

V.B.S. PURVANCHAL UNIVERSITY, JAUNPUR

M.Sc. [Environmental Sciences]

Syllabus (Effective from new batch, 2012)

Semester –I

Paper I **Ecosystem Dynamics**

- Unit-I. Structure, types & function of ecosystem, Marine Ecosystem. Homeostasis, Factor of distribution and adaptation; Food chain and Energy flow, Energy Subsidy, Ecological Pyramids.
- Unit-II. Concept of productivity, Methods for productivity measurement, Ecological efficiency, Global pattern of productivity.
- Unit-III. Ecological succession, succession models and concept of climax, trends in succession. Structure of the community, analytical and synthetic characters, climax community, Methods of sampling of community.
- Unit-IV. Biological cycling of C, N, S, P and Hydrological cycle. Cycling of non-essential elements, nutrient cycling in tropical forest.
- Unit-V. Ecology of population, Population growth, carrying capacity, biotic potential, interaction models for single and interacting species- Malthus model and Lotka-volterra model. Inter-specific associations.

Paper II **Environmental Chemistry**

- Unit-I. Thermodynamic states of the system, first law of thermodynamics, adiabatic transformation, second law of thermodynamics, Carnot cycle, Entropy, Gibbs free energy.
- Unit-II. Chemical potential and chemical equilibrium. Acid - base reactions; Solubility and solubility product. Carbonate equilibria (system). Stoichiometry.
- Unit-III. Structure and physicochemical properties of water, acidity and alkalinity. Solubility's and reaction of gases in water. Chelation. Polyphosphate in water.
- Unit-IV. Structure and physicochemical properties of atmosphere. Thermo-chemical and photochemical reactions in atmosphere. Chemistry of particulate and gaseous pollutants. Photochemical smog formation. Acid – base reaction in the atmosphere (acid rain). Ozone formation and depletion processes.
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Paper III **Environmental Geosciences**

- Unit-I. Earth process and geological hazards. Energy budget of earth. Earth processes.
- Unit-II. Introduction to plate-tectonics, Sea floor spreading, mountain building and evolution of continents.

- Unit-III. Coastal hazards: Cyclones and Tsunamis, river flooding causes, nature and extent of flood hazard. Urbanization and flood, effect of flood, flood mitigation method.
- Unit-IV. Earthquake: causes, intensity & magnitude; geographical distribution of earthquake zone: effects and mitigations. Volcanism: causes, effect and mitigation method.
- Unit-V. Principles of remote sensing and its application in environmental science. Application of GIS in environmental management.

Paper IV ***Environmental Microbiology & Biotechnology***

- Unit-I. Introduction to microbes, general characteristic, nutritional types and microbial diversity. Brief introduction of the technique for isolation and characterization of micro organisms, Microbial interaction.
- Unit- II Effect of environmental factors on growth and activities of microbes in air, water and soil. Micro organisms in extreme environment viz, Thermophile, Halophiles and Acidophiles.
- Unit-II. Role of microbes in agricultural fertility, viz biofertilizer and biopesticide, Microbial toxins and environmental hazards.
- Unit-III. Role of microorganisms in the degradation of man made compounds; pesticides (Chlorinated hydrocarbon), synthetic polymers (plastic). Acid mine drainage, accumulation of heavy metals and radionuclides and their recovery.
- Unit-IV. Types of bioremediation. Bioremediation of solid and domestic wastes, Application of bioremediation in removal of metals and oil spills.

Practical Exercise

- ⇒ Isolation of Bacteria from soil and water.
- ⇒ Staining of bacteria (Gram +ve and Gram -ve).
- ⇒ Study the Biochemical test for identification of microbes.
- ⇒ Determine the total hardness of given water sample.
- ⇒ Determine the alkalinity of given water sample.
- ⇒ Determine the free CO₂ content in given water sample.
- ⇒ Estimate the chloride content in given water sample.
- ⇒ Determine the acidity of water sample.
- ⇒ Estimate the dust fall on road side vegetation.
- ⇒ Study the Solid waste (lignocellulose) degradation by fungi.
- ⇒ Identification of rocks.

Semester-II

Paper V **Environmental Toxicology**

- Unit-I. Principles of toxicology. Dose-response relationship, lethal dose & lethal concentration. Exposure of toxicants, route & sites of exposure.
- Unit-II. Translocation of toxicants, biotransformation & bioactivation of toxicants. Mechanisms of action of organ specific toxicity, teratogenicity, carcinogenicity, immunotoxicity.
- Unit-III. Potency vs toxicity. Margin of safety. Toxicity tests. Target & non-target organ toxicity, Occupational factor & health hazards. Metal toxicity.
- Unit-IV. Concept of environmental stresses. Oxygen-an agent of oxidative stress. Concept of free radicals & their effect on living system.
- Unit-V. High temperature and low temperature stress and their effects on living system, UV light and photoreactivation, drought and salinity stress.

