

# **NATIONAL UNIVERSITY**



## **Syllabus** **Department of Environment Science**

**Four Year B.Sc Honours Course**  
**Effective from the**  
**Session : 2009–2010**

**National University**  
**Syllabus for Environmental Science B.Sc. Honours**  
**Sessions -2010-2011,2011-2012**

**Third Year (Honours)**

<b>Course Code</b>	<b>Course Title</b>	<b>Marks</b>	<b>Credit</b>
4472	Integrated Coastal Zone and Floodplain Managements	100	4
4473	Ecology and Biodiversity	100	4
4474	Environmental Impact Assessment	100	4
4475	Environmental Toxicology	100	4
4476	Remote Sensing and GIS	100	4
4477	Waste Management	100	4
4478	Geography and Geology of the Bengal Basin	100	4
4479	Hydrology and Water resources	100	4
4480	Laboratory and Field work on Environmental Sciences	100	4
	<b>Total</b>	<b>900</b>	<b>36</b>

<b>Course Code</b>	<b>4472</b>	<b>Marks: 100</b>	<b>Credits: 4</b>	<b>Class Hours: 60</b>
<b>Course Title:</b>	<b>Integrated Coastal Zone and Floodplain Managements</b>			

1. **Introduction:** Characteristics of Bangladesh coastal zone, Topographical changes, climate of costal zone, soils of coastal zones and floodplain, Coastal embankment project, sea level rise and its implication for Bangladesh
2. **Floodplain:** Introduction location & climate of flood plain, geomorphology, hydrology, biological agents, physiographic Units of the flood plains, Soil formation of seasonally flooded land (e.g. Ganges & Meghna floodplain) & non flooded land, Agriculture development on flood plains and its effect on environment. Human settlement & plantation management on floodplain and Char land.
3. **Environmental management of floodplain soil:** Soil in natural & man made environment, Soils as a medium for plant growth, sorption properties of soil, soil in relation to environment, soil acidification, erosion & conservation problems in Bangladesh floodplain and coastal areas.
4. **Coastal environment & Management:** Introduction, definition & importance, classification of coastal system: estuaries, tidal wetlands, coral reefs, beaches and shoreline, Description & categorisation of coastal ecosystem: Anthropogenic & natural disturbances of coast, environmental perturbation of coastal aquatic habitat: Impact of coastal aquaculture on environment (e.g. shrimp culture),
5. **Coastal resource and livelihood:** Evaluation of vital area, resource capability use allocation, Diversification, Livelihood groups: *Salt farmer, Fisher man and Small farmer*, Poverty, Vulnerability to environmental changes: regional and global perspectives
6. **Coast protection:** Multistructure embankment, groans etc, their problems & remedies, Development options in the coast: tourism and recreation (Cox's bazar & Kuakata) fisheries resources, Nature conservation, Infrastructure development. Guidelines for coast development & management; Policy analysis & case studies.
7. **Mangroves:** Sunderbanes and other mangroves of the world; problem and prospects

#### **Recommended References:**

1. Coastal environmental management plan for Bangladesh, Volume 2 Final report, Eeconomic social commission for Asia and the Pacific, Bangkok, Thailand.
2. An introduction to coastal ecology by PJS Boaden and R Seed (1985)
3. PDO-ICZMP Project Report, Living in the Coast PEOPLE AND LIVELIHOODS, WARPO, 2004
4. Policy & Practice in the management of Tropical water shed by HC. Pereira (1989) Balhaven press, London.
5. Soil and Water conservation by FR Troch (1991) Prentice Hall. NJ.
6. Water & Waste water by My Hammer (1996) Prentice Hall inc.
7. Soils & the Environment by A Wild (1996) Cambridge Univ. Press.
8. Environmental Soil chemistry by DL sparks (1996) Academic press.

