The University of Burdwan

Syllabus for B.Sc.(Gen.)
in
Environmental Science
Under Choice Based Credit System
w.e.f. 2017-2018 onward
# UG CBCS COURSE STRUCTURE FOR GENERAL ENVIRONMENTAL SCIENCE

## CORE COURSES

Credit: 6 [Credit 1 for Tutorial (T) + 5 for Lecture (L)]/ [Credit 2 for Practical (P)+ 4 for Lecture]

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Nature of Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CC1A</td>
<td>Environment &amp; Society</td>
<td>L + T</td>
<td>5+1</td>
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<tr>
<td>CC2A</td>
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<tr>
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<tr>
<td>DSE1A</td>
<td>Environmental Pollution and Monitoring Techniques OR Environmental Pollution and Laws</td>
<td>L+T</td>
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<td>Social Environmental Issues OR Environmental Economics and Management</td>
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<td>DSE1B</td>
<td>Disaster Management OR Human Wildlife Conflict and Management</td>
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<td>SEC4</td>
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## DSE COURSES

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## SKILL ENHANCEMENT COURSES

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<tr>
<td>SEC1</td>
<td>Biological Techniques OR Remote Sensing and Geographical Information System</td>
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<tr>
<td>SEC2</td>
<td>Conservation and Ecotourism OR Environmental Health</td>
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<td>Social Environmental Issues OR Environmental Economics and Management</td>
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<td>SEC4</td>
<td>Environmental Microbiology OR Environmental Biotechnology</td>
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# ABILITY ENHANCEMENT COMPULSORY COURSES

## ENVIRONMENTAL STUDIES
Credit: 4

<table>
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<tr>
<td>AECC1</td>
<td>Environmental Studies</td>
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<td>Communicative English/MIL</td>
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| Total Credit | 06 |


SEMESTER-I
CC1A: ENVIRONMENT & SOCIETY
CREDITS – 5+1 = 6

Lectures - 60

Environment: Types of environment; Multidisciplinary nature and scope of environment; Components of environment; Environmental education (10)

Natural Resources: Definition, concept on natural resources – water, land, forest, food and mining; Biodiversity – concept, value, threats, conservation (10)

Ecology and Ecosystem: Definition and concept of ecology; Phases of ecology; Concept of ecosystem; Structure and functional aspects of ecosystem; Productivity concept of ecosystem; Food chain and food webs in ecosystem; Ecological energetic (10)

Environmental Pollution: Sources and effects of pollution (air, water, soil, noise and radiation); Ozone layer depletion; Global warming; Greenhouse effect; Acid Rain; El-Nino, La-Nina; ENSO (10)

Social Issues: Raising environmental awareness in India; Sustainable Development; Global environmental issues; Environmental legislation; Environmental movement in India; Human population and environmental problems: Role of information technology on environment and human health; Green business and green design (20)

SEMESTER-II
CC1B: ENVIRONMENTAL RESOURCES
CREDITS – 5+1 = 6

Lectures - 60

Natural Resources: Current status of Water, Land, Forest, Food and Minerals resources (05)

Soil: Weathering processes and soil formation; Soil profile development; Basic concept of physical, chemical and mineralogical composition of soil; Soil types, porosity, permeability (10)

Energy Resources: Classification - conventional, non-conventional, renewable, non-renewable (05)

Fossil Fuels: Coal (composition, origin and classification); Petroleum (origin, mining, chemical composition, classification); Natural gas (concept on LNG, CNG, LPG); Oil (origin, utilization) (10)
Renewable Resources: Solar energy (PV cells, PG cells); Geothermal energy (origin, utilization); Ocean energy; Biomass energy; Hydroelectricity

Alternate Sources of Energy: Process of energy extraction from waste; Basic concept of petro-plants, biofuel

Biological Wealth: Concept; Values; Mega-diversity Hotspots; Hotspots of biodiversity; Red Data Book; Conservation of biodiversity (International & National); Threats of biodiversity