Paper VI **Atmospheric Pollution**

- Unit-I. Types and sources of air pollutants (primary and secondary pollutants). Methods of collection of air pollutants. Effects of pollution on living and non-living. Bio-indicators of atmospheric pollutants.
- Unit-II. Air quality standard & criteria. Management of air pollutants (SO_x, NO_x, O₃, Hydrocarbon, PAN, SPM).
- Unit-III. Carbon –sequestration, Carbon credit.
- Unit-IV. Sources of noise pollution. Measurement of noise and indices. Effect of meteorological parameters on noise propagation. Noise exposure level & standards.
- Unit-V. Decibel scale of loudness, addition of loudness, percentile level & equivalent sound pressure levels (Leq.). Noise pollution by supersonic transmission, sonic boom. Infra & Ultra sound sources & hazards. Hearing protection devices & affect of noise on man. Noise control & abatement measures.

Paper VII **Soil Pollution and Management**

- Unit-I. Soil formation and weathering, Primary and secondary minerals. Soil organic matter, C/N ratio. Anion and cation exchange phenomenon, Buffering capacity.
- Unit-II. Sources of soil pollution: Pesticides in soil, fate of pesticides, industrial effluent and soil pollution. Inorganic contaminant in soil: Metal and radionuclides.
- Unit-III. Different kinds of synthetic fertilizer, and their interactions with biotic and abiotic components of soil.
- Unit-IV. Soil management: Reclamation of acid/alkaline/saline/sodic soil. Soil erosion and its control.

Unit-V. Characterization and classification of solid wastes and its management.

Paper VIII **Water Pollution**

Unit-I. Types and sources of water pollution. Effect of water pollution on aquatic and terrestrial ecosystem; Eutrophication and Biomagnification. Water quality standards.

Unit-II. Effects of thermal, industrial and municipal water pollution on plants and animals. Water borne human diseases and causative agents.

Unit-III. Biological monitoring of water. Physicochemical composition and microorganisms in sewage, DO, BOD, COD, coliform test.

Unit-IV. Types of waste water and their characteristic: Primary, secondary and tertiary treatment of waste water. Oxidation ponds. Treatment of potable water.

Unit-V. Marine pollution: Source, Control and disposal of pollutants in marine system.

Practical Exercise

- ⇒ Estimate the Dissolved oxygen content to a given water sample.
- ⇒ Measure the Biological Oxygen Demand content to a given water sample.
- ⇒ Determine the Sludge Volume index.
- ⇒ Determine the Particle density of soil.
- ⇒ Determine the bulk density of soil.
- ⇒ Determine the Degree of calcareousness of soil sample.
- ⇒ Estimate the porosity of soil sample.
- ⇒ Determine the Total solid, Total dissolved solid, Total suspended solid of water sample.
- ⇒ Determine the Electrical Conductivity of soil.
- ⇒ Estimate the Organic carbon in soil.
- ⇒ Estimation of the Heavy metals from soil.
- ⇒ Removal of Heavy metal by fungi, Bacteria and Mechanical method.
- ⇒ Determine the specific gravity of soil.
- ⇒ Estimate the most probable number (M.P.N.) – Coliform Test.
- ⇒ Estimate the water holding capacity of soil.
- ⇒ Estimate the soil nutrient analysis.
- ⇒ Estimate the soluble carbonate and bicarbonate in given soil.

Semester-III

Paper IX **Natural resources and its harnessing**

- Unit-I. Natural resources - definition, classification, conservation and management.
- Unit-II. Energy resources & their impact: Source of energy – Solar, fossil fuel, hydroelectric power, tidal, wind, geothermal, nuclear and bio-energy. Magneto-hydrodynamics.
- Unit-III. Mineral resources & environmental impact of mineral exploitation.
- Unit-IV. Water resources: Global water balance, Degeneration of water resources. Conservation of ground and surface water resources. Rain water harvesting.
- Unit-V. Management of wildlife and forest resources.

Paper X **Climatology and Meteorology**

- Unit-I. Introduction to climatology, atmospheric air, temperature, pressure, winds, moisture & precipitation, wind rose. Cloud formation.
- Unit-II. Weather forecasting. General atmospheric circulation pattern of atmosphere & blocking action.
- Unit-III. Pollution climatology: green house gases, global warming, sea level rise & climatic change. El-nino & La-nina.
- Unit-IV. Atmospheric stability, environmental lapse rate, inversion, plume rise &, plume behavior models. Transportation and diffusion of pollutants.
- Unit-V. Gas laws governing the behaviour of pollutants in the atmosphere, heat islands.

Paper XI **Instrumentation**

- Unit-I. Types and application of different Microscopes, Design and function of scanning and transmission electron microscope.
- Unit-II. Water and Air samplers and their application. Principles, design and application of centrifuges and electrophoresis. .
- Unit-III. Beers Lambert Law, principle, design and application of UV_Visible spectrophotometer and UV-Visible spectrofluorometer in Environmental research.
- Unit-IV. Principle, design and application of Flame photometer and Atomic absorption spectrophotometer in elemental analysis of environmental samples.
- Unit-V. Principles of chromatographic technique, types of chromatography and their application. Design and application of Gas chromatograph and HPLC.