<b>Course Code</b>	<b>4473</b>	<b>Marks: 100</b>	<b>Credits: 4</b>	<b>Class Hours: 60</b>
<b>Course Title:</b>	Ecology and Biodiversity			

### Part A

1. **Introduction:** Concepts, principles, branches and scopes of ecology.
2. **Autecology, Population and Population regulations:** Definition and outlines of autecology, different aspects of autecological study of species, ecological features of species, and significance of autecological study, definition and characteristics of population dynamics, population structure, population growth, factors regulating population size.
3. **Community and Community dynamics:** Definition, concepts, characteristics and composition of community, community classification, life-form and biological spectrum, physiognomy, community development and evolution, community dynamics, diversity index (Shanone-Winner index)
4. **Ecosystems and Ecosystem dynamics:** Definition and concept of ecosystem, structure, components and functions of ecosystem, classification and description of ecosystem, ecosystem dynamics and energy flow in ecosystem, inter-relationships of ecosystem.
5. **Ecological factors and their impacts:** Introduction, Climatic factors: Light, Temperature, Precipitation, Humidity, Wind-speed and their effects on vegetation; Edaphic factors: Soil types, profiles, components, factors affecting vegetation, soil- water, soil micro-organism and their roles, soil physical and chemical properties; Physiographic factors: Topographic conditions and their effects on vegetation, and Biotic factors: Types, interactions between plants, animals and man, interactions between plants and plants, and interactions between plants and micro-organisms.
6. **Responses of plants to stress:** Stress, Plant responses to stress - water stress, temperature stress, chilling stress, freezing stress, salt stress; plant responses to Environmental Pollutants: Heavy metal, Air pollution.

### Part B

1. **Basic concepts:** Definition, significance of Biodiversity, Benefits from Biodiversity, Types of Biodiversity, Biodiversity and species concept, Status of biodiversity in Bangladesh.
2. **Threats and Conservation of Biodiversity:** Depletion of Biodiversity, Causes of threatening Biodiversity, IUCN categories of endangered species, Red data book, Measures for Biodiversity conservation, Protected area and biosphere serves Role of Zoos, Botanical gardens and captive breeding programme.

### Recommended References:

1. Odum, E.P. ECOLOGY. Modern Biology Series. Oxford & IBH Publication Co.Ltd. New Delhi.
2. Gopal, B. & Bhardwaj, N. ELEMENTS OF ECOLOGY. Vikas Publication Pvt. Ltd. India.
3. Shukla, R.S.& Chandel, P.S. 1988. PLANT ECOLOGY AND SOIL SCIENCE. S. Chand & Co. Pvt. Ltd. Ram Nagar, New Delhi, India.
4. Verma, P.S.& Agarwal, V.K. 1986. PRINCIPLES OF ECOLOGY.S. Chand & Co. Pvt. Ltd. Ram nagar, New Delhi, India.
5. Edward J. Kormondy. CONCEPTS OF ECOLOGY. Prentice-Hall of India Private Limited. New Delhi-110 001.
6. Biswarup Mukherjee. Environmental Biology.
7. William G. Hopkins. 2002. Introduction to Plant Physiology, 2<sup>nd</sup> edition, John Wiley and Sons. Inc. New York.

<b>Course Code</b>	<b>4474</b>	<b>Marks: 100</b>	<b>Credits: 4</b>	<b>Class Hours: 60</b>
<b>Course Title:</b>	Environmental Impact Assessment (EIA)			

1. Introduction, definition, scope and goal of Environmental impact assessment (EIA), international and national aspects of EIA, role of DoE on application of EIA in Bangladesh.
2. Background and legal framework, baseline studies, capacity building, Project cycle- IEE and EIA, EIA characteristics and function of EIA, Methodologies (Adhoc, checklist, matrices, network diagram, overlays and mathematical modelling), social impact assessment, EIA reporting and review, case studies (water quality impact, Large dam construction, tourism development; industrial development, afforestation)
3. Public involvement with Impact Assessment: Required of skill ecologist/personalities for EIA, Training provisions for EIA, Impact Assessment costs.
4. Environment Risk Assessment (ERA): Definition, legal framework, risk evaluation, risk characterization, public perception of risk Major steps in ERA , Risk characterization and comparative risk assessment, risk analysis, industrial issues and health risk, case studies
5. Environmental Regulation and Auditing: Hazardous waste legislation, protocols, institutional and legal framework, ISO 14000, the nature of environmental auditing, audit planning, basic component of auditing, beneficiary groups.
6. Environmental management planning (EMP): monitoring and mitigation of environmental problems, sustainability concept and development, valuing the environment.

