

## M. Sc. ENVIRONMENTAL SCIENCES

### 1<sup>st</sup> SEMESTER

Sl.NO	Paper Title	No. of credits	Hours per week	Max. Marks:100		Exam time (hrs)
				Internal	External	
1	Ecology And Environment	4	5	25	75	3 hrs
2	Environmental Chemistry And Instrumentation	4	5	25	75	3 hrs
3	Biostatistics And Environmental Modelling	4	5	25	75	3 hrs
4	Environmental Issues	4	5	25	75	3 hrs
5	Practical – I	4	6	-	100	3 hrs
6	Practical – II	4	6	-	100	3 hrs

### II SEMESTER

Sl.NO	Paper Title	No. of credits	Hours per week	Max. Marks:100		Exam time (hrs)
				Internal	External	
1	Energy And Environment	4	5	25	75	3 hrs
2	Environmental Pollution	4	5	25	75	3 hrs
3	Environmental Toxicology, Health & Safety	4	5	25	75	3 hrs
4	Natural Resource Management & Disaster Management	4	5	25	75	3 hrs
5	Practical – III	4	6	-	100	3 hrs
6	Practical – IV	4	6	-	100	3 hrs
7	Elective : I Environmental Issues and Sustainable Development	4	4	25	75	3 hrs

### III SEMESTER

Sl.NO	Paper Title	No. of credits	Hours per week	Max. Marks:100		Exam time (hrs)
				Internal	External	
1	Biodiversity And Conservation	4	5	25	75	3 hrs
2	Remote Sensing & Geographical Information System	4	5	25	75	3 hrs
3	Environmental Biotechnology	4	5	25	75	3 hrs
4	Environmental Monitoring And Management	4	5	25	75	3 hrs
5	Practical – V	4	6	-	100	3 hrs
6	Practical – VI	4	6	-	100	3 hrs
7	Elective : II Natural Disaster And Management	4	4	25	75	3 hrs

### IV SEMESTER

Sl.NO	Paper Title	No. of credits	Hours per week	Max. Marks:100		Exam time (hrs)
				Internal	External	
1	Environmental Policy And Sustainable Development	4	5	25	75	3 hrs
2	Environmental Law, Eia And Audit	4	5	25	75	3 hrs
3	Practical – V11	4	6	-	100	3 hrs
4	Project	12	18	-	200	3 hrs
5	Comprehensive Viva-Voce	4	-	-	100	3 hrs
	Total for Core Papers	100	130	350	2050	
	Total for Elective Papers	08	08	50	150	
	Grand Total	108	138	400	2200	

## ENV -101

### ECOLOGY AND ENVIRONMENT

#### UNIT –I

(10 Hours)

Definition, principles and scope of Environmental Science, Physico - Chemical and biological factors guiding the Environment, Biogeochemical cycles – (C, N, P, and S) and their importance. Earth, Man and Environment Relationship.

#### UNIT – II

(12 Hours)

**Ecosystem:** Definition Types of Ecosystems, Components of Ecosystems – Structure and Function. Trophic levels, Food chain, Food web and Ecological pyramids. Energy flow and Productivity, Biomes.

#### UNIT – III

(16 Hours)

**Population Ecology:** Definition – Characteristics of Population - Population Density, Natality, Mortality, Population Growth, Age distribution of population, Population fluctuations and dispersal.

**Community Ecology:** Ecological Succession – Types and general process of succession Nudation, Invasion, Competition, Climax Community organization: Ecological Niche, Interaction between species - Competition, Predation, Mutualism, Commensalism, Parasitism and Allelopathy.

#### UNIT – IV

(10 Hours)

**EARTH:** Origin, Composition, Structure and density; Composition of Lithosphere, Types and Properties of rocks, Plate Tectonics, Soil formation process - Physical and Chemical weathering, soil erosion –rare earth elements, Hydrosphere and Hydrological cycle.

#### REFERNCES:

1. Fundamental and Environmental Ecology, III Edition, Odum, E. P., (1971) Prentice Hall.
2. Living in the Environment – Principles, Connections and Solutions, Tyler Miller Jr. G., (1996) Wadsworth Publishing Co., New York.
3. Ecology and Environment, Sharma P. D., (1994) Rastogi Publications, Meerut.
4. Environmental Science, Daniel D Chiras., (1994) The Benjamin/Cummings Publishing Co. Inc.
5. Environmental Geology, III Edition, Edward A Keller, (1981) Charles E Merrill Publishing Co, Ohio.
6. Environmental Science Enger and Smith (2004), Mc Graw Hill

## ENV - 102

### ENVIRONMENTAL CHEMISTRY AND INSTRUMENTATION

#### UNIT – I

(12 Hours)

**Atmospheric Chemistry:** Concepts and scope of Environmental Chemistry, Stoichiometry, Gibb's energy, acid base reactions, Chemical equilibria, Solubility product, Solubility of gases in water, Photochemical reactions in the atmosphere – SO<sub>x</sub>, NO<sub>x</sub>, Ozone Chemistry – Particles in atmosphere – Types and effects.

