loss and their impacts. • IUCN Red List: Categories (e.g., Extinct, Critically Endangered, Vulnerable). Red Data Book. • Extinction: Chronospecies extinction, true extinction. • Trade : Wildlife trade 3.3 Biodiversity Conservation Strategies • In-situ: Biosphere reserves, national parks, sanctuaries. • Ex-situ: Aquariums, botanical gardens, zoos, cryopreservation, DNA banks. • Significance: Importance of biodiversity conservation. 3.4 Biodiversity Assessment • Parameters: Frequency, density, abundance, relative density. • Indices: Shannon-Wiener diversity index, Simpson's index, evenness index • Nutrient Dynamics: Models, inputs, biotic accumulation, and losses.	32	12

CLASS-XI

SUBJECT : ENVIRONMENTAL SCIENCE (EVSC)

SEMESTER-II

FULL MARKS:35

CONTACT HOURS : 80 HOURS

COURSE CODE : THEORY

Chapter	Subtopics	Contact Hours	Marks
4. Environment and sustainability	4.1 Sustainable Development • Definition and origin of sustainable development. • Relationship between environment and development. • Importance for present and future quality of life. • Brief overview of the Brundtland Commission Report. 4.2 Science of Sustainability • Concepts: Sustainability, carrying capacity, deep and shallow ecology, sustainability index. • Population growth vs. resource availability. • Sustainable consumption. 4.3 Sustainable Agriculture • Concept, need, and action plan for sustainable agriculture. • Green Revolution: Impact of fertilizers, pesticides, mechanization. • New practices: Animal husbandry, livestock management, aquaculture. 4.4 Urban Environmental Challenges and Sustainability • Urban Heat Island (UHI) and its impact on city climates. • Urban Stress and its effects on human health and quality of life. • Mitigation strategies for urban environmental issues. 4.5 Global Sustainability Challenges and Solutions • SDGs and global sustainability efforts • Circular economy and sustainable waste practices • Water management and governance • Fossil fuels vs. renewable energy	30	13

	• Technological innovations for sustainability • Life cycle assessment and eco-labelling		
5. Environmental Physics	5.1. Basic Concepts of Light and Matter • Spectroscopy: Absorption and emission spectra, Beer-Lambert law, light transmission, and scattering. • Laws of thermodynamics: Entropy, enthalpy, and free energy. • Heat transfer: Conduction, convection, and radiation. 5.2 Atmospheric Physics • Albedo, solar constant, and Earth's heat budget. • Radiation and subsidence inversion, mixing depth, and pollutant dispersal. 5.3 Physics of Climate • Temperature, humidity (absolute, relative, specific), dew point, pressure, wind, and precipitation. • Climatological norms, Earth's conveyor belt, ocean circulation, and ocean-atmosphere interactions. • Cyclone and anticyclone formation, climate classification.	25	10
6. Environmental Chemistry	6.1 Introduction to Environmental Chemistry • Definition & Scope: Overview of environmental chemistry and its importance. • Applications of Environmental Chemistry 6.2 Air Chemistry • Atmosphere composition and stratification. • Photochemical reactions: NO_x, SO_x, O₃, O₂, CO₂, CO, ions, and radicals. • Issues: Acid rain, ozone depletion, particulate matter, aerosols. 6.3 Water Chemistry • Physical and chemical properties of water. • Dissolved gases (O₂, CO₂) and Henry's Law. • Heavy metals (As, Hg, Pb), acidity, alkalinity, and water hardness. 6.4 Soil Chemistry • Soil composition: Inorganic and organic components. • Cation/anion exchange, and key nutrients (N, P, K) in soil.	25	12

CLASS-XII

SUBJECT : ENVIRONMENTAL SCIENCE (EVSC)

