M.Sc., Environmental Sciences

Semester III (CORE COURSE- IX)

M3 ENV01-CT 09 **CREDITS : 04**

ENVIRONMENTAL ENGINEERING AND WASTE MANAGEMENT

Unit I

Waste water treatment-primary, secondary and tertiary treatment; various technologies related to water treatment- ozonation, chlorination, reverse osmosis, ion exchange, disinfection, coagulation, UV treatment

Unit II

Air pollution control technologies-wet scrubbers, electro static precipitators, cyclone separator, gravitational settling chambers , bag filters, adsorption and absorption methods, incineration.

Unit III

Solid waste treatment technologies: land fill & sanitary land fill, composting, incineration; hazardous and industrial waste management; municipal solid waste management.

Unit IV

Energy conservation: renewable energy technologies-solar, wind, bio energy, geothermal, hydro power; nuclear energy production-process and functioning of nuclear reactors.

Unit V

Effluent treatment plant (ETP) & sewage treatment plant (STP) - design and working; eutrophication control and management procedure; reuse and recycling of plastic and metals

M.Sc., Environmental Sciences

Semester III (CORE COURSE- X)

M3 ENV02-CT 10 **CREDITS : 04**

ENVIRONMENTAL LAWS AND ETHICS

Unit- I

Environment (protection) act 1986; Environmental (prevention) rules 1986; Central and state boards for prevention and control of air and water pollution; provision of constitution of India regarding environment (Article 48 A & 58 A).

Unit - II

Air (prevention and control of pollution) Act 1981; Air (prevention and control of pollution) Amendment Act 1987 and rules 1982; The Water (prevention and control of pollution) Act 1974;

Unit- III

The water (prevention & control of pollution) amendment 1988 & rules 1975; Legislation related to forest and wild life conservation; Forest Conservation Act 1980; Indian Forest Act, 1970, revised 1982; Wildlife Protection Act 1972 and amendment 1991; Biological Diversity Act, 2002.

Unit - IV

Code of criminal procedure and environmental protection; guidelines issued by the government of India for inspection of Industries under pollution control laws; Scheme of lebeling of environmentally friendly products (ecomark); Public liability Insurance Act. 1991; Environment guidelines for industries which required industrial licensing, Industrial licensing procedure; Environmental Clearance Process; Consents for handling hazard substances; Environment protection issues & problems, international & national efforts for environment protection,

Unit - V

Environmental ethics : Concept and definition ; Anthropocentrism and Ecocentrism; Indian situation of ethics; shallow and deep ecology

M.Sc., Environmental Sciences
Semester III
(DISCIPLINE SPECIFIC COURSE- I)

M3 ENV03-DT 01 **CREDITS : 04**

ENVIRONMENTAL TOXICOLOGY

Unit I

Toxicology: definition, Origin, classification & general nature of toxicants in environment; Principles in toxicology: Concept of dose response relationship, Chronic toxicity, Sub acute toxicity and acute toxicity, concept of LC 50 & LD 50, Median tolerance limit, Statistical concepts of LD_{50}; Safe limits, MATC, threshold concentration, NOEL,NOAEL & bioaccumulation; Risk assessment; Biological and chemical factors that influence toxicity; Influence of ecological factors on the effects of toxicity.

Unit II

Toxicity testing: Holistic and numeric approach; Drug toxicity and abuse; Heavy Metal toxicity in animals; mutagenesis ,Teratogenicity and carcinogenicity; Practical problems in toxicity testing; Global dispersion of toxic substance; Dispersion and circulating mechanisms of pollutants; degradable and non-degradable toxic substances in food chain; Eco-system influence on the fate and transport of toxicants.

Unit III

Route of entry of pollutants into ecosystem-Surface water, land, Air; Uptake of toxic substances by plants, metabolic basis of toxicity of SO_2, NO_2, O_3 and heavy metals in plants; Microbial transport of toxic metals; Air and water borne toxins and diseases; Radiation toxicity and safety measures; Biomonitoring and bioindicators of toxicants; response of ecosystem to toxicants ; biodegradable and non-biodegradable toxic substance.

Unit IV

Uptake of toxic substances by animals; Accumulation and chemical localization of toxic substances by animals; detoxification and excretion of toxic substances by animals; Metabolism of toxic substances by animals.; Aquatic toxicity testing ,Response of planktons to animals; pest & pesticides: classification, surveillance, resistance & residual effects.