#### UNIT – II

(10 Hours)

**Soil Chemistry:** Soil profile, Micro and Macronutrients Pesticides: classification,– degradation, Pollution due to pesticides and DDT problems, Physico – chemical characteristics of soil , soil air, soil clays , organic carbon , soil humus and mineralization, cation exchange capacity, soil water solution , C/N ratio, soil acidity and salinity.

#### UNIT – III

(14 Hours)

**Aquatic Chemistry:** Trace elements in water – Types – Sources – Heavy metals – Organic, Inorganic , Biological and Radioactive – Types of reactions in various water bodies including marine environment – Chemistry of water, Concepts of DO, BOD, COD Potability of water.

**Green Chemistry:** Introduction – Inception and Evolution – Importance of solvents – Types of catalysts and their role – Applications.

#### UNIT –IV

(12 Hours)

**Principles of Analytical Methods:** Titrimetry, Colourimetry, Spectrophotometry, Flame photometry, Chromatography, Gas Chromatography, Atomic Absorption Spectrophotometry, HPLC, GLC, Electrophoresis, X– ray fluorescence, X- ray diffraction, ICMS.

#### REFERNCES:

1. Environmental Chemistry, Stanley E Manahan., (2001), Lewis Publishers.
2. Environmental Chemistry Sharma, B. K. Kaur H., (1995) Goel Publishing House.
3. Chemistry of the Environment, Bailey R. A., Clerke H. M., Ferris J. P., Krause S and Strong R. L., (1978) Academic Press., New York.
4. A Text book of Environmental Chemistry and Pollution Control. Dara S. S.,
5. Instrumental Methods of Chemical Analysis, Ewing G. W., (1985) 5<sup>th</sup> Edition McGraw Hill, U. K.
6. Fundamentals of Analytical Chemistry, Skoog D. A and West D. M., (2004) Thomson Asia Pvt. Ltd, Singapore.

**ENV – 103**  
**BIOSTATISTICS, COMPUTERS AND ENVIRONMENTAL MODELING**

**UNIT – I** (14 Hours)

Fundamentals of Statistics (Basic concept) – Collection of Data – Classification and Tabulation – Diagrammatic Representation – Measures of Central Tendencies and Dispersion – Standard Deviation, Skewness and Kurtosis – Normal distribution.

**UNIT – II** (12 Hours)

Statistical Hypothesis - Null Hypothesis - Test of Significance — Level of Significance Standard Error – z, t, paired t test,  $\chi^2$  test, Contingency table,– One way Analysis of Variance - Regression and Correlation, Rank correlation.

**UNIT - III** (10 Hours)

Fundamentals of Computer – Introduction to Computers – History of Evolution – Organization and working of computer – Fundamentals of Windows, Excel, Word and Power Point – Computer and Communication – Internet, E – mail.

**UNIT – IV** (12 Hours)

Elements used in Modeling — Models for ecological predictions – Exponential growth, Lotka – Volterra Model, Leslie’s Matrix Model, Point Source Stream Pollution Box Model – Gaussian Plume Dispersion Model.

**REFERENCES:**

1. Statistical Methods. Gupta S. P (1996) Sultan Chand & Sons Publications. New Delhi.
2. Fundamentals of Bio – Statistics. Khan I. A and Kanum A (1994) Ukaaz Publication, Hyderabad.
3. Statistics for Advanced Level. Miller J (1989) Cambridge University Press.
4. Business Mathematics and Statistics. Vittal R. R (1986) Murgham Publications.
5. Applications of Ecological Modeling in Environmental Management. Jorgensen S. E (1996) Elsevier, London.
6. Fundamentals of Computers. Rajaraman V (2000) Prentice Hall of India.
7. Introduction to Computers. Peter Norton (1998) Tata McGraw Hill.
8. Statistics for people who hate statistics. Neil J Salkind (2000) Sage Publications. Inc. New Delhi.
9. Introduction to Bio – Statistics. Gurumani (2005) MJP Publications, Chennai.
10. Rajathi,A. and Chandran, P. 2010. SPSS for you. MJP Publications, Chennai.

**ENV – 104**  
**ENVIRONMENTAL ISSUES**

**UNIT – I** (14 Hours)

Global Environmental Issues: Acid Rain, Ozone depletion, Marine pollution, Loss of coastal areas, Drought/ desertification – Lessons from large Dams, major/minor/watershed irrigation projects with emphasis on River linking projects in India, El Nino Phenomenon.

**UNIT - II** (12 Hours)

Climate change dynamics, Green House Effect Genesis and future of Kyoto protocol, Global warming – Effect of global warming on hydrological cycle, agriculture, livelihoods, Glaciers melting, Sea level rise, loss of Deltas Ecological Importance of wetlands in India,

**UNIT – III** (12 Hours)

Deforestation, Forest role in Climate change to earn carbon credits, Utilisation bioresources and patents, Biodiversity loss, Hot spots of biodiversity and conservation, Loss of rain forests/ Mangroves, International trade in endangered species, Disasters, Natural disasters- Disaster management initiatives in India, Case studies - Bhopal disaster, Chernobyl accident, Exxon Oil disaster etc.