Paper XII **Eco conservation and Sustainable Development**

- Unit-I. Concept and importance of biodiversity, biodiversity indices. Principles of biodiversity conservation, ex-situ and in-situ conservation, Extinction and

vulnerability of species threatened and endangered species, protected areas, botanical garden, national parks and sanctuaries, gene pool, hot spots, sacred grooves, key stone species.

- Unit-II. Criteria of choice of species for conservation, role of public and NGOs in biodiversity conservation.
- Unit-III. Evaluation of sustainable development, temporal and spatial dimensions of sustainable development, sustainable agriculture and Jhum cultivation. Concept of minimum viable population, inbreeding depression, Role of homozygosity and heterozygosity in conservation of species.
- Unit-IV. Eco-restoration and eco-development. Current Environmental issues in INDIA.
- Unit-V. Environmental education, environmental ethics, public awareness

Practical Exercise

- ⇒ Analysis of the plume behavior of emissions from brick kiln.
- ⇒ Draw wind rose diagram from given data.
- ⇒ Estimation of chlorophyll content of different plant leaves under stress.
- ⇒ Separation of chlorophyll pigment by paper chromatography.
- ⇒ Separation of protein by paper chromatography.
- ⇒ Separation of amino acid by thin-layer chromatography.
- ⇒ Protein profiling by SDS-PAGE.
- ⇒ Estimation of relative humidity of air.
- ⇒ Estimation of particulate matter (RSPM & NRSPM) in air.
- ⇒ Estimation of NO_x, CO_x & SO_x.
- ⇒ Enlist the aquatic Vegetation (Play major role in remediation).
- ⇒ Similarity and Dissimilarity index of pond.
- ⇒ Stress determination on plant, fungi and bacteria.
- ⇒ Measurement of light intensity.
- ⇒ Tabulate the temp., humidity, wind speed & wind direction.
- ⇒ Agarose-Gel electrophoresis.
- ⇒ Estimation of protein by *Bradford's* and *Folin Lowry's* method.
- ⇒ Identification of clouds.

Semester-IV

Paper XIII Environmental Management and Legislation

- Unit-I. Environmental organizations: Functions of important national & international organizations.
- Unit-II. Waste minimization technologies: Hazardous waste management rule 1989. Disaster management & risk analysis. Resource management. Environmental cost benefit analysis.
- Unit-III. Introduction of environmental impact analysis. Environmental impact statement & environmental management plan. EIA guide line 2006. Impact assessment methodologies. Guidelines for environmental audit. Environmental planning. Clean development mechanism (CDM).
- Unit-IV. Provision of constitution of India regarding environment (48A & 51A). Wildlife protection act 1972. Forest conservation act 1980. Air act 1981. Motor vehicle act 1988. Water (prevention & control of pollution) act 1974. The Environment (protection) act 1986.
- Unit-V. ISO 9000 and ISO 14000. Public liability insurance act 1991 & rules 1991. IUCN, red data book. Scheme of labelling environment friendly products (Ecomark). Intellectual Property Right (IPR).

Paper XIV Statistics and Bioinformatics

- Unit-I. Scope of statistics in environmental data analysis. Tabulation and diagrammatic presentation of data. Measures of central tendency (mean, mode, median). Dispersion (mean deviation and standard deviation).
- Unit-II. Simple measure of Skewness and Kurtosis. Test of significance. Z- test, t-test, chi-square test. Correlation and regression and analysis of variance (ANOVA).
- Unit-III. Introduction, classification and generation of computer, components of a computer system. Input and output devices.
- Unit-IV. Introduction and scope of bioinformatics.
- Unit-V. Biological database: Basic concept of primary, secondary and composite database,

Dissertation/Project Work

Dissertation work will be allotted in the third semester and report has to be submitted at the end of final semester. The project has to be carried out either in concern Organization/Laboratory/University/Industry/Institute with the consent of the Department or in the Department itself.

Scheme of Examination (Effective from new batch, 2012)

Semester -I

Paper I	Ecosystem Dynamics	50
Paper II	Environmental Chemistry	50
Paper III	Environmental Geosciences	50
Paper IV	Environmental Microbiology and Biotechnology	50
Practical		80 + 20 (sessional)

Semester-II

Paper V	Environmental Toxicology	50
Paper VI	Atmospheric Pollution	50
Paper VII	Soil Pollution and Management	50
Paper VIII	Water Pollution	50
Practical		80 + 20 (sessional)

Semester-III

Paper IX	Natural resources and its harnessing	50
Paper X	Climatology and Meteorology	50
Paper XI	Instrumentation	50
Paper XII	Eco conservation and Sustainable Development	50
Practical		80 + 20 (sessional)

Semester-IV

Paper XIII	Environmental Management and Legislation	75
Paper XIV	Statistics and Bioinformatics	75
Dissertation/Project Work		150