

**YOGI VEMANA UNIVERSITY
VEMANAPURAM, KADAPA**



**M. Sc. Environmental Sciences Syllabus
Semester & CBCS pattern
(Effective from 2018)**

**Department of Environmental Sciences
Yogi Vemana University
Kadapa**

M. Sc. ENVIRONMENTAL SCIENCES

Ist SEMESTER

Sl.NO	Paper Title and Code	No. of credits	Hours per week	Max. Marks:100		Exam time (hrs)
				Internal	External	
1	Ecology and Environment-ENV101	4	4	25	75	3 hrs
2	Environmental Chemistry-ENV102	4	4	25	75	3 hrs
3	Environmental Issues-ENV103	4	4	25	75	3 hrs
4	Energy Resources-ENV104	4	4	25	75	3 hrs
5	Practical – I – ENV105 (1 & 4)	4	9	-	100	3 hrs
6	Practical – II- ENV106 (2 & 3)	4	9	-	100	3 hrs

II SEMESTER

Sl.NO	Paper Title and Code	No. of credits	Hours per week	Max. Marks:100		Exam time (hrs)
				Internal	External	
1	Natural Resource Management and Disaster Management-ENV201	4	4	25	75	3 hrs
2	Environmental Pollution -ENV202	4	4	25	75	3 hrs
3	Environmental Microbiology and Toxicology -ENV203	4	4	25	75	3 hrs
4	Occupational health and Industrial safety-ENV204	4	4	25	75	3 hrs
5	Practical – III-ENV205 (1&2)	4	6+1	-	100	3 hrs
6	Practical – IV ENV206 (3&4)	4	6+1	-	100	3 hrs
7	Elective : I Basics in Environmental Science-ENV207	4	4	25	75	3 hrs

III SEMESTER

Sl.NO	Paper Title and Code	No. of credits	Hours per week	Max. Marks:100		Exam time (hrs)
				Internal	External	
1	Biodiversity and Conservation- ENV301	4	4	25	75	3 hrs
2	Remote Sensing and Geographical Information System-ENV302	4	4	25	75	3 hrs
3	Environmental Biotechnology- ENV303	4	4	25	75	3 hrs
4	Environmental Engineering-ENV304	4	4	25	75	3 hrs
5	Practical – V-ENV305 (1&2)	4	6+1	-	100	3 hrs
6	Practical – VI-ENV306 (3&4)	4	6+1	-	100	3 hrs
7	Elective : II Climate change and Sustainable development-ENV307	4	4	25	75	3 hrs

IV SEMESTER

Sl.NO	Paper Title and Code	No. of credits	Hours per week	Max. Marks:100		Exam time (hrs)
				Internal	External	
1	Environmental Policy and Sustainable Development-ENV401	4	4	25	75	3 hrs
2	Environmental Law, EIA and Audit- ENV402	4	4	25	75	3 hrs
3	Instrumentation and Techniques - ENV403	4	4	25	75	3 hrs
4	Biostatistics and Research Methodology-ENV404	4	4	25	75	3 hrs
5	Practical- VII –ENV405 (1,2,3 &4)	4	9	-	100	3 hrs
6	Project Report & Viva voce- ENV406	4	9	-	100	-
	Total for Core Papers	100	128 (excluding seminar hrs)	400	2000	
	Total for Elective Papers	08	08	50	150	
	Grand Total	108	136(excluding seminar hrs)	400 + 50	2000+150	

ENV -101

ECOLOGY AND ENVIRONMENT

UNIT –I

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

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

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

Human population growth and trends, Impact of human population explosion on environment.

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

UNIT – IV

EARTH: Composition of Lithosphere, Types and Properties of rocks, Soil formation process – Physical, Chemical and biological weathering, soil erosion, Rare earth elements, Hydrosphere and Hydrological cycle.

REFERNCES:

1. Odum, E. P., (1971) Fundamental and Environmental Ecology, III Edition, Prentice Hall.
2. Sharma P. D., (1994) Ecology and Environment, Rastogi Publications, Meerut.
3. Daniel D Chiras., (1994) Environmental Science, The Benjamin/Cummings Publishing Co. Inc.
4. Edward A Keller, (1981) Environmental Geology, III Edition, Charles E Merrill Publishing Co, Ohio.
5. Enger and Smith (2004) Environmental Science, Mc Graw Hill
6. P.S.Varma and V. K.Agarwal (2000) Environmental Biology, Chand & Company Ltd. Ramnagar, New Delhi.