**UNIT – IV** (10 Hours)

Natural resources depletion/ management and Poverty reduction, War and conflict, Food insecurity – Genetically Modified Organisms, Urbanisation – Population growth Renewable and non-renewable energy, Ebola.

### **ENV – 105: PRACTICAL - I**

1. Environmental Inventory Studies – Quadrat Method.
2. Species – Area Curve, Effective population size.
3. Data Analysis – Data entry – Tabulation – Preparation of graphs.
4. Plankton Analysis – Phytoplankton – Zooplankton.
5. Primary Productivity in Grass land
6. Calculation of mean, median and mode.
7. Calculation of correlation and regression.
8. Application of t' test, ANOVA by using Excel and SPSS.
9. MS – Word, Power point and Excel

### **ENV – 106: PRACTICAL – II**

1. Soil – Physical, Chemical and Biological Properties – Soil texture - Sand, Clay, Silt.
2. To determine the Soil moisture content and Total Organic Carbon of the given soil sample.
3. Soil pH – Conductivity – NPK – Soil bacteria and Fungi.
4. Determination of pH, Conductivity, Turbidity, Total Dissolved solids drinking water, Paper Chromatography and Centrifugation
5. Estimation of Hardness, Alkalinity/ Acidity and Chlorides.
6. Determination of DO, BOD and COD in a given water sample.
7. To determine the Sulphates by Barium chloride method of the given water sample
8. Estimation of Fluoride from the given water samples.
9. Spectrophotometric methods of estimation: Phosphate, Nitrate, Chromium.

## ENV- 201

### ENERGY AND ENVIRONMENT

#### UNIT – I

(14 Hours)

**Basic Concepts of Energy:** Energy – Laws of thermodynamics, Carnot cycle, Energy Classification, sources and their availability, Conventional energy sources: Firewood – Coal – Origin, Coal reserves in India– Petroleum and Natural Gas –Reserves of Petroleum and Natural gas in India and World – Hydroelectric Power, Nuclear fission, Conventional energy –advantages and disadvantages

#### UNIT – II

(12 Hours)

**Non Conventional Energy sources:** Need for Renewable energy. Solar Energy: Spectral energy distribution and Measurement, – Solar Collectors – Concentrating and non-concentrating type – Low temperature- Medium temperature and High Temperature- , Flat plate, Parabolic, Central tower, Solar Pond and Solar energy Applications – Solar Photovoltaic Systems – Semiconductors, Solar cell characteristics, Applications. Small Hydro resources, Nuclear fusion energy.

#### UNIT – III

(12 Hours)

Wind Energy: Wind Energy Conversion Systems, Wind turbines – Applications of Wind energy, Environmental impacts, Bioenergy – Biomass resources and Applications, Biomass combustion, gasification, Biofuels and production process Biogas. Geothermal Energy: Origin and distribution, Ocean Energy: Tidal and Wave Energy, Ocean Thermal Energy Conversion Technology, Environmental impacts.

#### UNIT –IV

(10 Hours)

India's present and projected energy consumption, Renewable energy potential and integration, Emerging technologies- Fuel cell, Batteries, Hydrogen energy. Energy storage. Energy Conservation Approach and Technologies, Energy Conservation Act 2001, Energy conservation through efficiency and sufficiency – BEE.

#### REFERNCES:

1. Encyclopedia of Environmental Sciences – Environmental Energy Resources. Trivedi R. P and Gurudeep Raj (2005).
2. Renewable Energy Resources. Tiwari G. N and Ghosal M. K., (2005) Narosa.
3. Bioenergy. Desai A. V Wiley Eastern Limited, International Development Research Center, Ottawa, Canada.
4. Non-conventional Energy Sources. Rai G. D., (2001) Khanna Publishers.

**ENV – 202**  
**ENVIRONMENTAL POLLUTION**

**UNIT – I**

(12 Hours)

Structure and Composition of atmosphere – Pressure, Temperature, Precipitation, Humidity, Atmospheric stability, Inversions and Mixing heights, General Circulation of atmosphere, wind roses.

Sources and Classification of Air Pollutants: photochemical smog, Indoor air pollution.

**UNIT – II**

(12 Hours)

Properties of water - pH, acidity, alkalinity, salinity, hardness, Speciation and Complexation. Water pollution - sources, sinks and classification of water pollutants, Eutrophication, Ground water pollution, Global discharge of heavy metals into water bodies. Effluent standards, Thermal pollution, Marine pollution.

**UNIT – III**

(10 Hours)

Soil Pollution; Sources, sinks and broad classification, movement and sorption mechanisms of inorganic contaminants and their impacts on physico – chemical and biological properties of soil and plants, Sediment pollution, Discharge of heavy metals into soil, synthetic fertilizers (N, P & K) and their interactions with components of soil, Soil pollution control measures, Radioactive pollution.

