

**DEPARTMENT OF EARTH AND ENVIRONMENTAL
SCINECES**

K.S.K.V. Kachchh University
Mundra Road, Bhuj-370 001, Kachchh

SYLLLABUS FOR M. Sc - ENVIRONMENTAL SCIENCE



SEMESTER-II

EnS-201 Environnemental Pollution - I

Unit-I: Basics and Air Pollution:

Definitions of Pollution and pollutant, types and origin, classification of pollutants, General concept, classification of pollutants

Air pollution: Composition of air, Major sources, Types and Properties of air pollutants, behaviour and fate of air pollutants, chlorofluoro carbons and ozone layer depletion, green house gases and concept of global warming, its origin, status and means to control

Unit-II: Air pollution: Meteorological aspects and Sampling Methods

Temperature lapse rates and stability, wind velocity and turbulence, plume behaviour and dispersion of air pollutants

Sampling and measurement of air pollutants, control methods and equipments

Unit-III: Water Pollution: Freshwater and Thermal

Water pollution: Introduction, definition of water pollution, types and sources of water pollutants and their effects, waste water treatment.

Thermal pollution: Introduction, Concept of thermal pollution, sources of thermal pollution, thermal power plant pollution, hazardous effects, long-term impact, thermal effects on marine life, effects on water quality, prevention of thermal pollution

Unit-VI: Water Pollution: Control and Treatment

Water treatment (types, methods of waste water treatment: Preliminary, Primary, Secondary and Tertiary: Removal of suspended and dissolved solids, nitrogen and phosphorous, advanced biological system, chemical oxidation, recovery of materials from process effluents), purification of water

EnS-202 Environmental Biotechnology

Unit-I: Biotechnology Essentials

Role of Biotechnology in environmental Protection; Microbiology and Biochemistry of waste water treatment (Biological treatment, impact of pollutants on biotreatment, important microorganisms, role of enzymes, principles of growth, Bioaugmentation)

Environmental Sampling, Processing, and Screening of Indicator Microorganisms

Unit-II: Ecofriendly Bioprocesses

Biofertilizers, Biocontrol of pathogens, and Biosurfactants

Biofuel: concept, characteristics and current status, production of Biofuel (Transesterification - Industrial Practice – Lurgi Process), the Indian and International Experiences, Commercial Production: Indian Efforts, Biofuel Usage - Field Trials, Advantages, and Socioeconomic implications

Unit-III: Cleaner Bioprocesses

Bioremediation: need and scope, principles and mechanisms, types and environmental applications

Specific Processes: Bioleaching, Bio-hydrometallurgy, Vermitechnology, Biodeterioration

Unit-IV: Advances in Environmental Biotechnology

Biodegradable and Ecofriendly Products: Biodegradable Plastics, Biosurfactants, Trickling filters, bioscrubbers and Biobeds.

Production of Bioenergy: Biomass production, and its utilization; waste materials for energy, biogas production, energy crops, cellulose as source of energy; energy and fuel using microorganisms, hydrogen gas production using hydrogenase and nitrogenase, hydrocarbon production.

ENS – 203 Dryland and Marine Environment - Indian Context

Unit – I Introduction to Marine Environment and Ecology

Ocean as an Ecosystem and Classification of Marine Habitats.

Marine Environmental Conditions (Tides, Temperature, Wave Action, Salinity, Nutrients, Other Factors), Adaptation of Intertidal Organisms at rocky, Sandy, and Muddy Shores, Resistance to Water loss, Heat Balance, Mechanical Stress, Respiration, Feeding, Salinity Stress, Reproduction, Distribution Pattern, Feeding Biology, Community Organization and Zonation.

Unit – II Importance of Marine Ecosystems

Important Marine/Coastal Ecosystems- Mangroves, Corals, Mudflats, Estuaries, Lagoons, Back and Brackish Waters. Coastal Activities (Ports, Harbor, Aquaculture, Salt Works) and their Impact on Coastal /Marine Ecology.

Unit – III Desertification- An Overview

Definition and UNCCD. Genesis of the Convention to Combat Desertification (CCD). Status of drylands and desertification in the world.

Climate and Desertification - Rainfall and Desertification of the Major Climatic Regions, Rainfall Distribution in the Drylands of India.

Major Factors Causing Desertification -Unsustainable Agricultural Practices, Shifting Cultivation, Unsustainable Water Management Practices, Land Use Changes, Deforestation & Loss of Vegetative Cover, Industrial and Mining Activities, Drought and Land Degradation.

Processes of Desertification - Soil Erosion, Wind Erosion, Water Erosion, Salinity-Alkalinity and Waterlogging.

