

SOS in Environmental Science Marks Scheme for M.Sc. Session :2010-2011

Semester I

Paper	Title of Paper	MARKS		
		INTERNAL	Univ. Exam	Total
I	Fundamentals Of Environmental, Climatic and Soil Science	15	35	50
II	Ecology, Biodiversity, Forestry, Wildlife and Their Conservation.	15	35	50
III	Environmental Economics and Natural Resources	15	35	50
IV	Energy and Environment	15	35	50
	Practical I	---	50	50
	Practical II	----	50	50
	Total Marks	60	240	300

Semester II

Paper	Title of Paper	MARKS		
		INTERNAL	Univ. Exam	Total
I	Air, Noise Pollution and Control	15	35	50
II	Water, Thermal and Radioactive Pollution	15	35	50
III	Hazardous Waste Treatment and Solid Waste Management and Occupational Health	15	35	50
IV	EIA, EMS and EA	15	35	50
	Practical I	--	50	50
	Practical II	--	50	50
	Total Marks	60	240	300

SOS in Environmental Science Marks Scheme for M.Sc. Session :2010-2011

Semester III

Paper	Title of Paper	MARKS		
		INTERNAL	Univ. Exam	Total
I	Earth Processes, Hazards And Risk Assessment	15	35	50
II	Biotechnology , Toxicology and Environmental Management	15	35	50
III	Surveying, Photointerpretation and Remote Sensing	15	35	50
IV	Environmental Administration, Law and Judicial Attitude	15	35	50
	Practical I	--	50	50
	Practical II	--	50	50
	Total Marks	60	240	300

Semester IV

Paper	Title of Paper	MARKS		
		INTERNAL	Univ. Exam	Total
I	Global Prospects Towards Environmental Ethics and Sustainable Development	15	35	50
II	Statistics, Biometry and Research Methodology	15	35	50
	Practical I/ case studies	--	50	50
	Field work/ Project Work/ Dissertation	50	100	150
	Total Marks	80	220	300

Paper I01: Fundamentals of Environmental, climatic and soil science

Unit –I

1. Definition, principle and scope of Environmental Science.
2. Structure and composition of atmosphere.
3. Brief account of Hydrosphere, Global water resources and hydrological cycle.
4. Lithosphere: A brief account
5. Biosphere and its components.

Unit II

1. Scale of meteorology: Meteorological parameters pressure, temperature, precipitation, humidity, radiation and wind
2. Atmospheric stability, inversion and wind roses.
3. Climate of India, Monsoons and El nino.
4. Weather and folklores on weather forecast.
5. Climate change

Unit III

1. Environmental ethics.
2. Environmental education
3. Role of people, Professionals and NGO's in environmental education and Protection.
4. Environmental movements in India.
5. Environment protection faith and religious beliefs.

Unit IV

1. Soil and its organic and inorganic constituents.
2. Physical properties of soil.
3. Electro chemical properties of solid constituents.
4. Gas and liquid phases in soil.
5. Bioremediation of contaminated soils.

Unit V

1. Methods of soil formation
2. Organic farming, microbes and agriculture
3. Soil types of India
4. Soil erosion and conservation
5. Soil pollution and remedial measures.

PAPER-I02: ECOLOGY, BIODIVERSITY, FORESTRY, WILDLIFE, AND THEIR CONSERVATION.

Unit I

1. Structure and function of ecosystem
2. Primary productivity
3. Secondary productivity
4. Energy flow and laws of thermodynamics;
5. Energy models and energy relations in ecosystems

Unit II

1. Characteristics of populations
2. Population growth , Population interactions
3. Population regulation: density dependent and density independent
4. Concept and Characteristics of communities
5. Community Development

UNIT III

1. Concept of Biodiversity.
2. Global and Indian scenario of Biodiversity.
3. Plant Biodiversity: Principles and conservation.
4. Biological Diversity and Agenda-21
5. Hot spots of biodiversity and Key stone species.

UNIT IV

1. Forest Mensuration,
2. Forest Protection and Regeneration of Forest.
3. Agro forestry, Social Forestry. JFM.
4. Forest policies and community participation for sustainable forest management.
5. Ecotourism.

