

Mahatma Gandhi University

DETAILED ACADEMIC SYLLABUS

&

MODEL QUESTION PAPER

FOR

M.Sc. Environment Science and Management

With effect from 2012-2013

Sree Sankara College ,Kalady

SCHEME OF WORK, EXAMINATION AND DISTRIBUTION OF MARKS

| Semester | Course Code | Subject | Credit | Marks% | | | | |
|------------------|------------------|---|---|------------|------------|--------|-----|-----|
| | | | | Internal % | External % | Total% | | |
| First Semester | Core Subject | ES 1 PG 1 | Environment, Ecology and Conservation Biology. | 4 | Total = 19 | 25 | 75 | 100 |
| | | ES 1 PG 2 | Environmental Geosciences | 4 | | 25 | 75 | 100 |
| | | ES 1 PG 3 | Environmental Chemistry, Analytical Techniques and Instrumentation | 4 | | 25 | 75 | 100 |
| | | ES 1 PG 4 | Biodiversity Conservation, Environmental Laws, Education and Policies | 3 | | 25 | 75 | 100 |
| | | ES 1 PGP 1 | Laboratory Course | 4 | | 100 | - | 100 |
| | Elective Subject | ES 1 PGE 1 | Research Methodology and Statistics in Environment Science and Management | 4 | Total = 4 | 25 | 75 | 100 |
| Second Semester | Core Subject | ES 2 PG 5 | Environmental Pollution and Control Techniques | 4 | Total = 19 | 25 | 75 | 100 |
| | | ES 2 PG 6 | Environmental Microbiology | 4 | | 25 | 75 | 100 |
| | | ES 2 PG 7 | Environmental Toxicology and Occupational Health Management | 4 | | 25 | 75 | 100 |
| | | ES 2 PG 8 | Remote Sensing and GIS | 3 | | 25 | 75 | 100 |
| | ES 2 PGP 2 | Laboratory Course | 4 | 100 | - | 100 | | |
| Elective Subject | ES2 PGE 3 | Environmental Economics and Sustainable Development | 4 | Total = 4 | 25 | 75 | 100 | |

| | | | | | | | | |
|---|---|---|--|---------------------------|--|---------------------------------|-------------------------------|-------------------------------------|
| T h i r d S e m e s t e r | Cor e S u b j e c t | ES 3 PG 9 ES 3 PG 10 ES 3 PG 11 ES 3 PG 12 ES 3 PGP 3 | Environmental Engineering Environmental Planning and Management Resource Management Energy Resource Management Laboratory Course | 4 4 4 3 4 | T o t a l = 1 9 | 25 25 25 25 100 | 75 75 75 75 - | 100 100 100 100 100 |
| | Ele c t i v e S u b j e c t | ES 3 PGE 5 | Disaster Management | 4 | T o t a l = 4 | 25 | 75 | 100 |
| F o u r t h S e m e s t e r | Cor e S u b j e c t | ES 4 PG 13 ES 4 PG 14 ES 4 PG 15 | Project work (Report / Thesis) Viva-Voce Field Study | 8 2 1 | T o t a l = 1 1 | 25 - 100 | 75 100 - | 100 100 100 |

Total Credit for Core Courses: 68

Total Credit for Elective Subjects: 12

Total Credits 80

SCHEME OF WORK, EXAMINATION AND DISTRIBUTION OF MARKS

First Semester

| Course No | Course Code | Subject | Credit | Marks | | |
|------------------|--------------------|--|---------------|-----------------|-----------------|--------------|
| | | | | Internal | External | Total |
| Core 1 | ES 1 PG 1 | Environment, Ecology and Conservation Biology | 4 | 25 | 75 | 100 |
| Core 2 | ES 1 PG 2 | Environmental Geosciences | 4 | 25 | 75 | 100 |

| | | | | | | |
|--------------------------|-------------------|--|----------|------------|-----------|------------|
| Core 3 | ES 1 PG 3 | Environmental Chemistry, Analytical Techniques and Instrumentation | 4 | 25 | 75 | 100 |
| Core 4 | ES 1 PG 4 | Biodiversity Conservation, Environmental Laws, Education and Policies | 3 | 25 | 75 | 100 |
| Practical 1 | ES 1 PGP 1 | Laboratory Course | 4 | 100 | - | 100 |
| Elective * | ES 1 PGE 1 | Research Methodology and Statistics in Environment Science and Management | 4 | 25 | 75 | 100 |
| Total Credit | | | | | | |
| Core Subjects: | | 19 | | | | |
| Elective Subject: | | 4 | | | | |
| Total Credit: | | 23 | | | | |