SEMESTER-III

FULL MARKS:35

CONTACT HOURS :80 HOURS

COURSE CODE : THEORY

Chapter	Subtopics	Contact Hours	Marks
7.Environmental microbiology and biotechnology	7.1 Introduction to Microbiology • Definition & Scope: Study of microorganisms and their roles. • Types of Microorganisms: Bacteria, fungi, algae, protozoa, viruses. • Microbial World: Habitats of microorganisms and their ecological roles. 7.2 Microbial Ecology • Symbiotic Relationships: Mutualism, commensalism, parasitism. • Microbial Communities: Presence in soil, water, and air. • Nutrient Cycles: Microbes' role in nitrogen, carbon, sulfur, and phosphorus cycles. 7.3 Microorganisms and Human Health • Impact on Health: Disease-causing microorganisms (e.g., E. coli, Salmonellosis). • Immunology: Antigen-antibody interactions, vaccines. 7.4 Biotechnology for Environmental Sustainability • Introduction to Biotechnology: Definition, branches, and tools/techniques. • Genetic Engineering: GMOs with examples. • Sustainable Agriculture: Biofertilizers, organic farming, vermicomposting, integrated pest management. • Concept of Bioremediation with their types. • Microbes for wastewater treatment and pollutant cleanup. • Biofuels: Concepts and types of biofuels based on generations. • Biosensors: Role in environmental monitoring. • Ethics & Biosafety: Guidelines and protocols for safe biotechnology use	30	12
8. Environmental Health and Toxicology	8.1 Environmental Health • Concept, Principle, and Components: Understanding environmental factors affecting health. • Epidemiological Concepts: Measurement of	30	12

	mortality, morbidity, screening, and surveillance. • Public Health & Environmental Stewardship: Promoting health through environmental protection. 8.2 Community and Health • Health Education & Communication: Introduction to health programs and family planning in India. 8.3 Occupational Health: Health issues in various occupations (e.g., Anthracosis, Silicosis, Asbestosis). 8.4 Concept of Toxicology • Toxicants & Xenobiotics: Types of toxic substances, exposure routes, and their effects. Toxicokinetic and Toxicodynamic. • Acute & Chronic Toxicity: Understanding dose-response (LD50, LC50). • Sublethal Concentration: NOEL, MATC for safe levels. • Bioassay: Types and methodologies for toxicity testing. • Biomarkers, Bioaccumulation, Bioconcentration, and Biomagnification: Key concepts in tracking toxic substance effects.		
9. Environmental legislation and policy	9.1 Environmental Conservation in British India & Independent India: • Indian Penal Code 1860, Van Mahotsava (1950), National Forest Policies (1952, 1988), National Water Policy (2002), National Environment Policy (2006). 9.2 Legal Provisions for Environmental Management: • Indian Forest Act (1927), Wildlife (Protection) Act (1972), Water (Pollution Control) Act (1974), Water Cess Act (1977), Forests (Conservation) Act (1980), Air (Pollution Control) Act (1981), Environment (Protection) Act (1986), Motor Vehicle Act (1988), Public Liability Insurance Act (1991), Noise Pollution Rules (2000), Biological Diversity Act (2002). 9.3 International Environmental Agreements: • Ramsar Convention (1971), Stockholm Conference (1972), Montreal Protocol (1987), UN Conference on Environment and Development (1992), Kyoto Protocol (1997), Convention on Climate Change, Carbon Credit and Trading, Clean Development Mechanism (CDM), World Summit on Sustainable Development (2002), Paris Agreement (2015).	20	11