**Recommended References:**

1. P.Watheru, 1992, Environmental Impact Assessment – Theory and Practice, Chapman and Hall Ltd, New York.
2. L.Q. Center, 1996, Environmental Impact Assessment, McGraw-Hill, Inc, New York. N.Harley and C.L.Spash, 1998.
3. C.J.Barrow, 1997, Environmental and Social Impact Assessment, John Wiley & Sons, New York.

<b>Course Code</b>	<b>4475</b>	<b>Marks: 100</b>	<b>Credits: 4</b>	<b>Class Hours: 60</b>
<b>Course Title:</b>	<b>Environmental Toxicology</b>			

1. **Introduction – principles and concepts:** Classification and sources of toxic substances: Pathways of toxic substances into ecosystem – principles and methods of studying toxins in an ecosystem: Effect of toxic substances – emphasis on physiological effects.
2. Toxic Action of Pollutants; General ways in which environmental toxicants may cause deleterious effects on living organisms; Processes involved in toxicant uptake, transport, storage, metabolism, action, and wherever applicable, excretions, highlighting several ways in which toxicants cause damage to plants, animals, and humans.
3. Factors Affecting Xenobiotic Action; Factors that influence the toxicity of xenobiotics (environmental toxicants); Physical and chemical characteristics of toxicants, environmental factors, biological factors, and nutritional factors.
4. The metabolism of environmental chemicals—biotransformation; Phases I and II reactions and stresses the importance of biotransformation for living systems and the consequences of the process (detoxification of xenobiotics, possible production of free radicals by biotransformation, and the action of cellular antioxidant defense systems, including endogenous antioxidants and free radical scavenging enzymes).
5. Defense Responses to Toxicants, several major defense mechanisms available to help the animal or human body to cope with environmental toxicants ; Mechanisms found in respiratory tract, gastrointestinal tract, liver, kidneys, and membranes; A brief discussion of defense mechanisms manifested by some plant species.
6. Sources, characteristics, health, and biological effects of several metals and a metalloid found in soil and water; Discussion on the effect of lead (Pb), cadmium (Cd), mercury (Hg), nickel (Ni), and arsenic (As); The three groups of synthetic organic pesticides: chlorinated hydrocarbons, organophosphates, and carbamates; Toxic effects of several related organic compounds, such as PCBs, PBBs, and dioxins.
7. Endocrine Disruption: definition, stresses, characteristics and mechanisms of disrupters actions; Examples of endocrine disruption observed in various countries.; Mutagenic Pollutants: an introduction, their actions and examples.
8. A brief introduction to ecological risk assessment; The framework for ecological risk assessment and its importance; Use of ecological impacts to influence regulatory and policy decisions.

#### **Recommended references**

1. Ming-Ho Yu, 2001, Environmental Toxicology: Biological and Health Effects of Pollution (Second Edition), CRS PRESS, New York
2. B.C. Rana; Pollution and Biomonitoring, Tata McGraw Hill, 1995.
3. Ballantyne, Bryan; Marrs, Timothy C.; Syversen, Tore, ed.. General and applied toxicology. -- 2nd edn.. -- New York : Glove's Dictionaries Inc., 1999.
4. Fife, Bruce. The Detox book : how to detoxify your body to improve your health, stop diseases and reverse aging. -- Colorado : Health Wise, 1997.
5. Hodgson, Ernest. A Text Book of Modern Toxicology. -- 2nd edn.. -- Boston : McGraw-Hill, 2000.
6. Hughes, W. William. Essentials of environmental toxicology : the effects of environmentally hazardous substances on human health. -- Bristol, PA : Taylor and Francis, 1996.
7. Massaro, Edward J. Handbook of human toxicology. -- New York : CRC Press, 1997.
8. Rand, Gary M., (ed.). Fundamentals of aquatic toxicology : effects, environmental fate, and risk assessment. -- 2nd edn.. -- Bristol, PA : Taylor Francis, 1995.
9. Sharma PD: Molecular Basis of Environmental Toxicity. Ann Arbor Sci Pub
10. Rose J (1998) Environmental Toxicology. Gordon and Beach
11. Sharma PD (1995) Environmental Biology and Toxicology. Ann Arbor Sci Pub

