

Department of **Environmental Management**  
**Faculty of Science**  
**University of Kalyani, Kalyani- 741235, West Bengal**



*Syllabus*

*For*

**M. Sc. Programme in Environmental Management**

**Total Marks – 2300; Semester 1: 600, Semester –2: 600, Semester –3: 600, Semester 4: 500**

**Total Credit Hours: 110; Semester 1: 30, Semester –2: 30, Semester –3: 30, Semester 4: 20**

<u>Paper</u>	<u>Course No.</u>	<u>Subject</u>	<u>Credit hours</u>	<u>Full Marks</u>		
				<u>Written</u>	<u>Internal Assessment</u>	<u>Practical</u>
Paper - I	Group-A S1- EMIA	Fundamentals of Environment and Ecology	4	40	10	
	Group-B S1- EM IB	Fundamentals of Environmental Management and Environmental Economics		40	10	
Paper-II	Group-A S1- EMIIA	Environmental Pollution and Management	4	40	10	
	Group-B S1- EMIIB	Ecotoxicology and Environmental Health		40	10	
Paper – III	Group-A S1- EMIIIA	Natural Resource Management	4	40	10	
	Group-B S1- EMIIIB	Bioresource Management		40	10	
Paper-IV (Practical)	Group-A S1- EMIVA	Water Quality Analysis				50
	Group-B S1- EMIVB	Soil Quality Analysis and Environmental Statistics				50

### INSTRUCTIONS TO THE PAPER SETTERS

1. Each theory paper is of 80 marks. There will be 14 questions in each paper of which 10 questions are to be attempted. Question No. 1 and 2 (objectives/ short answer type) are compulsory and to be answered in separate answer scripts to be submitted within the first 45 minutes from the commencement of examination.
2. Four questions are to be chosen from Question nos. 3 to 8 and the four questions from Question nos. 9 to 14. Questions carrying 10 marks should comprise of a number of parts.
3. Number of questions and division of marks are stated below:
4. The questions in each paper should be fairly distributed over the whole course content (syllabus) of that paper.

<b>Question No.</b>	<b>Total Marks</b>	<b>No. of questions to be attempted</b>	<b>No. of alternative questions to be set</b>
Question No. 1	8 x 1 = 08	Eight (8)	No Alternative
Question No. 2	6 x 2 = 12	Six (6)	Eight (8)
Question Nos. 3 - 8	4 x 5 = 20	Four (4)	Six (6)
Question No. 9 - 14	4 x 10 = 40	Four (4)	Six (6)

## SEMESTER – 1

Paper – I

FM -100 (4 credits)

### Group A (Course No. S1 EM IA): Fundamentals of Environment and Ecology

FM-50

1. **Life and Environment:** Origin of universe, earth, environment and life; biological control of the environment; atmosphere, hydrosphere, lithosphere and biosphere.
2. **Ecosystem:** Structure, principles and processes; kinds of ecosystem; cybernetics and homeostasis; ecosystem services; ecosystem management and optimization. Productivity of ecosystems.
3. **Biogeochemical Cycles:** Concepts; hydrologic cycle, carbon, nitrogen and phosphorus cycles (C, N, P) and their significance; impact of anthropogenic activities.
4. **Ecosystem Energetics:** Concept, laws of thermodynamics, food chain and food web; energy flow in ecosystem, energy budget.
5. **Population Ecology:** Properties, K- and r- selection; carrying capacity and sustainability, population regulation, human population and its implication in environment and development.
6. **Forest Ecology:** Concept, structure and dynamics; ecological and economic importance; consequences of deforestation.
7. **Aquatic Ecosystems:** Concept, structure and functional attributes, diversity, differences between lentic and lotic habitats, economic importance.

### Group B (Course No. S1 EM IB): Fundamentals of Environmental Management and Environmental Economics

FM-50

1. **Environmental Management:** Concept; importance; perspectives of environmental management in India; The Environment (Protection) Act, 1986; National Environmental Policy, 2006; environmental priorities in India.
2. **Principles of Management:** Design and structure of an organization; managerial functions, roles and skills; planning processes; problem solving and decision making; control mechanisms; management of conflict and coping with stress.
3. **Environmental Economics:** Concept of environmental and ecological economics; Fundamentals of the economics of environmental resources and common property resources; environmental externalities and externality theory; economic efficiency (demand-supply basics, accounting, valuation) cost-benefit analysis (CBA); precautionary principle and compensation principle; merits of various environmental economic techniques.
4. **Environmental Economics and Market Mechanisms:** Resource scarcity, economic efficiency and markets; Economics of sustainable development: Concept, Hartwick-Solow approach, ecological economical approach and safe minimum standard (SMS) approach to sustainability.
5. **Environmental Taxes and Policies:** Concept of green tax and green subsidy; polluter pays principles; carbon trading; assessing worthiness of environmental project: Legal, fiscal and market policies.

**Group A (Course No. S1-EM IIA): Environmental Pollution and Management**

FM-50

1. **Air Pollution:** Source, nature and impacts; acid rain; vehicular air pollution; indoor air pollution; status of air pollution in major Indian cities; air quality monitoring and air quality standard; control techniques and management issues; The Air (Prevention and Control of Pollution) Act, 1981; case studies.
2. **Water Pollution:** Sources, nature and impacts; eutrophication- concept, cause and effects; ocean pollution; ground water pollution; river pollution; Ganga Action Plan (GAP), Yamuna Action Plan (YAP); water pollution control; water pollution monitoring; water quality standards; The Water (Prevention and Control of Pollution) Act, 1974; case studies.
3. **Soil/ Land Pollution:** Sources and effects; soil quality and soil degradation; impacts of agricultural chemicals and industrial effluents; management and control of soil pollution in India.
4. **Noise Pollution:** Sources, measurement and impacts; status of noise pollution in major cities in India; regulation and control of noise pollution; noise mapping; case studies.
5. **Bio-pollution:** Concepts, processes and impacts; microbial pollution; bio-invasion, bioallergy and bioterrorism.

**Group-B (Course No. S1-EM IIB): Ecotoxicology and Environmental Health**

1. **Environmental Toxicology:** Concepts, toxicants and xenobiotics; genotoxicity; factors modifying the activity of toxicants; effects of toxicants in living systems; antidotes, treatment and detoxification of toxicants; toxicity bioassay methods.
2. **Toxicity of Heavy Metals:** Sources, distribution, toxic effects of heavy metals (Lead, Cadmium, Chromium, Mercury); antidotal measures; case studies.
3. **Arsenic and Fluoride Pollution:** Present status of arsenic and fluoride pollution in India; impacts on human life; remedial measures.
4. **Pesticide Toxicity:** Classification, nature, routes of exposure, modes of action, biological and health effects; pesticide residues in the environment: adsorption, retention, transport and degradation; concept of pesticide resistance.
5. **Emerging Contaminants:** Concept, types and modes of action; pharmaceuticals, PCPs, PPCPs; environmental threats and health hazards; Endocrine disruptors: types, characteristics, modes of action and toxic effects; Environmental carcinogens: categories, actions and toxic effects.
6. **Genetic Toxicology:** Concept, types, classes, effects of genotoxic agents; genotoxicity testing.
7. **Occupational Health:** Concept; specific health risks and diseases; emerging health risks for industrial workers: coal mines, battery, tannery and bidi; case studies; safety of industrial workers; health insurance, policy issues and welfare programmes.

**Paper – III Group A (Course No. S1-EM IIIA): Natural Resource Management**

1. **Basics of Natural Resources:** Concept, kinds; conservation vs preservation.

2. **Energy Management:** Conventional and non-conventional energy resources; renewable energy sources: solar photovoltaic and solar thermal, wind energy, tidal energy, ocean energy (OTEC), geothermal energy; biomass gasification; energy recovery from wastes; bio-fuel; nuclear energy and management of nuclear wastes; energy conservation and energy management; national energy policy.
3. **Management of water resource:** World water balance, conservation of freshwater resources; integrated water resource management; rainwater harvesting; watershed management; environmental issues of lakes, dams and reservoirs; river linking and its impacts.
4. **Management of Coastal and Marine Resources:** Coastal resources; mangrove and salt marsh ecosystems; Integrated coastal zone management (ICZM); Threats to marine ecosystem; marine resource management.
5. **Management of Soil and Land Resources:** Soil types, health and indicators; soil degradation and soil erosion; soil survey; integrated strategies for soil conservation and regeneration; case studies; land resources: recent changes in land use pattern, land use planning.
6. **Wetland Management and Conservation:** Wetlands- definition, functions, ecology and biodiversity; wetland loss and degradation; Ramsar sites; strategies for wetland conservation and management; wetland mapping.

**Paper – III Group B (Course No. S1-EMIIIB): Bioresource Management**

1. **Basics of Bioresources:** Concept, kinds, importance.
2. **Human Resource:** Management, scope and importance of human resource management (HRM) and personnel management; human development index (HDI).
3. **Animal Resources Conservation and Management:** Concept on livestock and livestock production management; role in livelihood and nutritional securities; sustainable livestock production, problems and opportunities; conservation of livestock biodiversity; livestock feed resources in different ecology; pasture conservation and management.
4. **Biodiversity Conservation:** Biodiversity – Concept, types, values, levels, indices and significance; assessing, analyzing and documenting biodiversity; peoples biodiversity register (PBR); DNA Bar coding; diversity loss and extinction; methods of biodiversity conservation; concepts of hot spots, mega biodiversity countries, red data book; traditional knowledge and biodiversity conservation; Intellectual Property Rights (IPR) and biodiversity; Bio prospecting and bio piracy issues with particular reference to India's biodiversity; CITES; Conventions on Biodiversity (CBD); The Biodiversity Diversity Act, 2002; The Biological Diversity Rules 2004.
5. **Forest Management:** Classification and distribution of forests; forest degradation; deforestation and desertification and their impact on environment; afforestation; current strategies of conservation and management of forest resource; agro-forestry, social forestry; Joint Forest Management; National Forest Policy; Forest (conservation) Act, 1980.
6. **Wildlife Conservation and management:** Wildlife- concept and values, strategies of wildlife conservation and management; protected area network, sanctuary, national park, biosphere reserve; Conservation Management Areas (CMAs); Wildlife Protection Act, 1972.

**Paper – IV Group-A (Practical) (S1-EMIVA): Water Quality Analysis**

1. Analysis of different water quality parameters (temperature, pH, turbidity, free carbon dioxide, alkalinity, dissolved oxygen) in different water systems.
2. Assessment of nutrient levels (nitrate, orthophosphate) of water bodies for management
3. Assessment of organic load [chemical oxygen demand (COD), biochemical oxygen demand (BOD)] in different water bodies for management
4. Assessment of primary productivity in different water bodies.

**Paper – VI Group-B(Practical) (S1-EMIVB): Soil Quality Analysis and Environmental Statistics**

1. Physicochemical characteristics of soil (grain size, porosity, organic carbon, organic matter,)
2. Assessment of nutrient levels (Total & available nitrogen, Total & available phosphate) of pond/agricultural soil for management
3. Statistical analysis: Mean, median, mode, standard error, standard deviation
4. Preparation and submission of Green files
5. Field excursion.