UNIT V

1. Diversity and distribution of wildlife in India.
2. Wildlife habitat and their management.
3. Red data book and endangered species, CITES.
4. Wildlife studies and Research Techniques.
5. Exploitation, Trade and sustainable utilization of wildlife.

PAPER-103 ENVIRONMENTAL ECONOMICS AND NATURAL RESOURCES

UNIT I

1. Fundamentals and theories of Environmental Economics.
2. Environmental quality as a public good.
3. Natural resources – efficiency and market failure.
4. Environmental issues in developed and developing countries.
5. Environmental issues and five year plan.

UNIT II

1. Concept of cost and benefits in an environmental programme – classification and distribution.
2. Cost benefit and cost effective analysis.
3. Concept of economic growth and development index of economic development.
4. Environmental cost of economic growth – damage cost and protection cost.

UNIT III

1. Forest resources in India and its crisis
2. State subsidies and resource use in dual society
3. Wetlands and woodlands with reference to India.
4. Natural range lands- savanna, steppes and other grasslands
5. The protection of threatened ecosystems, Natural parks and other natural reserves

UNIT IV

1. Water resources of India
2. Ground water provinces in India
3. Origin and composition of sea water, ice sheets and fluctuations of sea levels.
4. Resources of oceans
5. Biological resource management strategies.

UNIT V

1. Minerals essential nutrients of civilization, resources and reserves as a limiting factor
2. Strategies to reduce mineral consumption and conservation
3. Impact of mining on environment
4. Ocean as a new source of exploitation of mineral resources and their cycling
5. World food supply – agriculture, ecosystem and food production

PAPER-104 ENERGY AND ENVIRONMENT

UNIT I

1. Energy Budget on Earth.
2. Energy cycle and environmental effects.
3. Energy profile in India.
4. Grass root solutions in energy conservation.
5. Sustainable energy development in India.

UNIT II

1. Urban Energy Scenario.
2. Traditional fuels in an Urban Society.
3. Petroleum products.
4. Electricity.
5. Flow of Energy

UNIT III

1. Sun as a source of energy
2. Solar and its spectral characteristics.
3. Solar energy collection.
4. Solar photo applications.
5. Green building and their applicability.

UNIT IV

1. Wind energy, conversion, collectors and applications.
2. Hydraulic source of energy-hydroelectricity, ocean energy, ocean thermal electric conversion.
3. Geothermal energy-source applications, advantages and disadvantages.
4. Nuclear energy, Nuclear power plant-associative radioactive hazards.
5. Energy audit, Energy accounting & analysis.

UNIT V

1. Energy plantations.
2. Energy from biomass, biomass conversion technology.
3. Biomass gasification.
4. Anaerobic digestion.
5. Biogas technology (Methanogenesis)

PRACTICAL – I M.Sc. Environmental Science (Ist SEMESTER)

ATMOSPHERE

1. Study of Meteorological Parameters: Temperature, Precipitation, Relative Humidity, Wind velocity, Wind direction, Atmospheric pressure, Light intensity.

ENERGY

1. Field work on Urban Energy scenario
2. Study of Energy use pattern in rural area.
3. Electricity generation through photovoltaic cell (Solar Educational kit)
4. Loading of equipments on the solar module.
5. Other Practical applications of Solar Energy.
6. Practical applications of wind energy.
7. Biomass conversion Technologies.
8. Biomass gasification.
9. Biomass Technology.
10. Energy Audit report.

SOIL

2. Soil collection and preparation of samples.
3. Study of soil profile, colour, temperature, pH and EC.
4. Mechanical composition of the soil by simple wetting technique.
5. Determination of soil density and porosity.
6. Estimation of soil moisture content and water holding capacity (WHC).
7. Determination of Carbonate, Bicarbonate and Nitrate.
8. Determination of Organic carbon.
9. Determination of Nitrogen, Phosphorous and Potassium level in the soil.
10. Determination of Loss on Irrigation.

NOTE: At least 60% of the practical's listed be performed during the semester.