**UNIT – III**

(14 Hours)

Solid waste Pollution: Types, sources and consequences. Classification of wastes (Domestic, Industrial, Municipal, Hospital,) Transfer and transport, Recycle, Reuse, Reduce, Utilization of solid wastes into energy/manure, Disposal methods-domestic non hazardous and hazardous Solid waste, Basel Convention on transport of Hazardous Wastes.

Noise Pollution – Sources, measurement of noise and indices, Noise exposure levels and standards. Impact of noise on human health. Noise control and abatement measure.

**REFERENCES:**

1. Encyclopedia of Environmental Pollution and Control. Trivedy, R. K (1994) Environmedia Publications, Karad.
2. Textbook of Soil Science. 4<sup>th</sup> Ed., Biswar, T. D and Mukherjee, S. K (1987) McGraw Hill.
3. An Introduction to Soils and plant growth. 5<sup>th</sup> Ed, Roy I Donalue, Raymond W Miller and John C Shiekluna (1987) Prentice Hall of India.
4. Environmental Noise Pollution and its Control. Chhatwal, G. R., Mehra, M. O., Katyal T., Satake, K Mohan Katyal and Nagahiro, T (1989) Anmol Publications.
5. Water Pollution. Kudesia, V. P., (1985) Pragati Prakashan Publications.
6. Air Pollution. Henry C Perkins, (1974) McGraw – Hill.
7. An Introduction to Air Pollution. Trivedy, R. K and Goel, P. K., (1995) Techno Science Publications, Jaipur.
8. Environmental Science – A study of Inter relationships. Enger, E. D and Smith, B. E, 5<sup>th</sup> Ed., W.C.B Publication.



**ENV - 203**  
**ENVIRONMENTAL TOXICOLOGY, HEALTH & SAFETY**

**UNIT – I** (10 Hours)

Introduction to Toxicology, Basic Probit analysis, Concepts – Toxicants – Toxicity, Acute, sub acute, chronic Dose effect, LD<sub>50</sub>, LC<sub>50</sub> and response safe limits. Dose - Response relationships – Toxic Chemicals in the environment. Pesticides – classification and toxicity – pest Surveillance, resistance, residual effects.

**UNIT - II** (16 Hours)

Chlorinated xenobiotics in environment – Volatilization – Biological and non – biological degradations, Chlorinated organics in environment and their fate. Short chained chlorinated hydrocarbons –PCB – Dioxins, fate, toxicity and their global distribution. Bioindicators – Environmental specimen banking.

**UNIT – III** (14 Hours)

Industrial Toxicology and Risk Assessment, Bioaccumulation – Bioconcentration – Biomagnification Significant influence – Cellular response to chemical stress – cell receptors, cell injury and apoptosis-Toxicity Testing approaches.

**UNIT – IV** (8 Hours)

Public Health Programmes – Objectives and Scope – Urban and rural health – Sanitation - Case studies with special reference to particular disease Malarial Control Measures – HIV/AIDS – Polio.

**REFERENCES:**

1. Introduction to Environmental Toxicology: Impacts of chemicals upon Ecological systems. Landis, Wayne and Hing –ho Yu, Boca Raton, (1995) Lewis Publishers.
2. Environmental Toxicology and Chemistry. Crosby, Donald. G. (1998) Oxford University Press.
3. Ecotoxicology, Schuurmann, G. and Market, G. (1998) A. John Wiley & Sons, Inc.
4. Information Resources in Toxicology: Wexler, Philip et al, (2000) 3<sup>rd</sup> Ed. Academic press.
5. The Basic Science of Poisons Companion Handbook. Klassen, Curtis. D and John. B. Watkins (1999) III eds. Casarett and Doull's Toxicology 5<sup>th</sup> ed. New York. McGraw Hill.

**ENV – 204**  
**NATURAL RESOURCE MANGEMENT & DISASTER MANAGEMENT**

**UNIT – I** (8 Hours)

Renewable and non- renewable resources classification, factors that influence scarcity of natural resources. Equitable resource use for sustainable life system. Common property resources – wastelands, water bodies and forests in the Indian context.

**UNIT – II** (16 Hours)

Water resources of India, Rain water Harvesting, Watershed management, Wetland conservation and management, Ecological Importance of wetlands in India.

Food Resources: Sources of food Changes caused by Intensive agriculture, Overgrazing, Fertilizer, Pesticide problems, Water Logging and Soil salinity.

Forest resources: Forest cover in India Importance of NTFPs, Implications of deforestation, Community Forest management

Mineral Resources: Uses and Environmental effects of extracting and over exploitation of mineral resources.

**UNIT – III** (12 Hours)

Definition of Hazard, Risk and Disaster, Earth Quakes – Mapping and Zoning of Earth quakes in India, Tsunami, Climate change effects on Indian weather and Monsoon, Tropical cyclones, Floods, Fire Hazards.

**UNIT – IV** (12 Hours)

Disaster Management and Mitigation: Pre-disaster Planning- Protection measures during disaster – Relief Camp Organization – Risk Assessment and Vulnerability analysis, Preparedness, Forecasting and Warning. Role of NGOs, Executives and Army in disaster mitigation.