ENV - 102

ENVIRONMENTAL CHEMISTRY

UNIT - I

Atmospheric Chemistry: Structure and composition of atmosphere, Gibb's energy, acid base reactions, Chemical equilibria, Solubility product, Solubility of gases in water, Photochemical reactions in the atmosphere – SO_x , NO_x , Ozone Chemistry–Particles in atmosphere – Types and effects.

UNIT – II

Soil Chemistry: Soil profile, Micro and Macronutrients Pesticides: classification,–degradation, 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

Aquatic Chemistry: Sources– Heavy metals – Organic, Biological, Electrochemical theory of corrosion, Properties of water - pH, acidity, alkalinity, salinity, hardness, Concepts of DO, BOD, COD.

Green Chemistry: Introduction - Importance of solvents – Types of catalysts and their role – Applications.

UNIT – IV

Pollutant Chemistry: Chemistry of hydrocarbon decay, effects on macro and microorganisms - Surfactants: Cationic, anionic and non-ionic detergents, modified detergents, Pollution due to pesticides and DDT problems, Heavy metals: Toxic effects of Cd, Pb & Hg.

REFERNCES:

1. Environmental Chemistry, Stanley E Manahan., (2001), Lewis Publishers.
2. Environmental Chemistry, Sharma, B. K. Kaur H., (1995) Goel Publishing House.
3. A. Text book of Environmental Chemistry, V. Subramanian. (2011) IK International Publishing House Pvt. Ltd.,New Delhi.
4. A Text book of Environmental Chemistry and Pollution Control. Dara S. S.,
5. Environmental Chemistry Samir K. Banerji (2013) PHI Learning private Ltd.,
6. A text book of Environmental Chemistry, Balaram Pani (2007) IK International Publishing House Pvt. Ltd., New Delhi.

ENV – 103
ENVIRONMENTAL ISSUES

UNIT – I

Global Environmental Issues: Urban air quality, Acid Rain, Ozone depletion, Marine pollution- Loss of coastal areas, Drought-desertification, Water Crises, Conservation of water, Rain water harvesting, Alkaline and Saline soils, Soil erosion, Narmada Dam, Tehri Dam, Almatti Dam, El Nino Phenomenon.

UNIT - II

Climate change, Green house effect, Global warming, Effect of global warming on hydrological cycle, agriculture, livelihoods, Glaciers melting, Sea level rise, Loss of deltas, Wetland conservation. Genesis and future of Kyoto protocol

UNIT – III

Deforestation, Forest role in climate change to earn carbon credits, Mangroves, Utilization of Bioresources and Patents, Biodiversity loss, Hot spots of biodiversity and conservation, Endemic, Endangered and Threatened species, Disasters-Natural disasters, Disaster management initiatives in India, Case studies - Bhopal disaster, Chernobyl accident, Exxon Oil disaster etc.

UNIT – IV

Natural resources depletion/ management, Population growth, Urbanization, Poverty reduction, Food insecurity, Genetically modified organisms, Environmental ethics, Renewable and non-renewable energy, Hazardous waste and waste management, WHO, Ebola, Environmental education and awareness.

REFERENCES

Updated versions of Environmental science books

1. Ecology and Environment, Sharma P. D., (1994) Rastogi Publications, Meerut.
2. Environmental Science, Daniel D Chiras., (1994) The Benjamin/Cummings Publishing Co. Inc.
3. Environmental Chemistry Sharma, B. K. Kaur H., (1995) Goel Publishing House.
4. Environmental Science – A study of Inter relationships. Enger, E. D and Smith, B. E, 5th Ed., W.C.B Publication.
5. A Text book of Environmental Chemistry and Pollution Control. Dara S. S.,
6. Environmental Science Enger and Smith (2004), Mc Graw Hill
7. Encyclopedia of Environmental Sciences – Environmental Energy Resources. Trivedi R. P and Gurudeep Raj (2005).
8. Renewable Energy Resources. Tiwari G. N and Ghosal M. K., (2005) Narosa.
9. Environment and Natural Resources Conservation. Trivedi, R. K. (1994).
10. Forest Ecosystem of the World. Shafi. R. (1992).
11. Disaster Management. Shailendra K Singh, Subhash C Kundu and Shobu Singh (1998) Mittal Publications, New Delhi.