Unit – IV Management Strategies for Combating Desertification

Impacts of Desertification -Impact of Human Population Pressure on Forest Resources, Impact on Biodiversity, Impact of Livestock Pressures on Grazing & Forest Land Resources, Impacts of Depletion of Vegetative Cover, Impacts of Soil, Wind and Water Erosion, Impacts on Soil Fertility, Impacts of Inefficient Water Management, Impact of Desertification on Quality of Life, Impacts of Desertification on Climate Change

Measures to Combat Desertification and Mitigate the Effects of Drought – Policy, Strategy and Legislative Framework, Strategies for Environmental Conservation, Programmes and Institutional Framework, Programmes and Technologies for Combating Desertification with Special Reference to Conservation of Soil, Water & Vegetation, Programmes Specifically for Addressing Desert & Drought Prone Regions (DDP, DPAP, IGNP), Traditional/ Indigenous Technologies for Combating Desertification, Interlinking National Efforts with Regional and Global Activities in Combating Desertification.

Ens-204 Natural Resources, Conservation and Management in India

Unit – I Basis of Natural Resources

Introduction to Natural Resources (Land, Water Resources, Forests, Grassland, Biodiversity, Agriculture, Human & Livestock) and Common Property Resources (CPRs).

Basics of Environmental Economics and Valuation Methods for Natural Resources.

Land Use Classification - Agro-Climatic Regions, Agro-Ecological Regions, Bio-Climatic Regions, Agro-Meteorological Regions

Unit – II Natural Resource Conservation and Management

Programmes for Natural Resource Conservation -Integrated Afforestation and Eco-development Project Scheme (IAEPS), Integrated Wastelands Development Programme (IWDP), Eco-Task Forces and Scheme for Reclamation of Alkali Soils

Management of Natural Resources of the Country -Land, Water Resources, Meeting Water Requirements of the Country, Use of Cost-Effective Water Harvesting Systems, Environmental Issues, Unsustainable Agricultural Practices and Land Use Planning

Unit – III Energy Resources

Energy Resources-Introduction, Energy Resources, Basic Concept, Types, Origin, Conventional, Non-Conventional and Perpetual Sources of Energy.

Various Energy Resources- Solar Energy, Wind Energy, Tidal Energy, Biogas Energy, Geo-thermal Energy, Environmental Implications, Fuel Cells, and Hydrogen Cells.

Unit – IV Mineral Resources, Mining and Ecorestoration.

Mineral Resources- The Concept, Mineral Deposits, Types, Metallic and Non Metallic Resources, Conservation of Mineral Resources.

Mining-The Concept, Types, Process and Environmental Impacts of Mining, Processing the Minerals and Restoration of Mining Sites.

Practical:

- 1. Identification and staining of micro organism from different effluents.**
- 2. Study the biodiversity of marine organism and identification of different species.**
- 3. Study the different alternative energy sources.**
- 4. Industrial field visit for the study of effluent treatment plant.**
- 5. Field visit to coastal area of Kachchh and Jamnagar Marine National park for identification of different species.**

SEMESTER-III

EnS-301 Environmental Pollution - II

Unit-I: Soil and Solid waste Pollution

Soil pollution: Introduction, importance of soil, composition of soil, soil pollution by different wastes (industrial wastes, urban wastes, radioactive pollutants, agricultural practices {chemical fertilizers and pesticides}, chemical and metallic pollutants, sewage and domestic waste)

Solid waste pollution: Introduction, waste generation, Indian and International scenario, municipal wastes, agricultural wastes and sewage sludge, industrial wastes and mining wastes, hazardous wastes, biomedical waste, management of solid waste, waste treatment methods (Incineration, pyrolysis)

Unit-II: Soil and Solid Waste Pollution: Control and Management

Control of soil pollution, preventive measures, Integrated Pest management, Integrated Nutrient management, introduction of Organic Farming and Biofertilizers, restoration of degraded lands

Solid waste management: Introduction, management of municipal, agricultural, industrial, mining, hazardous (biomedical) waste, waste treatment methods (Incineration, pyrolysis) and management practices

Unit-III: Water Pollution: Marine

Pollution of Marine Environment: Sources and nature of pollutants, oil pollution, metallic pollutants, status of coastal and estuarine pollution in India, Chemicals and drugs from oceans, sea level rise, cause, effect and control

Unit-IV: Noise and Radioactive Pollution and Control

Noise Pollution: Introduction, Sources of noise, characteristics of sound, measurement of noise, types of noise, effects of noise pollution, Indian ambient noise level standards, prevention and control of noise pollution

Radiation Pollution: Introduction, types of radiation and radioactivity, source and effect

EnS-302 Environmental Toxicology

Unit-I: Basic Concepts and Definitions

Definition of toxicology, LC₅₀ and LD₅₀, toxic chemicals and xenobiotic, Routes and rates of administration, environmental/behavioural factors, effect and response Types of Toxicity studies: Acute, sub-acute and chronic toxicity