**REFERENCES:**

1. Environment and Natural Resources Conservation. Trivedi, R. K. (1994).
2. Environmental Dynamics of Pesticides. Haue. R and Freed V. H. (1975) Menum Press, London.
3. Forest Ecosystem of the World. Shafi. R. (1992).
4. Social Forestry for Rural Development. Singh. B. (1992) Anmol Publishers, New Delhi.
5. Changing the Global Environment. Botkin D. B (1989) Academic Press, San Diago.
6. Disaster Management. Shailendra K Singh, Subhash C Kundu and Shobu Singh (1998) Mittal Publications, New Delhi.
7. Environmental Risk and Hazards. Cuttler S (1994) Prentice Hall of India, New Delhi.
8. Disaster Management. Singh R. B (ed) (2000) Rawat Publications. Jaipur & New Delhi.

### **ENV – 205: PRACTICAL – III**

1. Measurement of sound by DB meter in silent, Industrial, Residential and Commercial Zones.
2. Chemical Coagulation Test – Jar test apparatus.
3. Estimation of Na and Ca by flame photometry.
4. Drinking Water Treatment (measure of 5 parameters before & after treatment) – pH, Chloride, Nitrate, Phosphate, Total Dissolved Solids).
5. Air quality – SPM – SO<sub>x</sub>, - NO<sub>x</sub>.
6. Estimation of K by flame photometry.

### **ENV – 206: PRACTICAL - IV**

1. Determination of total carbohydrates in biological samples.
2. Estimation of protein samples
3. Estimation of Chlorophyll in plants affected by air pollution.
4. Analysis of some ecological effects of urban pollution on plants.
5. Study of effects of detergents on plants.
6. Observation of the effects of metals on plants.
7. Determination of Air Pollution Tolerance Index.
8. Wind Rose, earth Energy budget

**ELECTIVE –I SYLLABUS**  
**SEMESTER -II**  
**ENV-207 ENVIRONMENTAL ISSUES AND SUSTAINABLE DEVELOPMENT**

**Unit –I**

Environment: Definition, Scope and importance of environmental studies, major environmental problems: Global warming, Climate change, Acid rain, Ozone depletion, impacts of mining. Ecological degradation of forests, Biodiversity loss, Water resources depletion, Air quality deterioration, Urbanization, Eutrophication and Restoration of lakes.

**Unit – II**

Sustainable development – Concept and key aspects, Sustainable Management of Water Resources, Sustainable forestry, Sustainable agriculture, Food security and GMOS. Energy and sustainable development – Renewable energies, Efficient use of energy, Conservation of non-conventional energy resources.

**Unit – III**

Current environmental issues in India- Case studies related to Environmental degradation and success stories, Role of public in environmental protection, and sustainable development, Role of NGO's.

**Unit - IV**

Environmental degradation – Man and degradation of natural Environment – Present status of wastelands in India – Wasteland reclamation practices, Wet lands status and degradation. Ramsar convention.

Environment protection Act -1986. CPCB, Role of United Nations in Sustainable Development, - UNEP, UNFCCC.

**REFERENCES:**

1. Environmental Economics in Theory and Practice. Hanley, Nick, Jason F. Shogren and Ben White. (1997) Macmillan New Delhi, India.
2. Handbook of Natural Resource and Energy Economics. Allen V. Kneese and James L. Sweeney. (1985) North Holland.
3. Environmental Economics: An Introduction. Field B. C (1994) McGraw.
4. Environmental Economics: Theory and applications. Katar Singh and Anil Shishodia (2007) Sage Publications India Pvt. Ltd.

**ENV - 301**  
**BIODIVERSITY AND CONSERVATION**

**UNIT – I** (10 Hours)

Biological Diversity — Concept, Definition and Scope of Biodiversity, Genetic Diversity, Species diversity and Ecosystem Diversity, Species Inventory. Direct and indirect uses of Biodiversity, Biogeographical zones of India- Global hotspots of Biodiversity, Vavilov centres of origin

**UNIT – II** (14 Hours)

Biodiversity loss, Species extinction – Threats to biodiversity, Invasive species, IUCN categories – Threatened species; Endangered, Rare and Vulnerable species, Red data Book, Measures of biodiversity, Alpha, Beta and Gamma diversities.

**UNIT – III** (12 Hours)

National and International Organisations associated with Biodiversity Conservation – IUCN, UNEP, WWF, NBAGR, NBPGR, GREEN PEACE, Biodiversity registers.

**UNIT – IV** (12 Hours)

Conservation and Management : National Legislation – National Biodiversity Authority, Current practices in conservation – *in - situ* Conservation - National Parks, Wildlife Sanctuaries and Biosphere reserves; *ex- situ* - Conservation of Threatened Species, National Biodiversity Bill 2002, Convention on Biodiversity.