PRACTICAL – II M.Sc. Environmental Science (Ist SEMESTER)

FORESTRY and Ecology

1. Quadrates:
 - i. Determination of frequency.
 - ii. Determination of Dominance.
 - iii. Determination of Density
 - iv. Determination of Basal area
 - v. Determination of Abundance
 - vi. Determination of IVI
 - vii. Calculation of Biodiversity Index.
2. Canopy cover
3. Tree height
4. Profile Diagram
5. Phenology.
6. To study the biotic components of pond ecosystem
7. Estimation of benthos population density.

WILD LIFE

6. Planning a census for wildlife.
7. To recognize population trends from the indirect evidence of dung.
8. Methodologies for preparation of pug marks of animals
9. Identification of wild animals and description of their habitats, putting photos, slide (Transparencies) or visual stuffed animal products.

Paper 201: Air, Noise pollution and control.

Unit I

1. Air pollution, sources and types.
2. Pollution dispersion models.
3. Pollutant behavior in the atmosphere.
4. Smog, Acid rain, cause consequences and control
5. Green house effect and ozone depletion.

Unit II:

1. Indoor air pollution.
2. Effects of air pollutants on ecosystem.
3. Monitoring of air pollutants: Sox, NOx, Co.
4. Air quality standards and management.
5. Control of air pollution.

Unit III

1. Introduction to automobile pollution
2. Exhaust emission and their measurement
3. Emission legislation
3. Environmental effects of automobile pollution
4. Emission control technology and Compressed Natural Gas

Unit IV

1. Noise pollution Definition and classification
2. Causes of noise pollution
3. Measurement of noise and sound pressure level
4. Impact of noise on human health
5. Noise control and abatement measures

Unit V.

1. Atmospheric reactions and secondary pollutants.
2. Effects of meteorological parameters on transport and diffusion of air pollutants.
3. Wind effects (planter wind motion, synoptic wind motions, land sea breeze, Micro scale wind motions)
4. Atmospheric stability (temperature lapse rates, inversion plume types.
5. Air quality impact assessment.

Paper 202: Water, Thermal and Radioactive pollution

Unit I

1. Sources and types of water pollution.
2. Chemistry and Biology of water.
3. Water quality parameters; criteria and standards.
4. Chemical and bacteriological sampling and analysis.
5. Toxicity of drinking water.

Unit II

1. Lake optics, thermal stratification in lakes and streams
2. Water borne diseases.
3. Wet land, conservation and RAMSAR.
4. Role of aquatic plants in pollution abatement.
5. Water and hydrological cycle

Unit III

1. Principle of ground water flow
2. Ground water contamination
3. Control of ground water pollution
4. Water shed management
5. Rain water harvesting.

Unit IV

1. Water and sanitation assessment
2. Strategies, issues in water environment and sanitation
3. Human rights and sanitation assessment
4. Ecosystem approach in low cost sanitation assessment in India.
5. Land treatment system and advance waste water treatment system.

Unit V

1. Thermal pollution, causes control and consequences
2. Radioactive pollution, causes control and consequences
3. Marine pollution, causes, control and consequences
4. E-waste, causes and consequences.
5. Desertification causes and control.

Paper 203: Hazardous waste treatment and solid waste management and occupational health

Unit I

1. Major industrial wastes
2. The apparel industries: Textiles, Tannery, and Laundry.
3. Food industries: Cannery waste, Dairy, Poultry and Distillery wastes.
4. Material industries: wood, metals, etc.
5. Chemical Industries.

Unit II

1. Introduction: Handling & storage to Hazardous materials.
2. Hazardous waste: sources, effects, characterization, sampling and analysis
3. Risk assessment and hazardous waste management, treatment, storage and disposal.
4. Guidelines for owner/operator/transporter of hazardous waste, storage, treatment and disposal.
5. Responsibilities of the occupiers, generators of hazardous waste and its management.

UNIT III

1. Solid waste characteristics, collection and Transportation.
2. Waste separation, storage and disposal.
3. Waste Reduction, Recycling and Recovery of materials..
4. Integrated municipal solid waste management.
5. Biomedical waste management.