ENV- 104
ENERGY RESOURCES

UNIT – I

Basic Concepts of Energy

Energy – Definition – Forms of energy – Kinetic, Potential, Mechanical, Thermal, Electrical, Chemical and Nuclear energy, Energy production and consumption in India

Energy Sources – Conventional and Non – conventional energy sources, Laws of thermodynamics, Carnot cycle.

Firewood – Fossil fuels – Origin – Coal reserves in India – Petroleum and Natural Gas – Reserves in India.

UNIT – II

Conventional energy sources

Conventional energy sources: Energy from fossil fuels, energy from major hydroelectric power, Nuclear Energy – Sources – Nuclear fission and fusion reactions.

Climatic effects of power production.

- Advantages and disadvantages of conventional energy sources.

UNIT – III

Non Conventional Energy sources:

Different Types and Need for non renewable energy sources

Solar power: Importance – Solar collectors – Concentrations – Flat Plate and parabolic Collectors, Solar towers – Non – convective solar pond, Ocean Thermal Energy Conversion (OTEC). Solar Photovoltaic Systems – semi conductors, Solar PV Panel, Solar PV systems and applications.

Wind Energy: Wind Energy Conversion Systems, Application of Wind energy. 3c.

Geothermal Energy: Geothermal Resources in India, small hydro resources in India their advantages, Ocean Energy – Tidal energy, Wave energy.

UNIT –IV

Non conventional energy sources: Emerging technologies and Conservation

Biomass energy – Biomass sources, Biofuels and Biogas –Bio ethanol, Biodiesel production Process - Gasification.

Emerging technologies – Fuel cells, Hydrogen energy

Energy conservation through efficiency and sufficiency measures.

Role of Energy Conservation Act, BEE, Energy for sustainable development.

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 – 105: PRACTICAL - I

1. Environmental Inventory Studies – Quadrant Method.
2. Species – Area Curve, Effective population size
3. Wind rose, Energy Budget
4. Examples of energy production problems
4. Estimation of productivity in Grass land
5. Plankton Analysis – Phytoplankton – Zooplankton. Counting – Identification – Primary productivity in water bodies.

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 and Centrifugation
5. Estimation of Hardness, Alkalinity/ Acidity and Chlorides.
6. Determination of DO, BOD in given water sample.
7. To determine the Sulphates by Barium chloride method of the given water sample
8. Heavy metal stress and its impact on growth

ENV – 201
NATURAL RESOURCE MANGEMENT & DISASTER MANAGEMENT

UNIT – I

Renewable and non- renewable resources classification, Factors that influence scarcity of natural resources. Equitable resource use for sustainable life system.

Water resources of India, Integrated water resources management – Rain water harvesting and Watershed management, Ecological importance and conservation of wetlands in India.

UNIT – II

Food Resources: Sources of food, Changes caused by Intensive agriculture, Overgrazing, Fertilizer and 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 extraction and over exploitation of mineral resources.

UNIT – III

Definition of Hazard, Risk and Disaster, Hazardous effects and impact of earth quakes, land slides, tsunami, cyclones, floods and volcanoes

UNIT – IV

Disaster Management and Mitigation: vulnerability analysis and risk analysis.

Pre disaster Planning - preparedness, forecasting and warning, disaster education.

Post disaster planning – relief measures and rehabilitation.

REFERENCES:

1. Trivedi, R.K. (1994) Environment and Natural Resources Conservation.
2. Shafi. R. (1992). Forest Ecosystem of the World. New Delhi, Nice printers.
3. Singh. B. (1992) Social Forestry for Rural Development. Anmol Publishers, New Delhi.
4. Botkin D. B (1989) Changing the Global Environment. Academic Press, San Diago.
5. Shailendra K Singh, Subhash C Kundu and Shobu Singh (1998) Disaster Management. Mittal Publications, New Delhi.
6. Cuttler S (1994) Environmental Risk and Hazards. Prentice Hall of India, New Delhi.
7. Singh R. B (ed) (2000) Disaster Management. Rawat Publications. Jaipur & New Delhi.
8. Savindra singh (2016) Environmental geography :- Pravallika publication, Allahabad.