**REFERENCES:**

1. Biodiversity – Strategies for Conservation, Dadhich L. K and Sharma A. P (2002) APH Publishing Corporation, New Delhi.
2. Global Biodiversity – Conservation Measure, Khan, T. I and Dhari N Al Ajmi (1999) Pointer Publishers, Jaipur.
3. An Advanced Textbook on Biodiversity – Principles and Practice, Krishnamurthy, K. V (2003) Oxford and IBH Publishing, New Delhi.
4. Global Biodiversity – Status of the earths Living Resources, Brian Groombridge (1992) Chapman and Hall, London.
5. Biodiversity: Principles and Conservation. Kumar U and Asija M (2006) 2<sup>nd</sup> Edition.

**ENV – 302**  
**REMOTE SENSING & GIS**

**UNIT – I** (12 Hours)

Remote sensing system components, Principles of Electro Magnetic Remote sensing, Energy interactions in Atmosphere and Earth's surface, Spectral signatures, Spectral Reflectance Curve, Atmospheric windows, Spatial, Spectral, Radiometric, Temporal Resolutions, features in Imagery interpretation.

**UNIT – II** (12 Hours)

Sensors and Platforms, IRS, Land-sat, INSAT, SPOT and other satellite systems – satellite data, ENVISAT, Principles involved in thermal IR image and microwave image interpretation, Applications of different types of images in Agriculture, Marine studies, Forest resources, Soil resources, water resources, and Disaster management.

**UNIT - III** (12 Hours)

Introduction and components of Geographic Information System (GIS), Map Characteristics – Scale, Topographic and Thematic Maps, Map Projections, Geographic Coordinate system, WGS 1984 Geodetic System, Fundamentals of geospatial data - Layers and Themes, Raster Model and Vector Model. GPS applications.

**UNIT – IV** (12 Hours)

Applications of GIS – Environmental Impact Assessment – Air Pollution Monitoring, Land Degradation, Desertification, Mining, Ground Water, Flood management, Coastal applications, Forestry, Agriculture.

**REFERENCES:**

1. Remote Sensing and GIS for Environmental Planning. Muralikrishna, I. V (1995). Tata – McGraw Hill.
2. Advances in Environmental Remote Sensing. Danson F. M and Plummer S. E (1995).
3. Fundamentals of Remote Sensing. George Joseph (2003). Universities Press (India) Ltd., Hyderabad.
4. Remote Sensing and Image interpretation. Lilles and Keifer (2004) John wiley and sons, New York.
5. Remote Sensing – Principle and Interpretation. Sabins. F. F (1987) Freeman and Co., New York.
6. Environmental Remote Sensing from Regional and Global Scales. Roody G. M and Curran P. J (1994).
7. GIS Fundamentals, Applications and Implications. Elangovan, (2006) NIPA, New Delhi.

## ENV – 303

### ENVIRONMENTAL BIOTECHNOLOGY

#### UNIT I

(10 Hours)

Environment Biotechnology – definition & scope, Introduction of photobiology-Electromagnetic spectrum, Effects of light on plant growth and development through phytochrome. Biotechnological methods for mitigation of Environmental pollution.

#### UNIT II

(12 Hours)

Environmental stress, Drought, salinity, extreme temperatures-Degradation of pesticides, oil spills, plastics and other pollutants by microorganisms and genetically engineered microbes. Bioindicators of hazardous pollutants, Aquifer (Underground water) indicators and mineral indicators.

#### UNIT III

(14 Hours)

Bioremediation, Bioremediation of contaminated soils and water land, Biopesticides in integrated pest management, Biofertilizers (Rhizobial, free living N<sub>2</sub> fixers and Phosphate solubilizing bacteria) and their importance significance and practice. Phytoremediation, Biopiracy and Bioprospecting,

#### UNIT IV

(12 Hours)

Leaching – Introduction, organisms for leaching, chemistry of leaching and commercial processes. Genetically engineered plants and animals. Bt toxins types, Biosafety and Bioethics, Environmental risk assessment of genetically modified crop plants patents.

#### REFERENCES:

1. Microbial aspects of Pollution. Skyes and Skinner.
2. Microbial Biotechnology Glazer and Nikaido 1995.
3. Prescott and Dunns industrial microbiology. Reed (Ed).
4. Biotechnology 3<sup>rd</sup> edition by John E. Smith. Cambridge low price editions.
5. Plant biotechnology, 1994. Prakash and Pierik. Oxford & IBH Publishing Co.
6. Environmental Risk & Hazards. Cuttler S. (1994). Prentice Hall of India. New Delhi.
7. Environmental Biology & Toxicology. Sharma P.D. (1994). Rastogy publications  
Biotechnology from A to Z 1993. William Bains, IRL Press, Oxford, England PP 358.

**ENV – 304**  
**ENVIRONMENTAL MONITORING AND MANAGEMENT**

**UNIT – I** (12 Hours)

Design of Pressure Pipes, Pump types, Characteristic Curves –Selection and determination of capacity, sanitary appliances. General layout of Water Treatment Plant – Aerators – Types and design, Flash Mixer – Design – Clari - flocculator – parameters for design – Filtration – Rapid sand filter and Pressure sand filter design – chlorine demand, residual chlorine and chlorine dosage.