Unit V

Toxic effect of pollution on terrestrial animals; xenobiotics in environment, bioconcentration, biological and non biological degradation, detoxification; chemical hazard assessment and communication; Information management system in Eco-toxicology; fumicatoris and masticatoris; Microbial toxicology-concepts and principle , Algal toxins, Mycotoxins, Cynobacteria; Eco toxicology-legal perspectives and animal ethics.

M.Sc., Environmental Sciences

Semester III

(DISCIPLINE SPECIFIC COURSE- II)

M3 ENV04-DT 02 **CREDITS : 04**

Instrumentation and Environmental Analysis

Unit I

Basic concepts of instrumentation, current, voltage and power; pH meter, conductivity meter, TDS meter, Visible spectrophotometer, Homogenizer, Autoclave , colony counter.

Unit II

Introduction of basic field instruments: Handy air sampler, Noise level/Sound level meter; lux meter; pedometer; compass; Anemometer; High volume air sampler-construction, principle and working.

Unit III

Introduction to advance concepts of Instrumentation -theory, principle & working and application of UV-Spectrophotometer, flame photometer, CO_2 analyzer, AAS, methane analyzer, refrigerated centrifuge, plant growth chamber, HPLC, gas chromatography, Paper chromatography, NMR, X-ray, Infra red gas analyzer.

Unit IV

Introduction to solution preparation; calculation of concentration of solution using specific gravity and molecular weight; units of concentration of solution; inter conversion; ionic product of water, pH, p^{OH}, buffer solutions.

Unit V

Selection of sampling sites, analytical methods and selection of appropriate analytical technique; sample blank preparation and solvent blank preparation ; efficiency of sampling; preparation of serial dilutions and standard curves for air, water , soil and plant analysis.

M. Sc. Environmental Sciences
Semester III

(PRACTICAL COURSE - CCPR-V)

M3 ENV05-EP01 **CREDITS-04**

1. Determination of the dust capturing capacity and percent leaf area injury of selected plant species.
2. Effect of heavy metals on seed germination and early seedling growth.
3. Effect of heavy metals on ascorbic acid content in plant leaves.
4. Effect of heavy metals on chlorophyll content, soluble protein, phenols and carbohydrates.
5. To calculate the LC 50 in fishes for heavy metals calculation of MATC and threshold concentration.
6. Short term bioassay lists of industrial pollutants in relation to fresh water animals.
    a) Calculation of 96 hours LC 50
    b) Assessment of threshold concentration.
    c) Calculation of MATC (Maximum acceptable toxicant concentration)
    d) Calculation of application factor or safe concentration)
7. Observation of stomata movement and measurement of stomatal aperture
8. Observation of various stages of cell division in onion root tips with special reference to heavy metals
9. Observation of plant cell structure in onion peel
10. Study of petro plants and energy weeds
11. Principle, construction and working of biogas plant

> **Spotting**:

- Study and identification of minerals and rocks.
- Toxicity curves
- Heavy metal identification
- Principle &working of STP'sand ETP's
- Identification and study of coal: bituminous, lignite, anthracite, peat
- Biomass pellets
- Different types of woods : briquettes
- Solar equipments: solar cooker, solar lantern, solar water heater, solar dryer, photovoltaic cel l

M. Sc. Environmental Sciences
Semester III
(PRACTICAL COURSE - DSE PR-I)

M3 ENV06-EP02 **CREDITS-04**

1. Working and principles of handling various equipments:
    a) High volume air sampler
    b) Spectrophotometer
    c) Refrigerated centrifuge
    d) Homogenizer
    e) Flame photometer
    f) Gas analyzer
    g) Growth chamber

h) Atomic Absorption Spectrophotometer i) Autoclave j) Polarograph k) Muffle furnace l) Bomb calorimeter Diagram, working and instrumentation of all the equipments mentioned above

> **Spotting**:

- pH meter, conductivity meter, TDS meter , turbidity meter, weigh balance
- Identification and study of local and migratory birds in and around the wetlands of Udai pur
- Studyand ecologicalsignificanceofendemicplantsandanimalsofsouthern Rajasthan
- Field excursion