***List of Courses for Electives**

ES 1 PGE 1: Research Methodology and Statistics in Environment Science and Management

ES1 PGE2: Wetland Management

Second Semester

| Course No | Course Code | Subject | Credit | Marks | | |
|---|-------------|---|--------|----------|----------|-------|
| | | | | Internal | External | Total |
| Core 1 | ES 2 PG 5 | Environmental Pollution and Control Techniques | 4 | 25 | 75 | 100 |
| Core 2 | ES 2 PG 6 | Environmental Microbiology | 4 | 25 | 75 | 100 |
| Core 3 | ES 2 PG 7 | Environmental Toxicology and Occupational Health Management | 4 | 25 | 75 | 100 |
| Core 4 | ES 2 PG 8 | Remote Sensing and GIS | 3 | 25 | 75 | 100 |
| Practical 1 | ES 2 PGP 2 | Laboratory Course | 4 | 100 | - | 100 |
| Elective * | ES2 PGE 3 | Environmental Economics and Sustainable Development | 4 | 25 | 75 | 100 |
| Total Credit _____ Core Subjects: 19 Elective Subject: 4 Total Credit: 23 | | | | | | |

***List of Courses for Electives**

ES2 PGE 3: Environmental Economics and Sustainable Development

ES2 PGE 4: Social Work: Approaches and Practice

Third Semester

| Course No | Course Code | Subject | Credit | Marks in % | | |
|--------------------------|-------------|---------------------------------------|--------|------------|----------|-------|
| | | | | Internal | External | Total |
| Core 1 | ES 3 PG 9 | Environmental Engineering | 4 | 25 | 75 | 100 |
| Core 2 | ES 3 PG 10 | Environmental Planning and Management | 4 | 25 | 75 | 100 |
| Core 3 | ES 3 PG 11 | Resource Management | 4 | 25 | 75 | 100 |
| Core 4 | ES 3 PG 12 | Energy Resource Management | 3 | 25 | 75 | 100 |
| Practical 1 | ES 3 PGP 3 | Laboratory Course | 4 | 100 | - | 100 |
| Elective * | ES 3 PGE 5 | Disaster Management | 4 | 25 | 75 | 100 |
| Total Credit | | | | | | |
| Core Subjects: | | 19 | | | | |
| Elective Subject: | | 4 | | | | |
| Total Credit: | | 23 | | | | |

*List of Courses for Electives

1. ES 3 PGE 5: Disaster Management
2. ES3 PGE 6: Green Chemistry

Fourth Semester

| Course No | Course Code | Subject | Credit | Marks in % | | |
|---|-------------|--------------------------------|--------|------------|----------|-------|
| | | | | Internal | External | Total |
| Project | ES 4 PG 13 | Project work (Report / Thesis) | 8 | 25 | 75 | 100 |
| | ES 4 PG 14 | Viva-Voce | 2 | - | 100 | 100 |
| Core 1 | ES 4 PG 15 | Field Study | 1 | 100 | - | 100 |
| <p style="text-align: center;">Total Credit</p> <p>Core Course: 1</p> <p>Project: 10</p> <p>Total Credit: 11</p> | | | | | | |

Total Credit for Core Courses: 58

Total Credit for Elective Subjects: 12

Credit for Project: 10

Total Credits 80

SYLLABUS

First Semester

M.Sc. Environment Science and Management

COURSE CODE- ES1PG 1

ENVIRONMENT, ECOLOGY AND CONSERVATION BIOLOGY

Number of Hours / Week: 3

Credits: 4

Objectives:

The Course enables the students to:

- ◆ Understand the concepts of ecology and ecosystem
- ◆ Study the structure, organization and processes in ecosystem and comparison of the major ecosystems
- ◆ Understand the structural and functional aspects of a population as an ecological unit
- ◆ Explain the concept of biological community, changes and interactions within community.
- ◆ Understand conservation biology, its need and methods.