**SEMESTER- III**

**CC1C: ENVIRONMENTAL POLLUTION**

Credits – 5+1 = 6

Lectures - 60

Pollution: Fundamentals Pollution; Types of pollutants and pollution

Air Pollution: Air pollutants—sources and effects of primary and secondary pollutants, particulate matters, indoor pollutants; Global climate change; Photochemical smog

Water Pollution: Sources-direct and indirect sources and their impact on water bodies, viz., marine, coastal, wetlands; groundwater pollution; Eutrophication, Lake acidification, salt water intrusion

Soil Pollution: Sources, types and effects of soil pollution

Thermal Pollution: Definition, nature of pollutants, environmental effects of coal ash

Vehicular Pollution: Characteristics of automobile emissions, effects of automobile pollutants

Fireworks Pollution: Definition, characteristics, composition; Pollution and effects; Safety and laws

**SEMESTER- IV**

**CC1D: GREEN TECHNOLOGY**

Credits – 5+1 = 6

Lectures - 60

Green Chemistry: Concept, principles, applications of green chemistry, e. g., use of CO$_2$, H$_2$O$_2$, TiO$_2$; Chitin; Concept of octane number and antiknock compounds; Directions in practising green chemistry
Green Technology: Green technology in waste management, Integrated Waste Management (IWM); Supercritical water oxidation (SCWO) of wastes; Rhizosphere in biodegradation of organic wastes; Green techniques in water treatments: Deionization, Desalination, Electrodialysis, Reverse osmosis; Green sources of energy; Green treatments of industrial effluents - Cyanide, Chromate (15)

Green Synthesis of Chemicals: Methyl methacrylate, polyurethane, paracetamol; Production of 3rd & 4th generation pest controller, Integrated Pest Management (IPM); Biodiesel, Biopolymers, Bioplastics; Alternative Fluorocarbons (AFCs) (15)

Instrumental Methods: Chemical analysis of environmental samples; Principles of AAS, X-Ray Fluorescence spectrophotometer, Gas Chromatography, HPLC (15)

SEMESTER- V
DSE1A: ENVIRONMENTAL POLLUTION & MONITORING TECHNIQUES
6 Credits

Lectures – 60

Radiation Pollution: Nature and types of radiation; Radiation hazards; Measurement of radioactivity; Nuclear accidents (10)

Pesticide Pollution: Sources, categories; Pesticidal effects in water; Elementary idea on IPML (10)

Metal Pollution: Metals in soil, food and water; Elementary idea on Lead and Cadmium pollution (10)

Analytical Techniques and Tools: Sampling, preservation and storage techniques; Principle, application and limitations of titrimetry, gravimetry and potentiometry; Ultrasound characteristics and Environmental applications of acoustic RADAR and LASER (10)

Bacteriological Examination of Water: Standard Plate Count and Coliform test with reference to IS: 1622 (10)

Data Collection and Representation Techniques: Concept of sampling, mean, median, mode, frequency distribution, standard deviation and standard error (10)
OR

**DSE1A: ENVIRONMENTAL POLLUTION & LAWS**

6 Credits

Lectures - 60

**Environmental Pollution:** Concept of pollutant and contaminant; Primary and Secondary pollutants

(5)

**Air pollution:** Definition, Sources and general effects and control measures; photochemical reactions in atmosphere; smog formation, types of smog (sulphur smog and photochemical smog), aerosols

(10)

**Soil pollution:** Definition, Sources and effects; Soil degradation, Erosion, Desertification, Stalinization; Control of soil pollution

(10)

**Water pollution:** Definition, Sources, Types and effects; Global impacts; Measurement of water pollution

(10)

**Noise pollution:** Sources; Measurement of noise level; Effects of sound pollution; Control of noise pollution

(5)

**Current environmental problems:** Acid rain; Global Warming; Global dimming; El Nino/Southern oscillation (ENSO); Global ozone depletion; Eutrophication; Bioaccumulation and biomagnifications