**UNIT – II** (14 Hours)

Physical and Chemical Unit Operations and Applications – Design Parameters and Design of Primary and Secondary Settling Tanks – Activated Sludge Process – Types and modifications – Design of Aeration Tanks and Oxidation Ditch – Diffusers and Mechanical Aerators, Tricking Filters and their Design. Duncan Mara Systems (Waste Stabilization Ponds).

**UNIT – III** (8 Hours)

Sludge Processing and Disposal Methods – Design of Anaerobic Digester and Sludge Drying Bed – Reverse Osmosis – Ion Exchange – Incinerators Land filling – Composting, Vermicomposting. Case studies: Dyeing, Paper and Pulp, Distillery, Thermal, Tannery, Electroplating

**UNIT – IV** (14 Hours)

Air Pollution Control - Minimum Stack Height – Plume Rise, Design of Settling Chamber, Cyclones, Fabric filters and Electrostatic Precipitators. Scrubber – Draught, Exhaust.

**REFERENCES:**

1. Introduction to Environmental Engineering and Science. Gilbert M. Masters (2004). Prentice – Hall of India Pvt. Ltd., New Delhi.
2. Wastewater Treatment. Rao M. N. and Datta, A. K (1987). Oxford & IBH Publishing Company Pvt. Ltd., New Delhi.
3. Environmental Engineering. Mackenzie L. Davis and David A. Cornwell (1991). Mc Graw Hill International Editions, New York.
4. Water and Wastewater Technology. Hammer M. J and Hammer Jr. M. J (2001). Prentice – Hall of India Pvt. Ltd., New Delhi.
5. Wastewater Engineering: Treatment and Reuse. Metcalf and Eddy (2003). Tata Mc Graw Hill Publishing Company Ltd., New Delhi.
6. Sewage Disposal and Air Pollution Engineering. Garg. S. K (1990) Khanna Publishers, India.
7. Advances in Industrial Wastewater Treatment. Goel P. K and Sharma K. P (1999). Technoscience Publications, Jaipur, India.
8. Chemistry for Environmental Engineering and Science. Sawyer C. N., Mc Carty P. L., and Parkin, G. F (2003) Tata McGraw – Hill Publishing Company Ltd., New Delhi.
9. Standard Handbook of Environmental Engineering. Robert A. Corbitt (1989) Mc Graw Hill.



### **ENV – 305: PRACTICAL - V**

1. Calculation of Latitudes and Longitudes of given places.
2. Interpretation of Toposheet.
3. Demarcation of land / Land Cover/ Forest cover
4. Water shed/ Drainage basin, paleochannels.
5. Slope Analysis.
6. Lineaments and Dykes.
7. Enumeration of local food plants, Medicinal plants
8. Enumeration of local endemic and endangered species
9. Estimation of species diversity. Shannon – Weiner Index, Simpsons Index
- 10 Georectification by using Arc-GIS.

### **ENV – 306: PRACTICAL – IV**

1. Isolation and identification of fungi and bacteria from the soil
2. Staining techniques – a) Simple staining b) Gram staining
3. Preparation of microbial and plant culture media
4. Microbial and Plant tissue culture techniques.
5. Environmental stress drought, salinity and tolerance experiments
6. Photobiology experiments
7. Biosafety, bioethics and Environmental risk assessment - plot design and field experiments.
8. Cell count by Haemocytometer.
9. Enumeration of characteristics of Bacterial Colonies
10. Bacteriological estimation of given water sample by multiple tube dilution technique (MTDT).

**ELECTIVE –II SYLLABUS**  
**SEMESTER –III**  
**ENV-307 NATURAL DISASTER AND MANAGEMENT**

**Unit –I**

Introduction

Definition of Disaster, Hazard, Risk, Vulnerability, Resilience; Natural and Man-made disasters, Environmental hazards, Dimensions of disaster, magnitude, differential impacts of disasters.

**Unit –II**

Disaster prone areas in India ,Earth quakes, Seismic zone area of India , Flood prone areas  
Floods, flood frequency, Droughts, Landslides, Avalanches, areas prone to cyclones and coastal hazards, Tsunami, lightning and heat waves.

**Unit – III**

Disaster management, Pre-disaster Planning in Disaster Prone areas - Prioritization – Regulations- Protection measures during disaster – Post disaster - Relief Camp Organization – survey and assessment , Disaster Management Cycle – Vulnerability Analysis – Warning System – Disaster Training — Case studies for disasters and management

**Unit IV**

Disaster prevention and preparedness in India - Institutional arrangements – mitigation, response and preparedness. Pre-disaster management, Early warning and prediction system, Role of Remote sensing and IT Post disaster rehabilitation and construction, Medical trauma, Rescue and logistic management, Floods and droughts disaster preparedness programs, watershed management, National Disaster policy of India (Salient features), Role of Media in disaster management and forecasting.