Unit 1: Environment and Ecology

1.1 Definition, principles and scope of Environmental Science

1.2 Ecology and Environment

1.3 Ecology and environment management:- Holistic approach, Gaia Hypothesis

1.4 Physio- chemical & biological factors (Concept of life and life supporting system)

Unit 2: Ecology and Ecosystems

2.1 Introduction

- Definition

- History of Ecology
- Subdivisions of Ecology (Autoecology and Synecology)
- Ecology and other subjects (Relationship)
- Fundamental ecological variables (Matter, light, Time, Space & Diversity)

2.2 Ecosystems

- Definition
- Components of Ecosystem
- Structure and function
- Size of Ecosystem

2.3 Processes in Ecosystem:

- Nutrient cycles
- Energy Flow
- Biogeochemical cycles
- Trophic relations
- Food chain, Food-web and Ecological pyramids
- Productivity and ecological efficiencies

2.4 Classification of Ecosystems:

- Biomes (Udvardy (1975), Bailey & Olson etc...)
- Holdridge Life Zone systems

Biogeography

- Definition and history
- Classification of Biogeography zones
- Phytogeography
 - Floristic regions of the World and India
- Zoogeography
 - Zoogeographical regions of the World and India

2.5 Comparative Ecosystem Ecology

- Structure, Function and Characteristics of:

Forests and Tundras (Temperate & Tropical Forests, Arctic and Alpine Forests), Deserts (Arid and Semi-Arid), Grassland and Savannas, Coastal and Marine, Coral Reefs, Wetlands (Lakes, Rivers, Estuaries, etc.), Mangroves, (Through Assignments and Seminars)

Unit 3: Population Ecology

3.1 Definition

3.2 Structure and measurements:

- Density
- Growth
- Natality
- Mortality
- Population dispersal and distribution

3.3 Population growth

- Factors affecting population
- Carrying capacity

3.4 Population Regulation

3.5 Strategies of species survivability(r- selection and k- selection)

3.6 Population Genetics

- Mendelian population
- Gene frequency
- Gene pool and genetic drift
- Hardy- Weinberg equilibrium
- Change in Gene Frequencies
- Speciation (Isolation and Speciation)
 - Morphological, Biological, Ecological & Phylogenetic Species Concept,
 - Ecotypes and other related terms

3.7 Human Population

- Historical overview

- Characteristics of human population growth
 - Exponential growth
 - Age-Sex distribution
- Trends in human population growth

Unit 4: Community Ecology

4.1 Concepts of Community

4.2 Community gradients (Ecotone, Edge Effect, Continuum Concept)

4.3 Characters of Community:

- Qualitative Characters
 - Floristic Composition, Stratification and Periodicity or Phenology
- Quantitative Characters
 - Density, Abundance & Species Diversity
- Production Characters
 - Primary production in Terrestrial and Aquatic Communities,
 - Productivity measurements.

4.4 Ecological Succession and Climax

- Classification
- Processes (Nudation, Invasion or Migration, Competition, Climax)
- Kinds of Succession (Hydrarch and Xerarch)

4.5 Community Organization:

Ecological Niche (Definition and Principles of Odum, Hutchinson and Gause)

4.6 Interactions between species:

- Competition
- Predation
- Mutualism
- Commensalism
- Parasitism
- Allelopathy

4.7 Stress Ecology and Adaptation (Introduction only)

Unit 5: Applied Ecology

5.1 Estimating Abundance:

- Mark and Recapture Method
- Quadrat and Line Transect's (Quadrat size, Shape and Number)
- Distance and Removal Methods
- Trapping and Collection techniques (Insects, Fishes, Rodents Etc)
- Census technique for Avifauna and Wildlife