<b>Course Code</b>	<b>4476</b>	<b>Marks: 100</b>	<b>Credits: 4</b>	<b>Class Hours: 60</b>
<b>Course Title:</b>	<b>Remote sensing and GIS</b>			

1. Introduction to different branches of Geographic Information Sciences (Global Positioning System (GPS), Remote Sensing (RS) and Geographical Information Systems (GIS)): Definition, history, functions and uses.
2. Remote Sensing: Fundamentals of RS, Types, Data acquisition techniques (Applications of Multispectral data, Geodetic, Acoustic and near-acoustic), Aerial photographs; various types of satellite, sensors and their characteristics and functions, Data processing and Image analysis, Remote Sensing software, Potentials of remote sensing for agriculture, environment and resource monitoring and management.
3. Geographic Information System (GIS): Techniques used in GIS, Data creation, Relating information from different sources, Data representation (Raster, Vector, Advantages and disadvantages, Voxel, Non-spatial data), Data capture, Raster-to-vector translation, Projections, coordinate systems and registration, Spatial analysis with GIS (Data modelling, Topological modelling, Networks, Cartographic modelling, Map overlay, Automated cartography), GIS software, GIS and Society, Database management systems (DBMS), data quality and errors in GIS, software (Arc-View and IDRISI)
4. Global Positioning System (GPS): Simplified method of operation, System segmentation (Space segment, Control segment, User segment), Calculating positions, Accuracy and error sources (Atmospheric effects, Multi-path effects, Ephemeris and clock errors, Selective availability, Relativity), and Applications (Military, Navigation, Target tracking, Missile and projectile guidance, Search and Rescue, Reconnaissance and Map Creation, others), DGPS.
5. Application of GIS: Knowledge-based approaches in GIS, information management and environmental research, application of GIS in socio-economic and environmental science, ecological models and GIS, hazard model and GIS, Digital Elevation Model (DEM) and its Applications.

#### **Recommended References:**

1. [http://en.wikipedia.org/wiki/Geographic\\_Information\\_System](http://en.wikipedia.org/wiki/Geographic_Information_System)
2. Martin, D. 1994. Geographic Information Systems and their Applications, London:Routledge.
3. Peuquet, D.J. and Marble, D.F. 1993 Introductory Readings in Geographic Information Systems, London: Taylor and Francis.
4. Michener, W.K., Brunt, J.W. and Stafford, S.G. 1994. Environmental Information management and Analysis, Ecosystem to Global Scales, London: Taylor and Francis.
5. Maguire, D.J., Goodchild, M.F. and Rhind, D.W. (eds) Geographical Information Systems, Vol. I and II, London: Longman.
6. Text Book on Remote Sensing, C.S. Agorwal, 1<sup>st</sup> edition 2000, Wheeler Publishing.

<b>Course Code</b>	<b>4477</b>	<b>Marks: 100</b>	<b>Credits: 4</b>	<b>Class Hours: 60</b>
<b>Course Title:</b>	<b>Waste Management</b>			