Unit IV

1. Energy recovery from solid waste
2. Municipal waste water treatment and energy recovery.
3. Integrated solid waste management
4. Environmental and health impact assessment of waste management
5. Wealth from wastes.

Unit V.

1. The people issue in construction, safety and health.
2. Construction, safety and health programme of UN with special reference to India.
3. Industrial hygiene activations in construction.
4. Personal protections equipment.
5. Safety Management.

PAPER-204 ENVIRONMENTAL IMPACT ASSESSMENT (EIA), ENVIRONMENTAL MANAGEMENT SYSTEM (EMS) AND ENVIRONMENTAL AUDIT (EA).

UNIT I

1. EIA: Introduction, Legislative frame work.
2. NEPA'S concept of Environmental Impact Analysis.
3. Elements of EIA
4. EIA Methodologies.
5. Guidelines for conducting EIA.

UNIT II

1. EIS: Introduction and legal basis for EIS.
2. Process for preparing EIS and public participation.
3. Environmental audit: Introduction, definition, benefits and objective of Environmental Audit.
4. Procedure and guidelines for EA
5. Draw backs of EIA

UNIT III

1. Environmental management: problems, reaction and legislation.
2. The integrated approach to Environmental Management. 12 steps to heaven.
3. EMS Audit, Management reviews and preparing environmental optional procedures.
4. Documentation assistance, manual, folders and assistance.
5. EIA notification 2006

UNIT IV

1. ISO 9000: A step towards TQM and Safety Management.
2. ISO 14000: Introduction, Certification and standards.
3. ISO 14001 series (upto ISO 14050 standards).
4. Introduction to Ecoplanning: Environmental Action Plan.
5. OHSAS 18000 health and safety.

UNIT V

1. Sitting of Industries – Introduction, Environmental site clearance, classification of Industries.
2. Site selection, Resource Analysis and Baseline information.
3. Environmental clearance and guidelines for Industries.
4. Industrial Scenario-Locational Policies
5. Industrial Policy of Indian and fiscal incentives for environmental protection

PRACTICAL – I M.Sc. Environmental Science (IInd SEMESTER)

ENVIRONMENTAL POLLUTION, PREVENTION, HAZARDOUS WASTE TREATMENT AND SOLID WASTE MANAGEMENT.

WATER AND WASTE WATER ANALYSIS:

1. Water sampling for Chemical, Bacteriological, Plankton and Benthic analysis.
2. Study of Physical characteristics of water: colour, odour, turbidity, and temperature.
3. Determination of solids.
4. Determination of pH.
5. Determination of conductivity.
6. Determination of Acidity and Alkalinity.
7. Determination of free CO₂, Hardness.
8. Determination of chloride.
9. Determination of Nitrate, sulphate, phosphate.
10. Determination of Fluoride.
11. Determination of Organic matter, Organic nitrogen.
12. Determination of Dissolved Oxygen.
13. Determination of Biological Oxygen Demand.
14. Determination of Chemical Oxygen Demand.
15. Study and Estimation of Plankton.
16. Study of Diatoms as Pollution Indicator.

NOTE : At least 60% of the Practical's listed be performed during the semester.

PRACTICAL – II M.Sc. Environmental Science (IInd SEMESTER)

EIA/EMS/EA AND SITING OF INDUSTRIES

Case Studies/Field Practicals.

1. Environmental Impact Assessment (EIA).
2. Environmental Impact statement (EIS).
3. Environmental Management system (EMS)
4. Environmental Audit (EA)
5. Study of Alternative Environmental Management Systems.
6. Study and implementation of ISO 9000 (TQM)
7. Study and implementation of ISO 14000 and 14001 Series.
8. Plan for How to site an Industry.
9. Ecoplanning of an Urban Area.
10. Ecoplanning in Rural Area.

AIR

1. Air Sampling.
2. Study of suspended particulate matter (SPM)
3. Analysis of SO₂ from Air.
4. Analysis of H₂S
5. No-No_x Analysis
 - (i) In Air.
 - (ii) In Petrol vehicle Exhaust.
6. CO-CO₂ Analysis
 - (i) In Air.
 - (ii) In Petrol vehicle Exhaust.
7. Analysis of NH₃ from air.
8. Determination of smoke from diesel vehicle exhaust.
9. Analysis of Aerosols.