5.2 Species Diversity measures:

- Species richness
- Species Heterogeneity (Simpson's Indices, Shannon-Wiener Indices)
- Vegetational Profile assessments

5.3 Taxonomy and Biosystematics

Unit 6: Conservation Biology

- Introduction
 - Origin, concepts and definition of conservation biology
- Fitness and Viability of Population
 - Minimum Viable Population
 - Heterozygosity and Fitness
- Pattern of Diversity and Rarity, including Endemism
- Habitat Fragmentation and its effects
- Community processes
 - Community Stability and Structure
 - Co-adaptation and co-evolution (plant and animal interactions-basic concepts only)
 - Keystone Species and Dominant species
 - Infectious diseases and conservation biology
- Conservation of Habitats
 - Threats and management of habitats
 - Theory and practice of conservation (basics only)

-Restoration, reclamation and regeneration of habitats (measures and steps introduction only)

References

1. **Brewer R** (1994), The Science of Ecology, Saunders College Publishing, New York.
2. **Chapman J. L and Reiss M J** (1992), Ecology-Principles and Applications, Cambridge University Press, Cambridge
3. **Colin R, Townsend, Michael Begon and John L Harper** (2012), Essentials of Ecology, third Edn, Blackwell publishing
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7. **Maxted N, B V Ford-Lloyd and J G Hawkes** (Ed1997). Plant Genetic Conservation- The in-situ approach. Chapman & Hall, Madras
8. **Michael Hutchings, Davis Gibson, Richard Bardgett and Mark Rees** (2011), Journal of Ecology, Vol 99, ISI Journal Citation Reports @ Ranking
9. **Michael P** (1990), Ecological methods for laboratory and Field Investigations, Tata McGraw Hill Publishing Company Limited, New Delhi.
10. **Mukherjee B** (1996), Environmental Biology, Tata McGraw- Hill Pub. Co. Ltd, New Delhi
11. **Nayar, M P** (1996). Hot spots of Endemic Plants of India, Nepal and Bhutan. TBGRI, Trivandrum
12. **Odum E P** (1971), Fundamentals of Ecology, W B Saunders Company, Philadelphia
13. **Odum E P** (1983), Basic Ecology, Saunders College Publishing, Philadelphia
14. **Robert L S** (1990), Ecology and Field Biology, Harper Collins Pub, New York.

COURSE CODE- ES1PG 2
ENVIRONMENTAL GEOSCIENCES

Number of Hours / Week: 3

Credits: 4

Objectives:

The course intends to:

- ◆ Give a basic understanding of the various physical or abiotic environment systems
- ◆ Describe the composition of different physical systems
- ◆ Outline the features of earth, land, water, soil and oceans
- ◆ Explain the importance of climate and weather to the global and regional environment
- ◆ Define and elucidate the various terms related to the physical environment

Unit 1: Environmental Process

1.1 Earth, man and environment

1.2 Origin, evolution and structure of Universe and solar system

1.3 Physical development of Earth

-Evolution, motion, structure (surface and interior)

-Origin of ocean, Atmosphere and Lithosphere

1.4 Geological Time Scale

1.5 Geo-dynamism

- Continental drift
- Plate tectonics
- Mountain building
- Earthquakes and volcano's
- Isostacy
- Sea floor spreading

1.6 Origin and evolution of biosphere and life

- Origin of life evolution

1.7 Earth

- Structure
- Composition and Density of Earth
- Interior of earth

1.8 Minerals

- Concept of major, trace and Rare Earth Elements (REE)
- Classification of trace elements
- Trace elements and health

1.9 Rocks and Rock cycle

- Properties of rocks
- Structure of rocks

Unit 2: Introduction to Physical Systems

2.1 Biosphere and its divisions

- Atmosphere
- Lithosphere
- Hydrosphere

2.2 Solar radiation

- Absorption
- Scattering

- Reflection

2.3 Atmosphere

- Stratification
- Pressure gradient

2.4 Thermodynamics of atmosphere

- Lapse Rate
- Atmospheric stability (Stable, Unstable, & Neutral Equilibria)
- Inversions
- Spatial and temporal ranges of variation in temperature

2.5 General circulation of air:

- