M.Sc., Environmental Sciences, 2015-16

Semester II

(CORE COURSE- V)

CREDITS : 04

M2 ENV01-CC05

BIODIVERSITY CONSERVATION

Unit I

Concepts and component of biodiversity- genetic, species and ecosystem biodiversity, evolution of organisms & distribution in space and time, levels of biodiversity, biodiversity indices, value of biodiversity, biodiversity trends, modern techniques of measurement and monitoring of biodiversity, bio perspecting, patent protection and bio piracy .

Unit II

Major threats to biodiversity, IUCN threat categories, Red data book, threatened plants & animals of India; Endangered flora and fauna of India and Rajasthan, Mega diversity zones of India, Hot spot concept and hot spots of India, Biodiversity informatics, International efforts in biodiversity conservation

Unit III

Conservation of biodiversity- *In-situ*- Sanctuaries, biospheres Reserves, National Parks, Nature Reserves, Preservations plots; *Ex- situ* - Botanical gardens, Zoos, Aquaria, Home Garden & Herbarium, In vitro conservation: Germplasm & gene banks, tissue culture, pollen and spore bank, DNA bank; Wildlife reserves in India, Theory of reserve design, Restoration of biodiversity; Ecosystem people and traditional conservation mechanism; Importance of biodiversity in Ecotourism; endemic flora and fauna of tropics and India with special reference to Rajasthan

Unit IV

National and International programmes for biodiversity conservation; Conservation of wildlife - significance and status of India, Wildlife reserves- Biosphere and nature reserves, Project tiger, sanctuaries and national parks in India; Impact of tourism on wildlife and problem in wildlife protection; Role of WWF,WCU,CITES, TRAFFIC .

Unit V

Conservation of forests; Indian strategies and planning; Agroforestry, Social forestry; Management of forest products; Forests and tribals; Chipko Aandolan; Coral reefs, mangroves and estuarine biodiversity and their conservation; wetland conservation with special reference to Rajasthan; Biodiversity and agenda-21;Biodiversity conventions.

M.Sc., Environmental Sciences, 2015-16

Semester II

(CORE COURSE- VI)

CREDITS : 04

M2 ENV02-CC06

ENVIRONMENTAL CHEMISTRY

Unit –I

Concept and Scope of Environmental Chemistry; segments of environment; Principles and cyclic pathways in the environments; Chemistry of Biologically Important Molecules: Chemistry of Water: Unusual physical properties, hydrogen bonding in biological systems, unusual solvent properties, changes in wate r properties by addition of solute. Protein structure and biological functions, enzymes, enzyme metabolism.

Unit - II

Basic chemistry: Structure of atoms, their properties, their nuclear stabilities and their arrangement in the periodic table; fundamentals of chemical thermodynamics and solution formation-Normality, Molarity, Molality, Molecular weight, Equivalent weight, Mole concept; basic organic chemistry and biochemistry;

Stochiometry, Gibb's energy, Chemical potential, chemical equilibria, acid-base reactions; Solubility product, solubility of gases in water, the carbonate system, unsaturated and saturated hydrocarbons.

Unit – III

Classification of elements, chemical speciation, Particles, ions and radicals in the atmosphere. Chemical processes for formation of inorganic and organic particulate matter; Thermochemical and photochemical reactions in the atmosphere; Basic concepts of surface and interface chemistry: Absorption, adsorption, catalysis; collides, surfactants; carbonate system, radionuclides, radioactivity, decay of parent and growth of daughter nuclides & methods of radiometric dating; C14 dating system and procedure, stable isotopes – their fractionation and application to geo thermometry and paleo climates.

Unit – IV

First law of thermodynamics, enthalphy, adiabatic transformations; second law of thermodynamics, Carnot's cycle, entropy, Gibb's free energy, chemical potential, phase equilibria, Gibb's Donnan equilibrium; third law of thermodynamics, enzymes catalysis,

Michaelis/ Menten equation; Concept, principle and utility of green chemistry, green reagents, green catalysts, industrial interest in green chemistry.

Unit – V

Oxygen and ozone chemistry, Chemistry of air pollutants, Photochemical Smog, Chemistry of water, concept of D.O., B.O.D., and C.O.D. Water treatment: Sedimentation, Coagulation, Filtration, tertiary and advanced treatment; Redox potential; Inorganic and organic components of soil; nitrogen pathways and NPK in soils. Bio transformation and bio magnification; Principles of photo chemistry- Photo chemical & photo sensitized reactions, energy transfer.

M.Sc., Environmental Sciences, 2015-16

Semester II

(CORE COURSE- VII)

CREDITS : 04

M2 ENV03-CC07

Environmental Sustainability and Management

Unit I

Introduction, concept and scope of environmental management; Systems and approaches, environmental management of resources-water, forest, biological, minerals and agriculture; International summits and treaties-Vienna convention, Montreal protocol, Kyoto protocol, Copenhagen convention

Unit II

Sustainable development –concept & growth of idea, indicators of sustainability, Sustainable use of natural resources, Sustainability in industry and agriculture, eco restoration, green funding

Unit III

Basic concept of environmental economics, International trade & environmental integrity, eco labeling, eco marketing, current environmental issues in India-case studies, Narmada Dam, Tehri & Almeti dam; the role of risk assessment in environmental Management decisions.

Unit IV

Management systems-Quality, environment, Health and safety, Social responsibility (ISO 9000, 14000,18000, 8000); international organization of standardization (ISO) and their clarification; Relation of EIA to Sustainable development;

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Unit V

Environmental Management of Industrial pollution, Management of Pollution due to mining, chemical & manufacturing industries (Petroleum, coal, cement, Paper & fertilizer)

M.Sc., Environmental Sciences, 2015-16

Semester II

(CORE COURSE- VIII)

CREDITS : 04

M2 ENV04-CC08

Environmental Hazards and Management

Unit I

Introduction to hazards, classification and types: –Natural Hazards, Chemical hazards, Physical hazards, Biological hazards; Basics of hazard management and mitigation, natural Hazards –causes, continental drift, plate tectonics and sea floor's spreading; hazard analysis, potential risk; Human perturbation and natural hazards – impact of deforestation, land use and developmental activities on natural hazards, Role of climate change; Man Made hazards - Dams & reservoirs, NPP; Desertification-causes, evaluation, Mitigation.

Unit II

Natural Disasters: nature, causes and effect, Cyclone, tornadoes, floods, earthquakes, avalanches, Tsunami ,land slides, drought, fires, volcanism, Case study of disasters-community reaction to disasters, coping mechanism; disaster management-pre disaster phase, actual disaster phase, post disaster phase.

Unit III

Disaster assistance-technological assistance, relief camps, food requirement, water needs, sanitation security, information administration, fire fighting training, Safety Measures – a general account, emergency rescue, disaster education- alternatives and new direction, Forecasting and warning systems

Unit IV

Concept of disaster recovery- mitigation and preparedness, program planning and management, Vulnerability analysis, Training needs – Target Groups, emergency preparedness plan, occupational risk analysis survey and health evaluation, behavioral studies, Man-made disasters-occupational injury, Industrial Safety Management Techniques – Industrial Safety Standards, Industrial Accidents and Disasters - Frequency Rate, Prevention and Control; Dispersion of Radioactive material and releaseof Toxicand inflammable materials

Unit V

Environmental hazards, protective measure while handling hazardous substance, hazardous waste disposal. Hospital waste handling and disposal, guidelines for their disposal, fire and explosion hazards, radiation hazards. Case studies related to hazardous waste accidents, simplified measures for their assessment. Various diseases related to handling of hazardous waste. Nasal cancer and other fatal diseases- their symptoms, prevention and control.

M. Sc. Environmental Sciences, 2015-16

Semester II

(PRACTICAL COURSE – CPR-III)

M2 ENV05-CP03 **CREDITS-O4**

1.Find out the percentage frequency values of grassland species using 1 x 1 size quadrat. Classify the species into frequency classes A to E and prepare the frequency diagram. Compare result with Raunkiers standard frequency diagram.

2.Determine the biomass of producers.

3.Find out the effect of various quadrat size 25 x 25, 50 x 50, 75 x 75 and 1 x 1 m on percentage frequency result on same grassland plot considered in exerciseI

4.Find out the species diversity indexin disturbed and protected vegetation area.

5.Find out the leaf area index of crop field.

6.Study of anatomical features of ecological adaptation in selected hydrophytes and xerophytes.

7.Study of climatic conditions obtained in open field and under the shade of trees for temperature, light intensity, wind velocity, R.Hand comparison of ground vegetation of these areas.

8.To determine the age of forest patch by DBH.

9.To determine the vegetation by Point frame quadrate method.

➢**Spotting**:

·**Xerophytes**: Nerium – Stem & leaf; calotropis stem; capparis stem; pinus needle; opuntia; euphorbia, casurina

·**Hydrophyte**s: Ecchornia, Hydrilla, trapa, nymphea, chara, potemogeton, scirpus, nelumbo

·Point frame

·**Xerophyticanimals**: Phyrnosoma ,draco

·**Aquatic animals**: exocetus, hyla, gappi, katla, Rohu, gambusea

M. Sc. Environmental Sciences, 2015-16

Semester II

(PRACTICAL COURSE – CPR-IV)

M2 ENV06-CP04 **CREDITS-O4**

1.Analysis of Soil samples

(1)Texture

(2)Moisture

(3)pH

(4)conductivity

(5)Water holding capacity

(6)Bulk density & porosity

(7)Calcium carbonate

(8)Sulphate

(9)Carbonate and bicarbonate (10)Organiccarbon & organicmatter (11)Chlorides

(12)Nitrates (13)Available phosphorus

2.To compare the wilting coefficient of a xerophyticand mesophyticplant.

3.Assessment of noise pollution in different zones of the city by Sound level meter.

4.Study of soil for bioticcomponents likebacteria, fungi& soil nematodes.

➢**Spotting**:

·Instruments- Spectrophotometer, sound level meter, colorimeter, refrigerated centrifuge

·Foot prints- of wild animals as available for demarcation of territory.

·Soil fauna-Micro & macro fauna: Millipede, centipede, earthworm, nematodes, actinomycetes

·Soil fungi and soil bacteria

·Sieves set for soil texture

M.Sc., Environmental Sciences, 2015-16

Semester III

(CORE COURSE- IX)

M3 ENV01-CT O9 **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, 2015-16

Semester III

(CORE COURSE- X)

M3 ENV02-CT 1O **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, 2015-16

Semester III

(DISCIPLINE SPECIFIC COURSE- I)

M3 ENV03-DT O1 **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 andnon-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 andnon-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, 2015-16

Semester III

(DISCIPLINE SPECIFIC COURSE- II)

CREDITS : 04

M3 ENV04-DT O2

Instrumentation and Environmental Analysis

Unit I

Basic concepts of instrumentation, current, voltage and power; pH meter, conductivity meter, TDS meter, Visiblespectrophotometer, 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 volumeairsampler- 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, Paperchromatography, NMR, X-ray, Infrared 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.