NOISE

10. Noise measurement.

III Semester

Paper 301: Earth Processes, Hazards and Risk Assessment

UNIT-I

1. Fundamental Concepts of earth.
2. Earth material and processes.
3. Resources from the earth
4. Land use pattern in India.
5. Land use management and practices.

UNIT-II

1. Hazards in the environment Dimension of Disaster.
2. Tectonic hazards
3. Atmospheric hazards
4. Hydrological hazards
5. Biophysical hazards

Unit III

1. Introduction to risk assessment.
2. The elements of human health and risk assessment.
3. Risk Characterization.
4. Applications of risk assessment.
5. Future directions in risk assessment.

Unit IV

1. The concept of disaster as a product of hazard and vulnerability.
2. Disaster risk management concept areas for action and components.
3. Risk analysis concepts goals and products.
4. Bhopal disaster analysis.
5. Chernobyl disaster.

Unit V

1. The chemistry of hazardous material.
2. Safety management practices for laboratory.
3. RCRA act and waste analysis plan.
4. Hazard communication.
5. Process technology and hazard analysis.

PAPER-302. BIOTECHNOLOGY , TOXICOLOGY AND ENVIRONMENTAL MANAGEMENT

UNIT I

1. Role of Biotechnology in environmental protection.
2. Plant Tissue culture: Principals, methods and its application.
3. Genetic engineering
4. Biotechnological methods in pollution abatement.
5. Genetically engineered microbes in Bio treatment of waste and environment.

UNIT II

1. Bioabsorption of metals.
2. Biopolymers and Bioplastics
3. Biofuels and Biodiesel.
4. Biofertilizers and Biopesticides
5. Bioleaching

UNIT III

1. Eco-friendly bio-products for environmental health.
2. Fermentation Technology.
3. Vermiculture Biotechnology.
4. Mushroom culture technology.
5. Hydroponics.

UNIT IV

1. Definition, scope, goals and divisions of environmental toxicology
2. Factors affecting environmental concentration of toxicants
3. Factors influencing toxicity
4. Toxicity of chemical mixtures
5. Dose, effect, response and dose response relationship

UNIT V

1. Membrane permeability & mechanism of chemical transfer
2. Xenobiotic compounds in the Environment
3. Degradation of Xenobiotic compounds
4. Toxicity testing methods (single and multi - species, acute, sub-acute and chronic toxicity tests)
5. Environmental diseases.

PAPER-303: SURVEYING, PHOTOINTERPRETATION AND REMOTE SENSING.

UNIT I

1. Types of maps-survey of India maps, toposheets, map reading.
2. Symbols signs used in maps.
3. Primary Division and Classification of Surveying.
4. Survey methods-campus survey, Plane table survey, and Theodolite survey.
5. Basic concepts of cartography and Digital cartography.

UNIT II

1. Introduction to aerial photography, Basic information and specifications of aerial photography.
2. Scale, vertical exaggeration and types of aerial photographs.
3. Stereoscopy and aerial mosaics.
4. Principles of photo interpretation.
5. Application of aerial photo interpretation in environmental science.

UNIT III

1. Basic concepts and principles of remote sensing, ground truth Collection and spectral Signatures.
2. (a) Platforms: Balloon, Rocket, Aircraft, Spacecraft.
(b) Satellites: Land sat, SPOT, IRS-IKONOS
3. Sensors Imaging & Non imaging, Active and Passive.
4. Thermal infrared imaging system and its applications.
5. Radar Imaging system and its application.

UNIT IV

1. Fundamental of digital image processing.
2. Introduction to image enhancement technique – the image histogram, contrast stretching and band rationing and Edge Enhancement.
3. Image classification: Unsupervised, supervised.
4. Basic concepts of Geographical Information System (GIS) and GIS Applications.