1. **Introduction:** definition, classification of waste, general aspect of waste managements
2. **Solid waste management:** Characteristic of solid waste, solid waste collection, solid waste collection estimate and cost, waste transfer, maximum and economic haul time, disposal techniques, modes of operation, environmental consideration, liquid leachability, utilization of waste to energy production, resource conservation and recovery, low, high and medium technology.
3. **Hazardous waste management:** Types of hazardous waste, risk perception and risk assessment, toxicity consideration, one-hit mode, reasonable maximum exposure, risk characterization and risk management, transport regulations, disposal protocols.
4. **Radioactive Waste Management:** Definition, sources and characteristics of radioactive wastes, effects of radiation on living organism, acute effect and delayed effect, risk estimates, radioactive waste management techniques, safe disposal, long term assessment, case study.
5. **Treatment technologies of solid and hazardous wastes:** Biological, physical and chemical treatment, batch distillation and fractionation techniques, ion-exchange techniques, electrodialysis, reverse osmosis, waste incineration, land disposal and ground impounding.
6. **Municipal and household wastes management:** Disposal design, recovery and recycling of household wastes, domestic garbage, bulk treatment on commercial scale, recycling of paper.
7. **Hazardous waste and risk analysis:** Hazard identification, mutagenesis, carcinogenesis, dose-response relationship, human exposure assessment, risk characterization, contaminant degradation, application of risk assessment.
8. **Hazardous waste regulatory act:** The Comprehensive Environmental Response, Consumption and Liability Act (CERCLA), the National Priority List (NPL), the Hazard Ranking System (HRS), the National Contingency Plan (NCP), Superfund Amendments and Reauthorization Act (SARA), national and regional provisions of hazard treatment.

#### **Recommended References:**

1. Introduction to Environmental Engineering, M. L. Davis, D. A. Cornwell, 3<sup>rd</sup> edn, McGrawHill, 1998.
2. Environmental Chemistry, C. Baird, WH Freeman and Company, N. Y., 2<sup>nd</sup> edn, 2000.
3. Environmental Chemistry, S. E. Manahan, 7<sup>th</sup> end, Lewis Publishers, 2000.
4. Introduction to Environmental Engineering and Science, G. M. Masters, Prentice-Hall Inc., 1991.



<b>Course Code</b>	<b>4478</b>	<b>Marks: 100</b>	<b>Credits: 4</b>	<b>Class Hours: 60</b>
<b>Course Title:</b>	Geography and Geology of the Bengal Basin			

1. Map projection system and Geographical position of the Bengal Basin
2. Geological and structural setting of the Bengal Basin.
3. Physiography and hydrography of the Bengal Basin - major subdivisions.
4. The development of Bengal Delta through time.
5. Stratigraphy, structure, and geological history of the Bengal Basin.
6. Relationship of the Bengal Basin with its neighbouring sedimentary basins.
7. Economic minerals and rocks of the Bengal Basin and their utilization.

**Recommended References:**

1. Curray, J.R. & Moore, D.G., 1974, Sedimentary and Tectonic Processes in the Bengal Deep-Sea Fan and Geosyncline; In: Burke, C.A. & Drake, C.L. (eds.), The Geology of the Continental Margins, Springer-Verlag, Heidelberg, New York, p. 617-627.
2. Evans, P., 1932, Tertiary succession in Assam; Trans. Min. Geol. Inst., India, vol. 27, p. 155-260.
3. Evans, P., 1934, The Tectonic Framework of Assam; Geological Society of India Journal, vol. 5, p. 80-86.
4. Khan, F.H., 1991, Geology of Bangladesh; The University Press Ltd., Dhaka.
5. Reimann, K.U., 1993, Geology of Bangladesh; Gebrueder Borntraeger, Berlin.

<b>Course Code</b>	<b>4479</b>	<b>Marks: 100</b>	<b>Credits: 4</b>	<b>Class Hours: 60</b>
<b>Course Title:</b>	Hydrology and Water Resources			