ENV – 202
ENVIRONMENTAL POLLUTION

UNIT – I

Pressure, Temperature, Precipitation, Humidity, Atmospheric stability, Inversions and Mixing heights, wind roses, Sources and Classification of Air Pollutants: photochemical smog, Indoor air pollution, Vehicular pollution, Effect of air pollutants on man, plant, animals, materials and on climate.

UNIT – II

Speciation and Complexation. Water pollution - sources and classification of water pollutants, Eutrophication, Ground water pollution, Global discharge of heavy metals into water bodies. Potability of water, Effluent standards, Thermal pollution, Marine pollution.

UNIT – III

Soil Pollution; Sources – organic contaminants of soil, Industrial waste effluents and heavy metals, their interactions with soil components, Soil micro organisms and their functions, Sediment pollution, synthetic fertilizers (N, P & K) and their interactions with components of soil, Soil pollution control measures, Radioactive pollution.

UNIT – III

Solid waste Pollution: Types, sources and consequences. Classification of wastes (Industrial, Municipal, Hospital) Recycle, Reuse, Reduce, Utilization of solid wastes into energy/manure, Disposal methods-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 measures.

REFERENCES:

1. Encyclopedia of Environmental Pollution and Control. Trivedy, R. K (1994) Environmedia Publications, Karad.
2. Textbook of Soil Science. 4th Ed., Biswar, T. D and Mukherjee, S. K (1987) McGraw Hill.
3. An Introduction to Soils and plant growth. 5th 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 Pollution Management and control for sustainable development. Khitoliya R. K. (2014) S. Chand and Company Pvt. Ltd., New Delhi.

ENVIRONMENTAL MICROBIOLOGY AND TOXICOLOGY

UNIT – I

Microbial diversity, Soil microorganisms and their functions, Aeromicroflora, Air borne diseases and allergens, Water borne diseases, Culture media, Types of media, Isolation of pure cultures, Growth curve, Microorganisms as source of food – Single Cell Protein – Fermented foods.

UNIT - II

Introduction to Toxicology, Toxicants, Toxicity, Acute, sub-acute and chronic Dose effect, LD₅₀, LC₅₀ and response safe limits, Dose Response relationships, Toxic chemicals in the environment. Biochemical aspects of Arsenic, Cadmium, Lead, Mercury, Carbon monoxide, MIC, Pesticides – Classification, Residual effects, Oceanic pollution by toxic wastes

UNIT – III

Xenobiotics in environment, PCB, Dioxins, Bioindicators, Bioaccumulation, Bioconcentration, Biomagnification, Cell receptors, Cell injury and Apoptosis, Toxicity Testing approaches, Environmental specimen banking

UNIT – IV

Public Health Programmes– Urban and rural health, Sanitation, Case studies with special reference to particular disease-Malarial Control Measure, AIDS, Polio, Chikungunya, Dengue, Cancer, Bacterial, viral and fungal diseases for plants

REFERENCES

1. Leslie Collier, Balows Albert and Sussman Max, Topley and Wilson's Microbiology and Microbial infections. Oxford University Press
2. Microbiology, Pelczar MJ Jr, Chan ECS, Krieg NR
3. Introduction to Soil Microbiology, Alexander, M., 1977, 2nd Edn., Wiley John
4. Introduction to Environmental Toxicology: Impacts of chemicals upon Ecological systems. Landis, Wayne and Hing-ho Yu, Boca Raton, (1995) Lewis Publishers.
5. Environmental Toxicology and Chemistry. Crosby, Donald. G. (1998) Oxford University Press.
6. Ecotoxicology, Schuurmann, G. and Market, G. (1998) A. John Wiley & Sons, Inc.
7. Information Resources in Toxicology: Wexler, Philip et al, (2000) 3rd Ed. Academic press
8. Environmental Biology & Toxicology. Sharma P.D. (1994). Rastogy publications
9. Biotechnology from A to Z 1993. William Bains, IRL Press, Oxford, England PP 358.