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SEMESTER-IV

FULL MARKS:35

CONTACT HOURS :80 HOURS

COURSE CODE : THEORY

Chapter	Subtopics	Contact Hours	Marks
10.Environmental pollution control and Green Technology	10.1 Introduction to Environmental Pollution • Pollutants: Definition and types. 10.2 Air Pollution • Pollutants: Major primary and secondary pollutants. • Effects: Health impacts, photochemical smog, industrial smog, temperature inversions, greenhouse effect, and global warming. • Control: Gaseous absorption, adsorption, cyclone separators, ESP. • Case Studies: Black carbon aerosol in the Himalayas, Bhopal Gas Tragedy. • NAAQS & AQI: Standards and calculations. 10.3 Water Pollution • Sources: Surface, ground, and ocean water pollution. • Concepts: DO, BOD, COD, Eutrophication. • Health Impact: Waterborne diseases (Diarrhea, Typhoid). • Control: Water quality standards, STP, ETP, WHO guidelines. • Case Studies: Ganga Action Plan (GAP), Minamata Disaster. 10.4 Soil Pollution • Causes and Effects: Impact on environment, vegetation, and life forms. • Control: Soil reclamation and pollution control measures. 10.5 Noise Pollution • Sources & Effects: Measurement, current situation in India, prevention, and control. 10.6 Radioactive Pollution • Types & Sources: Hazards and disposal methods. • Case Study: Chernobyl disaster, 1986. 10.7 Analytical Methods with principles and application • Techniques: UV-VIS Spectrophotometry, Atomic Absorption Spectrophotometry, Electrophoresis, Chromatography, and Microscopy—properties, types, and applications.	30	13

	10.8 Green Technologies with principles and application • Technologies: CFLs, motion detection lighting, programmable thermostats, carbon capture and storage (CCS), Flue Gas Desulfurization (FGD), and solvent recovery systems.		
11.EIA and Environmental management	11.1 Concept of Environmental Management • Need for Environmental Management: Importance of managing environmental resources for sustainable development. • Environmental Aspects: Social, economic, and moral approaches to environmental management. 11.2 Waste Management • Solid Waste: Disposal, recycling, and treatment methods. • Liquid Waste: Management of wastewater, and treatment technologies. • Biomedical Waste: Proper disposal and treatment of healthcare-related waste. • Hazardous Waste: Handling, disposal, and risk mitigation. 11.3 3R Management: • Reduce, Reuse, Recycle Key principles for waste minimization and resource efficiency. 11.4 Environmental Impact Assessment (EIA) • Introduction to EIA: Definition, objectives, and significance of conducting EIA for development projects. • Types of EIA: o Rapid EIA: Quick assessment for urgent projects. o Comprehensive EIA: In-depth evaluation of large-scale projects. o Strategic EIA: Focused on policies, plans, and programs. • Methodologies of EIA: General procedures used to evaluate the environmental impacts of projects. • Fundamentals of the Latest EIA Notification (Draft) 2020: Overview of the new guidelines and changes in the draft notification. • Case Studies of EIA: o Hydropower Projects: Environmental concerns and EIA studies for hydroelectric plants. o Thermal Power Projects: Environmental impact assessment for coal and gas-fired power plants.	30	12
12.Environmental statistics	12.1• Statistical Analysis Tools: Brief principle of Sampling, probability theory, distributions (Normal, Lognormal, Binomial, Poisson, t, F). Basic concepts of mean, median, mode, standard error, standard deviation, correlation, regression, hypothesis testing (t-test, Chi-square) with examples. 12.2 • Data Presentation: Basic concepts of Frequency, histograms, pie charts, and pictograms. 12.3 • Environmental Modelling: Principles of Linear simple and multiple regression models, validation, and forecasting.	20	10

	12.4 • Air Pollution Dispersion: Principles of Box model for air pollution modelling and prediction.		
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CLASS XI

SUBJECT: ENVIRONMENTAL SCIENCE (EVSC)

COURSE CODE: PRACTICAL

FULL MARKS: 30

CONTACT HOURS: 40

Evaluation Scheme	Marks
One experiment from Group A	7
One experiment from Group B	7
Spotting (Total three) from Group C. One from each set.	(3X2)=6
Practical Record Book +Viva Voce	(3+2)=5
One Investigatory field study from Group D + viva voce on field study	(3+2)=5

A. List of experiments:

1. Determination of total hardness of water sample provided by EDTA method.
2. Determination of total alkalinity of water sample provided by phenolphthalein/methyl orange.
3. Characterization of water samples: Turbidity, Color, Odor, Temperature, pH,
4. To test the presence of chloride, nitrates, carbonates and bicarbonates in the water sample provided.