(10)


(10)

**SEMESTER- VI**

**DSE1B: DISASTER MANAGEMENT**

6 Credits

Lectures – 60

**Understanding Disaster:** Concept and definitions of disaster; Hazard, vulnerability, risk, capacity: Types, trends, causes and consequences and control of various disasters, viz., Geological, Hydro-meteorological, Biological and Technological disasters

(15)
**Disaster Management:** Vulnerability of natural hazards in India; Disaster management cycle; Activities associated with various stages of cycles  

**Institutional Framework:** Constitutional frameworks in India – Role of Governments, Non-Governments and State Government agencies  

**Risk Assessment:** Concept and evaluation of risk; Hazard identification; Exposure assessment; Hazard assessment; Risk characterization; Man-made Environmental degradation; Problems related to toxic wastes and chemicals and radioactive substance disposal  

OR  

**DSE1B: HUMAN-WILDLIFE CONFLICT & MANAGEMENT**  

**6 Credits**  

**Lectures – 60**  

**Wildlife Management:** Need of environmental management; Wildlife conservation: moral obligation; Philosophy of wildlife management; Human wildlife conflicts; Role of government, wildlife biologists and social scientists; concept of deep and shallow ecology  

**Human Wildlife Co-existence:** Symbiotic relationship between tribals and forest, forest and development; Community participation in forest management, case study of Chipko movement, sacred groves forests, India’s Bishnoi community and their conservation practices; Ecological-economic welfare and development; Man and biosphere programmes; Concept of conservation reserves and community reserves, importance of wildlife corridors  

**Wildlife Conservation Laws in India:** Types of protected areas (Wildlife Sanctuaries, National Parks, Biosphere Reserves); IUCN categories of protected areas, Natural World Heritage sites; Concept of core and buffer area in a protected range; Brief introduction to Wildlife Protection Act of 1972; Forest Act of 1927; Environmental Protection Act of 1986; Forest Conservation Act of 1920; Tiger task force, Status of current protected areas in India  

**SEMESTER- III**  

**SEC1: BIOLOGICAL TECHNIQUES**  

**2 Credits**  

**Lectures -20**  

**Basic Histological and Cytological Techniques:** Fixation and Fixatives; Tissue-processing & Microtomy; Staining
Microscopy: Components of microscope; magnification and illumination; Types of microscope – Light, Electron, Phase, Polarised, Fluorescence

Biological Analysis: Collection and preservation of plankton; Enumeration of net plankton, counting in Sedgwick Rafter cell

OR

SEC1: REMOTE SENSING & GEOGRAPHICAL INFORMATION SYSTEM (GIS)
2 Credits

Remote Sensing: Principles, properties; Electromagnetic radiation and its interaction with atmosphere; Spectral reflectance of Earth’s surface features; Types and characteristics of different data acquisition platforms; Satellite geometry, sensors and resolutions; Data products and their characteristics; Basic principle of visual interpretation

GIS: Concept of GIS; Spatial data model; Attribute data management; Process of GIS

SEMESTER- IV
SEC2: CONSERVATION & ECOTOURISM
2 Credits

Conservation: Concept of Wildlife Conservation - Reserves design, survey techniques of tiger, birds, deer, bison, elephants and insect; In-situ habitat management of wild animal; Concept of Zoo management; Nursery technology, Plantation technique in India,

Ecotourism: Elementary idea of Mass tourism and its Impact on environment and culture; Concept of Ecotourism, Guideline and policy (National and International) of ecotourism; Planning of ecotourism; Ecotourism circuit development; Types of Alternative Tourism, Elementary idea of Rural tourism, Adventure tourism; Development, economical benefits and impacts of Ecotourism

OR

SEC2: ENVIRONMENTAL HEALTH
2 Credits
Environmental Health: Concept of health and disease; Principles of epidemiology and epidemiological methods, aims of epidemiology