ENV204 - OCCUPATIONAL HEALTH AND INDUSTRIAL SAFETY

UNIT-I

Occupation health: Definition and scope. Overview of work place health hazards. Physical, chemical, biological and radiological health hazards. silicosis, asbestosis, pneumoconiosis, siderosis, Byssinosis. Ways to reduce occupational risks.

UNIT-II

Industrial hygiene: Definition, Environmental factors and their effects on Workers health. Hazards at work places. Benefits and goals of industrial hygiene program. Medical facilities in factories, Ventilation and heat stress, Significance of ventilation, Purpose of lighting, Uses of good illumination.

UNIT-III

Personal Protective Equipments (PPEs), Types of PPEs their use care and maintenance. Different air pollutants in Industries, Effect of different gases and particulate matter, acid fumes, smoke, fog on human health.

UNIT-IV

Industrial safety: Importance of Industrial safety, role of safety department, Safety committee and Function principles of safety management, fire prevention, accident prevention, handling of dangerous substances. First aid : Body structure and Functions, Position of causality, the unconscious casualty, fracture and dislocation, Injuries in muscles and joints, Bleeding, Burns, and accidents caused by electricity, Safety activities of the ILO (International Labour Organization) Introduction to OSHAS 18001 and OSHA

REFERENCES:

- 1.Risk assessment- A Practical Guide, 1993, Institution of Occupational Safety and Health, United Kingdom
- 2.Industrial safety management By: L.M. Deshmukh Publishers: Tata Megraw Hill ,New Delhi Year: 2006 Edition: First
3. Industrial safety health and environment Management system By: R.K. Jain & Sunil S. Rao Publishers: Khanna Publishers Year: 2008 Edition: Second
- 4.R.K.Jain and Sunil S.Rao , Industrial Safety , Health and Environment Management Systems, Khanna publishers , New Delhi (2006)
5. Slote.L,Handbook of Occupational Safety and Health, John Willey and Sons, NewYork .

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_x, - NO_x.
6. Spectrophotometer methods of estimation: Phosphate, Nitrate, Chromium.

ENV – 206: PRACTICAL -IV

1. Isolation and identification of fungi and bacteria from the soil
2. Staining techniques – a) Simple staining b) Gram staining
3. Characterization of waste water
4. Determination of total carbohydrates in biological samples.
5. Estimation of protein contents
2. Study of effects of detergents on plants.
3. Observation of the effects of metals on plants.
4. Analysis of some ecological effects of urban pollution on plants.
6. Detection of some organic chlorine chemicals in fruits and vegetables.
7. Noise level survey at workplace using sound level meter.
8. Demonstration of use of portable fire extinguishers.
9. Industrial safety-Case study

ELECTIVE –I SYLLABUS
SEMESTER -II
ENV-207
BASICS IN ENVIRONMENTAL SCIENCE

Unit –I

Ecosystem: Concept, Structure, functions, food chain, food web, Ecological pyramids, Energy flow in ecosystem, Forest ecosystem, grassland, desert and Aquatic (ponds, rivers, estuaries).

Unit – II

Environment: Importance of environmental studies, Natural resources, Forest, Water, Mineral, energy, land, Acid Rain, Ozone depletion, Urbanization, Eutrophication,

Unit –III

Biodiversity and its conservation, Biogeographical classification of India, India as a megadiversity nation, value of biodiversity, Hotspots of biodiversity, Threats to biodiversity, Habitat loss, man –animal conflicts, endangered and endemic species of India.

Unit IV

Air pollution, water pollution, soil pollution, marine pollution, noise pollution, radioactive pollution, thermal pollution.

REFERENCES:

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 Pollution Control Engineering, C. S. Rao, (2006) New age International Publishers.

ENV - 301
BIODIVERSITY AND CONSERVATION

UNIT – I

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

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

UNIT – III

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

UNIT – IV

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

ENV – 302
REMOTE SENSING & GIS

UNIT – I

Remote Sensing components, Electromagnetic radiation, Energy interaction in the Atmosphere and Earth's surface

1b. Spectral signatures, Spectral reflectance curve, Atmospheric windows

1c. Spatial, Temporal, Radiometric Resolutions

UNIT – II

2a. Sensors and Platforms classification- Land observation satellites and sensors – LANDSAT, IRS, CARTOSATSPOT

2b. Weather observation satellites/ Sensor–INSAT, NOAA, GOESS

Future Satellite System – ENVISAT.

2c. Features in Image Interpretation, Principles involved in thermal IR image and microwave image interpretation

2d. Applications of different types of images in Agriculture, Land use land planning,, Forestry, water resources, Soils, Disaster management etc.

UNIT - III

3a. Introduction and components Geographical Information Systems,

3b. Map Characteristics, Scale, Topographic and Thematic

3c. Map projections- Geographic Coordinate systems UTM projection, WGS Geodetic system

3d. Fundamentals of Geospatial data – Layers, themes, Raster Model, Vector Model

UNIT – IV

4a. Applications of GIS – Environmental Impact Assessment – Land Degradation, Desertification

4b. Air Pollution Monitoring — Industry – Mining – Ground Water –

4c. GIS in coastal management and flood management, Damage Assessment –

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

Environment Biotechnology- Bioremediation, Bioremediation in-situ and ex-situ, Phytoremediation, Biopesitocides, Biopesticides in integrated pest management, Biofertilizers- Rhizobial, Free living N₂ fixers and Phosphate solubilizing bacteria, mycorrhiza, BGA, their importance and practice, Vermicomposting

UNIT- II

Degradation of aliphatic and aromatic hydrocarbons, Degradation of pesticides, Bioindicators of hazardous pollutants, Extremophiles, Fermentation technology, Biofermentors, Major products of microbes- Alcohols, Antibiotics, Aminoacids and Organic acids, Immobilization technology, Methanogenesis

UNIT- III

Environmental stresses, Biotic and abiotic factors-Drought, Salinity, Extreme temperature, Light and Heavy metal stresses, *In vitro* techniques-Plant cell culture, Cloning/Recombinant DNA technology, Genetically engineered microbes, plants and animals, Drought and salt tolerance, Herbicide resistance, Dolly

UNIT- IV

Leaching, Germplasm, Conservation and gene banks, Pearl culture, Sericulture, Biosafety and Bioethics, Environmental risk assessment of genetically modified crop plants, Bt toxin types, Biopiracy and Bioprospecting, Patents

REFERENCES:

1. Environmental Biotechnology-SK Agarwal, APH Pub.1998
2. Microbial aspects of Pollution. Skyes and Skinner.
3. Microbial Biotechnology Glazer and Nikaido 1995.
4. Prescott and Dunns Industrial microbiology. Reed (Ed).
5. Biotechnology 3rd edition by john E. Smith. Cambridge low price editions.
6. Plant Biotechnology, 1994. Prakash and Pierik. Oxford & IBH Publishing Co.
7. Environmental Risk & Hazards. Cuttler S. (1994). Prentice Hall of India. New Delhi

ENV – 304
ENVIRONMENTAL ENGINEERING

UNIT – I

Design of Pressure Pipes, Pump types, Characteristic curves, General layout of Water Treatment Plant – Aerators – Types, Flash Mixer – Design – Clari–flocculator– Filtration – Rapid sand filter and Pressure sand filter design – chlorine demand, residual chlorine and chlorine dosage, Role of Ozone and UV as a Disinfectant.

UNIT – II

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

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

UNIT – IV

Air Pollution Control - Minimum Stack Height – Plume Rise, Design of Settling Chamber, Cyclones, Fabric filters and Electrostatic Precipitators. Scrubber, 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. Environmental Pollution Control Engineering, C. S. Rao, (2006) New age International Publishers.

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. Enumeration of local food plants, Medicinal plants
6. Enumeration of local endemic and endangered species
7. Estimation of species diversity. Shannon – Weiner Index, Simpsons Index
8. Georectification by using Arc-GIS.

ENV – 306: PRACTICAL –VI

1. Bioremediation of pollutants (phytoremediation of metals)
2. Enumeration of characteristics of bacterial colonies
3. Serial dilution experiments
4. Cell count by Haemocytometer
5. Preparation of microbial media
6. Antimicrobial experiments
7. *In vitro* techniques
8. Plant tissue culture media
9. Embryo, Axillary bud and Callus culture
10. Isolation of DNA
11. Electrophoresis
12. Genetic transformation
13. Effect of light, heavy metal on *in vitro* seed growth
14. Biosafety, bioethics experiments
15. Environmental risk assessment - plot design and field experiments.

ELECTIVE –II SYLLABUS
SEME STER–III
ENV-307 CLIMATE CHANGE AND SUSTAINABLE DEVLEOPMENT

Unit –I

Structure and composition of Atmosphere, Montreal protocol, El –Nino Phenomenon, Monsoon in India, urban heat island, New weather patterns, water resources, Agriculture.

Unit –II

Green house effect: Global warming – major green house gases, sources of green house gases, possible consequences of a green house warming, ozone layer depletion – stratospheric ozone, climate change: effect on organisms and human.

Unit – III

United Nations frame work convention on climate change (UNFCC), clean development mechanism (CDM), Kyoto Protocol, Intergovernmental panel for climate change (IPCC), Overview of Conference of Parties (CoP).

Unit IV

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

REFERENCES:

1. J. T. Hardy (2003) Climate change causes, effects and solutions, John Wiley and sons.
2. Tyler Miller Jr. G. (1996) Living in the environment – principles, connections and solutions, Wadsworth Publishing Co. New York.
3. Critchfield, Howard J., 1998. General Climatology, Prentice Hall Pvt. Ltd. New Delhi, India.

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.

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

Definition – Purpose of EIA, Objectives of screening Projects;– Writing the Environmental Assessment report, Project Alternatives. Environmental Assessment Procedures. The Environmental Impact Statement Process- limitations EIA guidelines 2006 – Notification of Government of India, Public Participation, Environmental Management Plan ISO14000.

UNIT – II

Article 48 A & 58 A, 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

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

UNIT – IV

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, E –waste (management and handling) rules 2016, Biomedical waste rules 2016.

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: Instrumentation and Techniques

UNIT-I

Centrifugation & Separating techniques: General principles of centrifugation, Types of centrifugation, Microcentrifuge, High speed and Ultracentrifuges, Dialysis, Ultrafiltration, Reverse osmosis- Principles of electrophoresis, Agarose electrophoresis, Polyacrylamide gel electrophoresis, SDS-PAGE, 2D PAGE

UNIT-II

Microscopy and Spectroscopic techniques: Principles and applications of light, Phase contrast, Fluorescence, Scanning and Transmission electron microscopy- Titrimetry- Gravimetry- Colourimetry- Beer-Lambert's Law, UV-VIS Spectrophotometry, NMR Spectroscopy, Atomic absorption spectrophotometer (AAS), Flame photometry, X-Ray diffraction, X-Ray fluorescence

UNIT-III

Chromatographic techniques: Chromatographic techniques and types, Paper chromatography, Thin layer chromatography, Gas chromatography, Gas liquid chromatography, Ion exchange chromatography, High performance liquid chromatography

UNIT-IV

Radiochemical and Nanomaterial techniques: Radioactivity- Detection and measurement of radioactivity- Radioactive isotopes-Applications of radioisotopes in biological sciences- Autoradiography- Nanotechnology processes, Nano materials, Nanoengineering materials for pollution prevention, Nanotechnology products

REFERENCES:

- Marr, L.L. and Cresser, M.S. Environmental chemical analysis, International Text Book Company (pub), New York (1983).
- Willard, Merritt, Dean and Settle, Instrumental methods of analysis, CBS Publishers, New Delhi (1986)
- Lenore S. Clesceri, Arnold E. Greenberg, Andrew D. Eaton. Standard methods for the examination of water and waste water, APHA, Washington (1998)
- Keith Wilson and John Walker, Principles and techniques of practical biochemistry, 5th Edition, Cambridge University Press, (2000)
- Gurudeep R Chatwal and Sham K Anand, Instrumental methods of chemical analysis, Himalaya (2005)
- Murugesan and Rajakumari, Environmental science and biotechnology- Theory and Practice, MJP Publishers, New Delhi (2005)
- Keith Wilson, Kenneth H. Goulding, A biologist guide to principles and techniques of practical biochemistry, 3rd ed., ELBS Series. (2006)
- Chatwal and Anand, Instrumental methods of chemical analysis, 5th ed., Himalaya Publications, (2006)
- Douglas. A., Skoog & West, Fundamentals of analytical chemistry, 8th ed., Harcourt Publications, (2006)
- Jo Anne Shatkin, Nanotechnology: Health and Environmental Risk, CRC press, (2008)
- Mao Hong Fan, Chin-Pao Huang, Alan E Bland, Z Honglin Wang, Rachid Sliman, Ian Wright, Environanotechnology, Elsevier, (2010)

ENV – 404

BIO-STATISTICS AND RESEARCH METHODOLOGY

UNIT-I

Fundamentals of Statistics: Collection of data, Classification and Tabulation, diagrammatic representation. Measures of central tendency-Mean, Median, Mode, Normal distribution, Skewness, Kurtosis, Measures of Dispersion – Standard deviation, standard error. Statistical hypothesis, Null hypothesis, level of significance,

UNIT-II

Statistical analysis: Statistical tests-Z, t, Chi-square, Contingency test, One-way analysis of variance, Correlation and Regression. Environmental models-Lotka-voltera model, Guassian air pollution model.

UNIT-III

Scope of research in Environmental Science: Definition of research, Characteristics of research, Code of research ethics, Importance of controls and standards, Steps in research process, Selection of research problem, Objectives, Literature collection.

UNIT-IV

Research data generation and Grants: Design, planning and execution of investigation, Presentation and interpretation of research data, Preparation of research articles and review papers for scientific journals, Research thesis writing, Preparation of research proposal for grants.

REFERENCES:

- Statistical Methods. Gupta S. P (1996) Sultan Chand & Sons Publications. New Delhi.
Instrumental Methods of Chemical Analysis, Ewing G. W., (1985) 5th Edition McGraw Hill, U. K.
Fundamentals of Bio-Statistics. Khan I. A and Kanum A (1994) Ukaaz Publication, Hyderabad.
Business Mathematics and Statistics. Vittal R. R (1986) Murgham Publications.
Statistics for people who hate statistics. Neil J Salkind (2000) Sage Publications. Inc. New Delhi.
Introduction to Bio-Statistics. Gurumani (2005) MJP Publications, Chennai.
Kothari, C. R. (1980). Research Methodology: Research and techniques, New Delhi: New Age International Publishers
Leedy, P. D. (1980). Practical Research: Planning and design. Washington: Mc Millan Publishing Co., Inc
Research Methodology-Methods and Techniques. Kothari, C.R., (1989), Wiley Eastern, New Delhi. 16.
Introduction to Research Methodology in Agricultural and Biological Sciences, V.Venkatasubramanian (1999), New Century Book House (P) Ltd., Chennai
Wallinman, N. (2006). Your Research Project: A step-by-step guide for the first-time researcher. London: Sage Publications
Kumar, R. (2011). Research Methodology: a step-by-step guide for beginners (3rd edition). London, UK: TJ International Ltd, Padstow, Cornwall.

ENV – 405: 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
6. Estimation of the amount of nitrate and fluoride in ground water samples.
7. Water quality Index, Soil Health Card.
8. Microscope and its advantages
9. Paper chromatography
10. Electrophoresis demonstration using DNA or protein sample
11. UV-spectrophotometry for estimation of chemical or biological samples
12. Demonstration of Scanning electron microscope (SEM) function
13. Calculation of mean, median and mode.
14. Calculation of correlation and regression.
15. Application of 't' test, ANOVA and correlation
16. Statistical tests by using MS Excel and SPSS

406: PROJECT DISSERTATION & VIVA - VOCE

M.Sc. Environmental Science
(MODEL QUESTION PAPER)

Time: 3 hours

Max. Marks: 75

PART-A

Write short notes on any FIVE of the following

5X3 = 15

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)
- 7)
- 8)

Part-B

Answer all questions

4X15 = 60

9. a) Essay Question
(or)
b) Essay Question
- 10.a) Essay Question
(or)
b) Essay Question
11. a) Essay Question
(or)
b)Essay Question
12. a) Essay Question
(or)
b) Essay Question

(Two essay questions from each unit)