

**Department of Environmental Science  
University of Kalyani, Nadia  
West Bengal, India**



**(Semester System)**

**The Master of Philosophy (M.Phil.)  
Course in Environmental Science  
(Self Finance Course)**

## **TEACHING FACULTY**

### **Full time faculty members :**

1. Dr. S. C. Santra, Professor (Ecology & Environmental Biotechnology)
2. Dr. D. Das, Professor (Environmental Geology)
3. Dr. D. K. Khan, Professor (Environmental Geography)
4. Dr. R. Bhattacharya, Reader (Atmospheric Physics)
5. Dr. (Mrs.) S. Mukherjee, Lecturer (Environmental Chemistry)
6. Dr. A. Bhattacharya, Lecturer (Environmental Toxicology)

### **Guest Faculty :**

Various experts of different Universities, Research Institutes and Corporate Bodies will be invited to deliver lectures.

**Regulations :**

1. The Master of Philosophy (M. Phil.) degree shall be a post-M.Sc. degree in science. The relevant programme shall provide adequate knowledge for understanding research activities on environmental sciences. Emphasis shall be laid on training in research methodology in concerned subject or in an interdisciplinary field.
2. Any candidate who has passed the Master's (2 years) in Environmental Science, Botany, Zoology, Physiology, Chemistry, Physics, Mathematics, Statistics, Biochemistry, Biophysics, Geology, Geography, Management and Agricultural/ Fishery/veterinary Sciences, Degree in Engineering , Medical and Veterinary Sciences of any recognised University may admitted to the M. Phil. Programme on Environmental Science. Twenty five students of all streams mentioned above will be admitted on merit basis.
3. Govt. agencies and industries may sponsor their candidates for M. Phil. Course, provided the candidates have requisite basic qualifications as mentioned in para 2 above.
4. The course shall be of one year duration including one month study leave.
5. The candidates shall have to complete the course works, review/dissertation/project works and also have to deliver a seminar talk, preferably at the end of the academic session.
6. The candidates shall be evaluated on a continuous basis through examinations, internal assessment, review/dissertation works, field study and vivavoce examinations. Each candidate has to attend more than 60% lectures of the course and also to submit dissertation and appear before the vivavoce examinations. In order to pass a candidate must obtain 50% marks in aggregate. Each successful candidate shall be awarded the M. Phil. Degree in Environmental Science. Like all other examinations of the University, M. Phil. Examination will be conducted as per University Rules.
7. The course shall be conducted by the Department of Environmental Science, Kalyani University. Some experts from other reputed Institutions, Industries and Universities will be invited to deliver special lectures on the selected topics as included within the framework of the course.
8. Post Graduate Board of Studies of the Department will frame the syllabus and regulations from time to time.
9. The course fee for each candidate shall be Rs.20,000/- for the entire period in addition to other fees of the University as per rule. Payment shall be made at the time of admission. The cost for field studies shall be charged separately.

## **COURSE STRUCTURE**

**(Three semester)**

### **Semester –I**

Marks - 350

Course-101	:	Environmental Biology	- 100
Course-102	:	Environmental chemistry	- 100
Course-103	:	Environmental Geology	- 100
Course-104	:	Environmental Science Practical -I & Field work	- 50

### **Semester -II**

Marks - 350

Course-201	:	Wildlife management, Immunology & Toxicology	- 100
Course-202	:	Environmental physics	- 100
Course-203	:	Environmental Geography, Impact Assessment and Laws & movements	- 100
Course-204	:	Environmental Science Practical - II & Field work	- 50

### **Semister -III**

Marks - 300

Course-301	:	Project work	- 250
Course-302	:	Grand viva	- 50

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**Grand Total 1000**

\* There shall be a few field studies in each semester. Cost of project work to be borne by the candidates.

## Semester -I

### Course -101: ENVIRONMENTAL BIOLOGY

**Full marks - 100**

**1.1 Life processes & Evolution :**

Concept of life, origin and evolution of life forms, Evolution mechanism.

**1.2 Biodiversity :**

Diversity of life forms, genesis, values, cause of extinction of species, threat to biodiversity, global and national biodiversity status, conservation of biodiversity, acts & treaties relating to biodiversity conservation, bioprospecting, biopiracy, WTO regime and commercialization of biodiversity.

**1.3 Basic Ecology :**

Community concept, types of community, succession process, competition and co-existence, mutualism and parasitism, population growth.

**1.4 Ecosystem :**

Concept, trophic structure, energy flow, productivity, nutrient cycle, homeostasis in ecosystem. Ecosystems of India - status & conservation strategies, Climate change & ecosystem impact, Wetland ecosystem - its values and management.

**1.5 Environmental pollution :**

Types of various pollution, their causes, chemical nature of pollutants and their impact on various biological systems, methods in pollution abatement technology.

**1.6 Environmental resources & accounting :**

Forms of natural resources, natural resource accounting, valuation methods.

**1.7 Environmental biotechnology :**

Concept, various application areas with case studies, future potential of environmental biotechnology in pollution abatement, biofuel harvesting, and enhancement, sustained agricultural productivity through improvement of agricultural biotechnology.

**References :**

1. Collinvaux, P. - Ecology
2. Campbell, B. - Biophysical Ecology

3. Groombridge, B. (Ed) Global biodiversity - Status of the Earth's living Resources, Chapman & Hall, London.
4. Moriarty, F. - Ecotoxicology
5. Odum, E. - Fundamental Principles of Ecology.
6. Park, K. : Text book of Preventive and Social Medicine.
7. Santra, S.C. : Environmental Science, Kolkata.
8. Stiling, P. : Ecology - theories and applications. PHI.
9. Smith, R. L. Elements of Ecology.
10. UWEP : Global Biodiversity Assessment. Cambridge Univ. Press. Cambridge.

## **COURSE -102: ENVIRONMENTAL CHEMISTRY**

**Full marks – 100**

### **1.1 Atmosphere and Atmospheric Chemistry :**

Importance of the Atmosphere, Physical Characteristics, Energy transfer, Particles in the atmosphere, Physical & Chemical processes for particle formation, Composition of organic particles, Effects on biota, Mitigative measures, Air pollution - gaseous inorganic and organic air pollutants, reactions, effects and fate of air pollutants in the atmosphere, control strategies.

### **1.2 Photochemistry :**

Chemical, photochemical, photosensitized reactions in the atmosphere. Photochemical smog - mechanisms of smog formation. Effects of smog, thermal inversion.

### **1.3 Global environmental concerns :**

Anthropogenic change in the atmosphere, Greenhouse gases and Global warming, Acid rain, Ozone layer destruction, Nuclear winter, El nino, Asian Brown Haze.

#### **1.4 Water pollution & waste water transport :**

Water pollution status (surface water & ground water), control strategies, waste water composition & characteristics, waste water treatment, waste water reclamation and reuse, industrial waste water treatment & disposal .

#### **1.5 Hazardous wastes and their management :**

Concept, sources, properties, effect and fate of toxic waste. Radioactive waste and Biomedical waste. Hazardous waste treatment technologies, International treaties on disposal of hazardous waste, Industrial solid waste treatment - steel, pharmaceutical, leather, thermal power plant.

#### **1.6 Green Chemistry :**

Concept, principles and utility of green chemistry : green reagent, green catalyst. Industrial interest in green chemistry.

#### **References :**

1. Manahan, S. E. - Environmental chemistry
2. Dey, A. K. - Environmental chemistry
3. Metcalf and Eddy Inc - Waste water Engineering
4. Gerand Guyot - Physics of the Environment & climate

### **COURSE 103: ENVIRONMENTAL GEOLOGY**

**Full marks – 100**

#### **1.1 Environmental Geology :**

Concept and scope of environmental geology; changing global phenomena with respect to earth surface features; weathering processes; plate-tectonics.

## **1.2 Natural Resources :**

Renewable & non-renewable, status evaluation, exploitation ways with particular reference to fossil fuel and metallic ores, water resources - status evaluation, conservation and their management, geological basis of ground water and surface water contamination with case studies, geochemical processes and their relevance to human health.

## **1.3 Natural Hazards :**

Climatic origin (Cyclone, flood, drought, global warming); Geological origin (landslide, earthquake, volcanism); Impact of such natural hazards & their management.

## **1.4 Remote Sensing :**

Principles, techniques & application in environmental sciences, GIS-techniques & application.

## **References :**

1. Valdia, A. - Environmental Geology
2. Strahler, A. V. and A. H. Strahler - Environmental Geosciences
3. Lillies, T. M. and R. W. Kiefer - Remotesensing & Image interpretate.

## **COURSE 104: ENVIRONMENTAL SCIENCE PRACTICAL –I**

**Full marks – 50**

1. Drainage basin analysis and terrain features evaluation based on toposheets, satellite imageries; microscopic study of mineralized rocks specimen
2. Air quality monitoring (chemical / biological)
3. Drinking water quality monitoring (chemical / biological)
4. Wastewater quality monitoring (chemical / biological)
5. Soil quality monitoring (chemical / biological)
6. Noise monitoring & computation of Leq value and noise index
7. Biological indices computation with planktons
8. Field sampling in forest for analysis of plants, birds and mammals

## **Semester – II**

### **COURSE 201: WILDLIFE MANAGEMENT, IMMUNOLOGY & TOXICOLOGY**

**Full marks - 100**

#### **1.1 Wildlife management :**

Status evaluation and management strategies, global & national scenarios, acts & treaties relating to wildlife management & conservation.

#### **1.2 Biomonitoring :**

Concept and methods, application of biomonitoring in soil quality, water quality and air quality assessment, biosensor technology.

#### **1.3 Public health :**

Concept of health & diseases, nutrition & health, health & environment, epidemiological analysis of diseases (method of analysis with examples), occupational health assessment, community health care programme, Clinical and diagnostics- principles and techniques.

#### **1.4 Environmental Toxicology :**

Concept, risk assessment, drug abuse, poisoning, forensic toxicological investigation, food poisoning - causes & effects.

#### **1.5 Medical microbiology & parasitology :**

Microbial basis and cause - effect relationship of various tropical diseases. Vector borne diseases in tropics and their management.

#### **1.6 Immunology :**

Concept, type of immunity, immunological effects of biopollutants, control strategies for regulation of immunological diseases.

#### **References:**

1. Basic Toxicology, Frank C. Lu. McGraw Hill Int.
2. Immunology , Kuby, 4th Edition

## **COURSE-202: ENVIRONMENTAL PHYSICS**

**Full marks - 100**

### **1.1 Atmospheric Thermodynamics :**

Hydrostatic equation, Laws of Thermodynamics, Adiabatic Processes, Concept of Stability, Equilibrium conditions.

### **1.2 Radioactive Transfer :**

The spectrum of radiation, absorption and emission of radiation by molecules, black body radiation, scattering of solar radiation, global energy balance, radiation budget equation. Radiation fluxes in natural environment, alpha, beta, gamma and X-radiation, cosmic radiation. Absorption of electromagnetic radiation and interaction with matter. Radiation as environmental pollutant, radioisotopes, detection and measurements, linear energy transfer. Relative biological effectiveness, biological effects of radiations.

### **1.3 Atmospheric Dynamics :**

Navier Stokes theorem, thermal wind, continuity equation, thermodynamic energy equation, general circulation, pollution dispersal in atmosphere, dispersion equation. general idea about synoptic and meso-scale disturbances.

### **1.4 Ecological Modeling & Biostatistics :**

Data collection and processing, statistical methods of sampling of population, variance analysis, regression analysis, environmental model analysis.

### **References :**

1. A course in dynamic Meteorology – N. Pandharinath (BS Publication)
2. An introduction to dynamic Meteorology – J.R.Holton (Academic Press)
3. Microwave Remote Sensing – F.T. Ulaby, R.K.Moore, A.K.Fung (Addison wesley publication)
4. Mathematical analysis for modeling J. Rosenblatt & S.Bell (CRC Press)
5. Analysing Env. Data – A Pentecost (Long mann)

**COURSE-203: ENVIRONMENTAL GEOGRAPHY IMPACT ASSESSMENT AND  
LAWS & MOVEMENTS**

**Full marks- 100**

**1.1 Landscape Ecology :**

Concept, structure, developmental processes and functions, impact of man's activity on landscape processes, changes in the landscape with time and space, application of landscape ecological studies.

**1.2 Land degradation :**

Concept, genesis of land degradation and its environmental consequences, wasteland - mapping and management, desertification - mapping and management, environmental carrying capacity - assessment methodology, sustainable development with respect to land management.

**1.3 Human Ecology :**

Man-environment relationship, environmental crisis in society, impact of major human activities on environmental processes. Land use policy (urban and rural) in India, restoration and rehabilitation technology for various developmental activities.

**1.4 Environmental Impact assessment :**

Concept, scope, processes, evaluation methodology, procedure for Environmental clearance, environmental audit, Life cycle analysis, Environmental management (ISO-14000)

**1.5 Environmental Laws & Movement :**

Indian constitutional provisions and legal coverage of environmental protection in India, Environmental laws in India with some cases, Composition and functioning of State Pollution Control Board and Central Pollution Control Board, International Convention and Treaties, National Environmental Movements, Public participation in environmental protection in India.

**Reference:**

1. Forman, T. T. and M. Gordon - Landscape Ecology
2. A. H. Strahler and A. N. Strahler - Geography and Man's Environment.
3. Canter, C.L. - Environmental Impact Assesment

**COURSE-204: ENVIRONMENTAL SCIENCE PRACTICAL - II**

**Full marks- 50**

1. Field survey techniques & applications.
2. Landuse and land cover mapping (Toposheet / satellite imageries)
3. Air-photo interpretation
4. Studies on Cell viability and cytotoxicity
5. Studies on DNA & Protein Gel/SDS PAGE
6. Studies on Histology/Histopathology
7. RS/RW data analysis
8. Preparation of Rose diagram
9. Study of Solor radition parameters