B. List of experiments:

5. To measure the climate temperature by Six's maximum and minimum Thermometer :
Correctly read the maximum and minimum temperature from Six's Thermometer and record them in a proper table.
6. To measure the humidity by hygrometer : Note down the dry bulb and wet bulb temperature reading in a proper table and find out the Relative Humidity of the atmosphere with the help of relative humidity chart.
7. To measure atmospheric pressure: Correctly read the atmospheric pressure from the

Fortin's Barometer with the help of Vernier scale and record them in a proper table. Calculate the atmospheric pressure.

8. To Study the effect of light on the growth of plants (Moong /Pea/ barley/ wheat) provided (Grown in two pots in light and dark conditions). Make the following observations using your experimental data and record in a tabular form as given below.

Number of seeds germinated in each pot, Color of seedling and leaves ,Height of seedlings, Length of internodes, Number of leaves produced per plant (seedlings)

C. Study and observe the following (Spotting):

(Set-I): Identification of specimen (photograph/museum specimen) and comment on their importance: Sarpagangha, Yam, Sami, Cinchona, Neem

(Set-II): Identification of specimen (Photograph) and comment on their cause of endangeredness : Red panda, Snow leopard, Cheetah, Koala, one horned rhino , Ginkgo biloba.

(Set-III): Identification of specimen (photograph/museum specimen) and comment on their impact on biodiversity of India: *Lantana sp*, *Parthenium sp*, *Tilapia sp*.

D. Field study

1. Field study in ecology using both qualitative and quantitative studies (Checklist/Quadrat /Transect) from any one of the following bio-geographical area (plain/coastal/ forest/ Hills) with report submission.
2. Identification of flora with highlight on economic significance and importance to ecological balance
3. Identification of fauna with highlight on economic significance and importance to ecological balance
4. Choice of five plants of your neighbourhood and description in terms of height and leaf characteristics.
5. To describe: a) climate of an urban area b) yearly variation in suspended particulate matter in the same area.

CLASS XII

SUBJECT: ENVIRONMENTAL SCIENCE (ENVSC)

COURSE CODE: PRACTICAL

FULL MARKS: 30

CONTACT HOURS: 40

Evaluation Scheme	Marks
One experiment from Group A	7
One experiment from Group B	7
Spotting (Total three) from Group C. One from each set.	(3X2)=6
Practical Record Book +Viva Voce	(3+2)=5
One Investigatory field study from Group D + viva voce on field study	(3+2)=5

A. List of experiments:

1. Determination of LC50 and LD50 with data provided.
2. Determination of Water Holding Capacity of soil sample provided (at least two samples).
3. Determination of soil moisture content.
4. Determination of soil pH of at least soil sample.

B. List of experiments:

5. Determination of Dust fall rate.
6. Estimation of Noise level (dB(A)).
7. Studies on goodness of fit for regression model with given data set on any environmental issues.
8. Simple staining using curd.

C. Study and observe the following (Spotting):

(Set-I):Identification of pest in agriculture (photographs/ museum specimen) and comment on their economic importance: *Leptocorisa sp* , *Scirpophaga incertulus* , *Gryllinae sp* , *Amphipyra pyramidoides*.

(Set-II): Identification of Microorganisms in environmental sample (Permanent slide / photograph) and comment on their economic importance: *Escherichia coli*, *Bacillus sp*, *Staphylococcus aureus* , *Plasmodium sp* , *Aspergillus sp*

(Set-III): Identification of bio-indicators (Photograph/ museum specimen/permanent slides):

Microbes: *Escherichia coli*, *Lichens*

Plants: *Mosses*, *Water hyacinth*

Animals: *Dragonfly larva*, *Earthworm*

D. Field study

1. Preparation of an Environmental Management Plan on the basis of given scenario.
2. Review on local environmental issues and making design of action plan.
3. Review on social responsibility of environmental management and report submission.
4. Report on global/ local environmental pollution issues.
5. To segregate domestic waste into bio-degradable and non-biodegradable components.
6. To make an audit of the electrical energy consumption by various household appliances.