**REFERENCES:**

1. Environmental Dynamics of Pesticides. Haue. R and Freed V. H. (1975) Menum Press, London.
3. Forest Ecosystem of the World. Shafi. R. (1992).
4. Social Forestry for Rural Development. Singh. B. (1992) Anmol Publishers, New Delhi.
5. Changing the Global Environment. Botkin D. B (1989) Academic Press, San Diago.
6. Disaster Management. Shailendra K Singh, Subhash C Kundu and Shobu Singh (1998) Mittal Publications, New Delhi.
7. Environmental Risk and Hazards. Cuttler S (1994) Prentice Hall of India, New Delhi.
8. Disaster Management. Singh R. B (ed) (2000) Rawat Publications. Jaipur & New Delhi.

**ENV – 401**  
**ENVIRONMENTAL POLICY AND SUSTAINABLE DEVELOPMENT**

**UNIT – I** (14 Hours)

National Environmental Policy (NEP, 2000) – Goals and Objectives, Environmental Policy Strategies in Pollution Control, National Policy on Climate Change and International Convention on climate change - UNFCCC, IPCC reports. Global Warming Potential.

**UNIT -II** (8 Hours)

Role of Environment in Economic growth, Ecosystem services and goods –. Environmental Valuation, Types of Environmental Values (Values of Biodiversity), Externalities - Methods of abatement of Externalities, Common Property resources, Net present value calculation

**UNIT - III** (12 Hours)

Units of Measurement, National Emission Standards for water, Noise, National Ambient Air Quality Standards, Life Cycle Assessment, Cost –Benefit Ratio, Effects of pesticides, Carcinogenic Organic Chemicals, Soil Health indicators, Soil contamination and crust formation.

**UNIT – IV** (14 Hours)

**Sustainable Development:** Definition and concept. The emergence Conceptualization of the notion of sustainable development, The Time line calendar of sustainable development, Key aspects and Strategies for Sustainable Development. Guidelines to Campaign for Sustainable Society.

**REFERENCES:**

1. Environmental Economics in Theory and Practice. Hanley, Nick, Jason F. Shogren and Ben White. (1997) Macmillan New Delhi, India.
2. Handbook of Natural Resource and Energy Economics. Allen V. Kneese and James L. Sweeney. (1985) North Holland.
3. Environmental Economics: An Introduction. Field B. C (1994) McGraw.
4. Environmental Economics: Theory and applications. Katar Singh and Anil Shishodia (2007) Sage Publications India Pvt. Ltd.

**ENV – 402**  
**ENVIRONMENTAL LAW, EIA AND AUDIT**

**UNIT – I**

(12 Hours)

Definition – Purpose of EIA, Objectives of screening Projects;– Writing the Environmental Assessment report, Concept of Significant Impact – Project Alternatives. Environmental Assessment Procedures. The Environmental Impact Statement Process- limitations EIA guidelines 2006 – Notification of Government of India, Public Participation, Environmental Management Plan ISO 14000.

**UNIT – II**

(14 Hours)

Legal Basis for Environment Impact Assessment, Constitutional Amendments – Article 48 A & 52 A. Regulatory frame work in India: Power and Functions of Central and State Pollution Control Boards to safeguard environment. Case studies: Land Clearing Projects – Urban localities Dam sites – EIA for Hydel, Thermal, Nuclear, Mining Projects– Highways Projects.

**UNIT - III**

(10 Hours)

EIA Methodologies – Adhoc Method – Checklist Methodologies – Matrix methods – Network Methods – Preparing EIS and Checklists. Base line information and predictions - land, water, atmosphere, energy, Biota, Environmental audit: Objectives – Scope – Goals - Approach to audit, Kyoto Protocol 1997.

**UNIT – IV**

(12 Hours)

Environmental Laws and Acts: Need for Environmental Laws – Role of Indian Judiciary in the protection of Environment - Forest Conservation Act 1980, Wild Life Protection Act 1972, Air (Prevention and Control of pollution) Act 1981, The Water (Prevention and Control of pollution) Act 1974, Motor Vehicle Act 1988, Environment Protection Act 1986, Hazardous Waste (Management and handling) rules 1989

**REFERENCES:**

1. Environmental Impact Assessment. Canter L. W., (1996) Mc Graw Hill, New York.
2. Environmental Impact Statements. Bregman J. I., (1999) Lewis Publishers, London.
3. Environmental Impact Assessment – A Comprehensive Guide to project and Strategic Planning. Eccleston C. H., (2000) John Wiley and Sons.
4. Handbook of Environmental Laws, Guidelines, Compliances and Standards. Trivedi R. K Vol I and II, B. S. Publications.
5. Environmental Law and Policy in India. Shyam Divan and Armin Rosencranz, (2001) Oxford Uni Press.

### **ENV – 403: PRACTICAL – VII**

1. Case study analysis for EIA of a major industry/Mining activity.
2. Preparation of Environmental Impact Statement.
3. Solid waste: Collection, Disposal - Composting, Vermicomposting – Bacteriological analysis.
4. To detect the most probable number (MPN) of coliform in the given water sample
5. Determination of zinc and nickel by spectrophotometry.
6. Estimation of the amount of nitrate and fluoride in ground water samples.
7. Water quality Index, Soil Health Card.

### **ENV – 404 PROJECT & DISSERTATION**

### **ENV – 405 COMPREHENSIVE VIVA - VOCE**