Chemical Interactions: Additive, synergism, antagonism and ideosyncrotic reactions. Dose response relationship, statistical concept of toxicity, translocation of toxicants

Unit-II: Mechanisms and Principles

Mechanism of toxicity: Biotransformation of toxicants (conjugation and hydrolysis), Free-radical toxicity, the concept of bioequivalence and bioavailability, bioaccumulation of pollutants/xenobiotics, antidotes, case studies

Bioaccumulation and detoxification: the concept, hyperaccumulation, bioconcentration, biomagnification of toxicants, biomarkers and bioindicators

Unit-III: Heavy metals

Definition and sources of heavy metals, heavy metals in the environment (marine, fresh water and terrestrial ecosystems), bioavailability and bioaccessibility

Metal uptake by organisms and the mechanism, metal uptake from solution and food, availability of metals from sediments, factors affecting the metal uptake

Unit-IV: Chemical Speciation

Definition of terms related to speciation, speciation analysis, speciation study in water and soil or sediments

Speciation approaches - direct and combined speciation methods quality control in speciation, role of chemical models, bioreporters and biosensors in chemical speciation studies

EnS-303 Environmental Impact Assessment (EIA), Planning & Monitoring

Unit-I: Environmental Impact Assessment and Strategic Environmental Assessment

The concept, principles, types of EIAs, Procedures for undertaking EIAs, Data requirement, Methodologies for data collection, and data acquisition, Public concerns on EIA, strategies for undertaking EIAs, Steps in EIA, Environmental Impact Statement (EIS) and Environmental management Plan (EMP)

Recent Concepts and Advances in Impact Assessment, Strategic Impact Assessment (SEA), difference between SIA and EIA, Public Involvement in SEA, EA, differences from EIA, Methods and their usage in SEA: Guidance and Good Practices

Unit-II: Environmental Auditing

Environmental Auditing: Setting up an audit programme, typical audit process, Notification of MoEF, Guideline for Environmental Audit, Form-V-rule14

Audit methodology, setting guidelines for industries, areas to be avoided, benefits of environmental auditing, Procedure for obtaining environmental clearance license, Environmental Management and ISO 14000

Unit-III: Environmental Legislations and Guidelines

Environmental Protection Act (EPA), 1986; EIA notification (1994, 2006); Air pollution and prevention Act, 1981; The Water (prevention and pollution) Act, 1974; Central and State Pollution Control Boards for prevention and control of air and water pollution: roles and responsibilities; GPCB & CPCB Norms

Forest Conservation Act, 1980 and 1982 (revised); Wildlife (protection) Act, 1972, Coastal Regulation Zone Notification, 1991; Biodiversity Conservation Act, The Mines Act, 1952, The Hazardous Waste (Management and Handling) Rules, 1980

Unit-IV: Environmental Education and Participation

Environmental Education: Background, goals, objectives, guided principles, humanity and environment relationship, Strategies for development: authorization, EE methodologies, evaluation, future of EE, and EE modeling

Public Participation: Environmental Movements in India, NGOs and their role; Eco-tourism, Eco-Development and Environmental Ethics, Rio Earth Summit: Convention on Nation's Biodiversity, UN convention on climatic change, International Treaties and Conventions, Dispute Resolution and Community Based Planning and Collective Action

EnS-304 Research methodology, Biostatistics and Computer Applications

Unit-I: Introduction to Research and Scientific Writing

Characteristics and Types of Scientific Research, Organizing Scientific Research: Experimental Design, Research Methodology, Sampling designs

Research proposals, Paper, Reviews, thesis, conference reports, book reviews, project reports, reference writing and scientific abbreviations

Preparation and delivery of Scientific Presentations

Unit-II: Introduction to Biometry

Statistics, Definition and scope, Sampling and sample designs, presentation of data (tabular, graphical and diagrammatic presentation),

Measures of central tendency, dispersion and standard error; Probability distributions: binomial, poisson and normal distribution, Statistical significance (Hypothesis testing, types of error, level of significance)

Unit-III: Parametric Tests

Student's t distribution, Analysis of variance, χ^2 test and goodness of fit

Regression and Correlation Analysis

Unit-IV: Computer Applications

History, development and types of computers; Computer hardware, software and peripheral devices; Basic working on DOS, Windows and Linux

General awareness and use of popular software and packages, Microsoft office, Internet-Browsing

Practical:

- 1. Identification and separation of different compound from the mixture**
- 2. GIS laboratory practice and learning of different mapping techniques**
- 3. Environmental Impact Assessment of coastal area because of different industrial activities.**
- 4. In vitro toxicology study.**
- 5. Field visit to different industrial area for Effluent Treatment Plant.**

Syllabus
M.Sc. (Environmental Science)

Department of Earth and Environmental Science
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Submitted to
The Academic Council
KSKV Kachchh University
Bhuj-Kachchh