UNIT V

1. Application of remote sensing in the assessment of environmental degradation.
2. Application of remote sensing in natural hazard detection.
3. Remote sensing in solid waste management studies.
4. Role of remote sensing and GIS in water quality mapping and monitoring.
5. Future prospect of remote sensing with special reference to environmental Sciences.

PAPER- 304. ENVIRONMENTAL ADMINISTRATION, LAW AND JUDICIAL ATTITUDE

UNIT I

1. Environmental protection: issues and problems.
2. International and National efforts for environmental protection.
3. Judiciary and Protection of environment.
4. Public policies strategies in Pollution control
5. Environmental legislation

UNIT II

Legislative measures:

1. The water (Prevention and Control of Pollution) Act, 1974 as amended up to 1988.
2. The merchant shipping (amendment) act, 1970.
3. Water and marine pollution act 1974.
4. Judiciary approach and water pollution.
5. Case studies:
M.C. Mehta v. Union of India, The Ganga Pollution case, AIR 1988 SC 1115.

UNIT III

1. The Air (Prevention and Control of Pollution) Act, 1981 as Amended by Amendment Act, 1987.
2. Motor vehicle Act, 1988 pertaining to pollution.
3. Kolahal Adhinium.
4. Sanitary Environment: the constutional and judiciary approach.
5. Municipal council, Ratlam v. Vardhichand and others. the Ratlam municipal case, AIR 1980 SCV 1622= 1980 Cr. L.J. 1975

UNIT IV

1. The Environment Protection Act, 1986 Amendments 1991 and Rules 1986.
2. Wildlife Protection Act, 1972 Amendment 1993 and 2002.
3. Forest Conservation Act, 1980 – Amended upto 1988.
4. Judiciary approach.

UNIT V

1. Hazardous waste management and handling rules 1989. Amendments there of 2000.
2. Municipal Solid Waste management and Rules 2000.
3. Environmental law and Public Interest Litigation.
4. Environmental law in the curriculum of legal education.
5. Panchayat act and IPR issue.

PRACTICAL – I M.Sc. Environmental Science (IIIrd SEMESTER)

ENVIRONMENTAL BIOTECHNOLOGY AND TOXICOLOGY

10. Tissue culture technologies effects of environmental agents on tissue culture.
11. Hydroponics
12. Vermiculture technology
13. Mushroom technology.
14. Study of microbes in the environment.
15. Microbiological study of water.
16. Effects of toxicants on plants and animals.
17. Heavy metal detection.
18. Toxicological studies of Drinking Water.
19. Study of Bioaerosols

20. Ecological effects of toxicants and their measurement.

ENVIRONMENTAL LAWS AND JUDICIAL ATTITUDE

1. M.C. Mehta V. Union of India, AIR 1992 SC 852.
2. M/S Narula Dyeing and Printing works V. Union of India, AIR 1995 Guj 185.
3. Rural Legis lation and entitlement Kendra-Dehradun V/S State of atter Prdesh (1987) Supp. Sec 487.
4. The Bhopal Gas Disaster case.
5. Ganga water Pollution N.C. Mehta V/S Union of India Sec 47, April 1988 SC 115. Date of Decision 22.09.1987.
6. Tarun Bhagat Singh V/S Union of India, 1992 Supp (2) SCC 448 at 457, AIR 1992 SC 519.
7. U.P. Pollution Control Board V.M.P.Modi Distillery and other, AIR 1988 Sc 1128.
8. Mandu Distillery Pvt. Ltd. V.M.P. Pradushan Niwaran Mandal, Bhopal, AIR 1995 M.P. 57.
9. Mahavir Soap and Godakhu factory V. Union of India AIR 1995 Ori 218.
10. Satyavan V. AP Pollution Board, AIR 1993 AP 257.

NOTE : At least 60% of the Practicals listed be performed during the semester.

PRACTICAL – II M.Sc. Environmental Science (IIIrd SEMESTER)

SURVEYING

10. Calculation of SOI Map lay out number.
11. Interpretation of SOI Topographic sheet.
12. Map Reading.
13. Study of the border information of Aerial photograph.
14. Determination of Scale.
15. Stereo-test and orientation of Aerial photographs.

REMOTE SENSING

16. Identification of features from single vertical aerial photograph.
17. Study of Topography through stereographs and aerial photographs.
18. Preparation of land use map.
19. Visual Interpretation of stereo-pair for environmental studies.

NOTE: At least 60% of the practical's listed be performed during the semester.

PAPER-401 GLOBAL PROSPECTS TOWARDS ENVIRONMENTAL ETHICS AND SUSTAINABLE DEVELOPMENT

UNIT I

1. Totality of environment-Holistic view and ecology to environmental Science
2. Environmental Science on the move.
3. Ecosystem Management and Environmental ethics
4. From Stockholm to Rio and Beyond
5. Human Impact on Natural Environment.

UNIT II

1. Global issues and strategies.
2. World Trade and environment.
3. The vital issues process: Managing critical infrastructures in the global areas.
4. Issues calling for immediate attention.
5. Managing the Environment: The Physical and Socio economic setting.

UNIT III

1. Terrorism and its impact on human ecosystem.
2. Effects of Nuclear Explosions and Threat of Nuclear Terrorism.
3. Genesis of Biological warfare and current threat.
4. Chemical warfare.
5. The chemical weapons convention.

UNIT IV

1. The global environment debate.
2. Managing global commons.
3. Poverty, Trade, DEBT, and Environment.
4. Intellectual Property Rights (IPR).
5. Economics and ethics: Foundation of a Sustainable future.

UNIT V

1. Sustainable Development: brief history and interpretation.
2. Sustainable development in India.
3. Rural development, industrialization and self employment.
4. Strategies and appropriate Technologies for Sustainable Development.
5. Environmental Accounting.

PAPER-402. STATISTICS, BIOMETRY AND RESEARCH METHODOLOGY

UNIT I

1. Introduction.
2. Collection, Tabulation and classification of data.
3. Measure of Central values, mean, mode and median.
4. Geometric mean and Harmonic mean.
5. Measure of dispersion – Standard deviation.

UNIT II

1. Calculation of coefficient of correlation in simple series.
2. Linear regression.
3. Curve fitting up to second order.
4. Probability and theoretical distribution-addition theorem, multiplication theorem.
5. Binomial, poisson and normal distribution.

UNIT III

1. Large samples: relating to attributes, relating to variable differences of means.
2. Small samples: 'f' test.
3. ANOVA – 1 way classification.
4. ANOVA – 2 way classification.
5. Chi Square test.

UNIT IV

1. Concept and method of Research
2. Sources of information on research and relation of research topic.
3. Measurement of Research problem.
4. Use of Sampling and Questionnaires construction for Research.
5. Processing of Research data and preparation of research report.

UNIT V

1. Approaches to development of models.
2. Linear, simple and multiple regression model.
3. Lotka-volterra Model and Leslie's matrix model.
4. Point source stream pollution model.
5. Box model and Gaussian plume model.

(Note: Mathematical aspects of statistics and derivations are not` included in this syllabus.)

PRACTICAL - I. M.Sc. Environmental Science (IVth SEMESTER)

Practical / Field Work / Case Studies:

GLOBAL PROSPECTS TOWARDS ENVIRONMENTAL ETHICS AND SUSTAINABLE DEVELOPMENT.

1. Impact of terrorism on the natural environment-Case study
2. Impact of terrorism on the human ecosystem.
3. Impact of the human activities on the natural environment.
4. Environment accounting in different areas.
5. Study of level of industrialization.
6. Study of physical setting of the area.
7. Study of social setting of the area.
8. Study of technologies for sustainable development adopted in your area.
9. Study of impact of industrialization on local environment.
10. Local issues calling for immediate attention.

STATISTICS, BIOMETRY AND RESEARCH PROCESS AS APPLIED TO ENVIRONMENT

11. Methods and techniques of research.

12. Level of research project.
13. Problem, selection and research design.
14. Questionnaires construction for research.
15. Study of collection of data and tabulation.
16. Application of standard deviation and standard error.
17. Application of Test of Significant.
18. Application of ANOVA.
19. Application of Chi Square Test.
20. Approaches to development of Model.

NOTE : At least 60% for the particles listed be performed during the semester.