1. **Introduction:** Hydrologic Cycle, Importance of Hydrology, Water Balance, Energy Budget.
2. **Precipitation and Water losses:** Types and forms, causes and measurements of precipitation and its analysis; types of water losses, Infiltration, methods determining Infiltration, Factors affecting evaporation, methods determining evaporation and evapotranspiration.
3. **Runoff:** Sources, Catchment characteristics, Factor affecting runoff and runoff estimation Hydrologic Instrumentation, Remote Sensing in Hydrology.
4. **Hydrograph:** Definition, Hydrograph separation, Unit Hydrograph, Preposition and application of unit hydrograph, Catchment modelling.
5. **Groundwater:** Definition, origin and depth of GW, springs and wells, Aquifers and Aquifers properties, Water yield, Groundwater flow, Groundwater investigations, Well tests, Steady state well Hydraulics, Methods of Groundwater exploration.
6. **Hydrological Environments:** Hydrogeological environments of Bangladesh, Sea-water intrusion in coastal aquifers, Hydrogeological models and their use in resource assessments.
7. **Water Resources planning & management:** Water, and its impurities, criteria of water quality, Sources of fresh water, characteristics of domestic industrial & Irrigation water. Estimation & Collection system of surface & ground water, Effluent disposal, reuse & misuse of water, Basic concept of water resource planning & management, Wetlands & water resources, Soil water relationship, Human impact on water resources: Irrigation & flood control system strategic planning: conceptual frame work & models: Watershed management of urban (Municipal) & Rural area emphasis on drinking water (urban) & Irrigation water (Rural), Economic considerations, Business response, water and conflict

**Recommended References:**

1. Kiely, G., 1998, Environmental Engineering, McGraw-Hill.
2. Raghunath, H.M., Hydrology: Principles, Analysis and Design.
3. Abdel-Aziz, I.K., 1986; Groundwater Engineering. McGraw-Hill Book Co., New York.
4. Lloyd, J.W. & Heathcote, J.A., 1985, Natural Inorganic Hydrochemistry in relation to Ground Water: An Introduction; Claredon Press.
5. UNITED NATIONS, 1982, The Hydrogeological Condition of Bangladesh; United Nations Ground Water Survey Technical Report, New York.

<b>Course Code</b>	<b>4480</b>	<b>Marks: 100</b>	<b>Credits: 4</b>	<b>Class Hours: 60</b>
<b>Course Title:</b>	Laboratory and Field work on Environmental Sciences			

### **Chemistry**

1. Determination of dust falls per unit area of an Urban & Rural.
2. Determination of particulate matter per unit volume of air in Urban & Rural areas.
3. Microscopic examination of particulate matter (Morphological Studies).
4. Arsenic determination in groundwater by Low-cost kit and Laboratory.
5. Determination of ammonium, nitrate, and phosphate ions by strip.
6. Determination of Organic & Inorganic Components of airborne particulate matter.
7. Chemical identification of Inorganic Components of particulate matter (Pb, Fe, Ni, Cu).
8. Determination of SO<sub>2</sub> / CO<sub>2</sub> in air of an Urban & Rural area.
9. Determination of total acid in air of an Urban & Rural area.

### **Remote Sensing and GIS**

Application of GIS and ArcInfo Software for Agriculture, Landuse, and Forestry.

1. Interpretation of Aerial Photography and Satellite Images for Environmental Applications including Coastal, Fluvial, and Urban Preparation & geoenvironmental map from imaging.
2. Environmental Change Detection using Integrating GIS, Remote Sensing and Topo Map Information.
3. Geohazard and Risk Assessment using Remote Sensing and GIS data.
4. Fields observation of specific sites which are interpreted on respective image.
5. Submission of Field Report, based on satellite imagery and Aerial photograph data analysis and interpretation.

### **Biology**

1. Field Survey.
2. Determination of productivity of aquatic ecosystem.
3. Quantification of bloom forming plankton (phytoplankton + zooplankton).
4. Determination of the biomass of producers in the given area.
5. Study the biotic component of a pond ecosystem of J.U. Campus.
6. Determinations of moisture content, water holding capacity and pH of soil.
7. Basic Rules and Requirements of a Microbiology Laboratory.
8. Preparation of culture media.
9. Technique of serial dilution.
10. Water quality test through faecal coliform counts by streak plate method / pour plate method / spread plate method and enumeration of coliform bacteria.
11. Study of root nodules in legume plants.
12. Sampling of bacteria from air, water and soil.