Diseases: Concept on water, air, vector borne diseases; Some communicable diseases-- Viral hepatitis, dengue, Leishmaniasis; Non-communicable diseases - cardiovascular, diabetes;

Health Programs: Health Programs in India; Demography and family planning; Nutrition and health; Health education; World health report; Health impact assessment; Role of Information Technology in environment and human health

SEMESTER- V
SEC3: SOCIAL ENVIRONMENTAL ISSUES
2 Credits

Lectures -20

Man-Environment Relationship: History and relationship; Need for public awareness; Ecosystem services to society; Environmental movements in India; Human population growth and problems, regulation of population

Social Issues: Global environmental issues; Unsustainable to Sustainable Development; Groups; Environmental awareness; Environmental ethics; Women and Child welfare;

Environmental sustainability: Concept of sustainable city, urban planning, social responsibility; International treaties & Conventions [Wetlands (Ramsar)], International Trade in Endangered Species (CITES), Biodiversity (CBD), Transboundary Movements of Hazardous Waste (Basal), Climate Change (Kyoto Protocol)

OR

SEC3: ENVIRONMENTAL ECONOMICS & MANAGEMENT
2 Credits

Lectures -20

Environmental Economics: Concept, scope and interrelation; Concept of supply and demand; Types of economic system, Concept of Ecological economics

Principles of Management: Definition and concept on environmental management; Environmental quality measurement (ISO:14000), Environmental management system; Management of air pollution,
water pollution, noise pollution in respect to Indian scenario; Waste Water Treatment; Strategies for sustainable Water Management; Drinking Water Standard; Ganga Action Plan (GAP), Yamuna Action Plan (YAP) (15)

SEMESTER- VI
SEC4: ENVIRONMENTAL MICROBIOLOGY
2 Credits
Lectures -20

**Bacteriology:** Bacterial morphology: Shape, size, structure and function of bacterial cell membrane, cell wall, capsule, flagella (10)

**Virology:** Descriptive properties of virus; Morphology and structure of bacteriophages (10)

OR
SEC4: ENVIRONMENTAL BIOTECHNOLOGY
2 Credits
Lectures -20

**Role of Microbes with relation to Environment:** Bacteria, Fungi, Protozoa, Virus (5)

**Waste Treatment:** Wastewater treatment techniques; Solid waste treatment methods (vermiculture, landfill, hazardous waste treatment); Phytoremediation (10)

**Agricultural Biotechnology:** Biofertilizer, Biopesticide, Integrated pest management; Biofuel (5)

Suggested Readings

SEM - I
1. Environmental Science: S.C. Santra, New Central Book Agency
2. Ecology and Environment: P.D. Sharma, Rastogi Publication.
3. Fundamental of Ecology: E.P. Odum, W.B. Saunders Company, USA
8. Textbook of Environmental Studies: Erach Bharucha; University Grants Commission; University Press 2013
SEM-II
1. The Economic Approach to Environmental & Natural Resources, James R. Kahn., George Proval
2. Economics of Environment, Dorfman and Dorfman
4. Dasgupta and Heal (1979): Economic Theory of Exhaustible Resources; CUP

SEM-III
5. Zero Pollution Industry, Nemerow, N.L. Wiley Intersciences
7. Landfill Waste Pollution and Control, Kenneth Westlake., Albion Publishing

SEM-IV
5. Environmental Chemistry with Green Chemistry, Asim K Das, Books and Allied (P) Ltd., 2010
7. Green Chemistry (PB): Nova; Luque

**Sem V**
1. D'Monte, Darryl. 1985. *Industry versus Environment Temples or Tombs*. Three Controversies, Delhi, CSE.
7. Environmental Economics-An Indian Perspectives, Edited by R. N. Bhattacharya, Oxford University Press

**SEM-VI**
2. A text book of Microbiology: Dubey & Maheswari
3. Environmental microbiology and Biotechnology: D.P. Singh and S.K. Dwivedi; New Age International publications
5. General Microbiology: Powar and Daginawala, Himalaya Publishing House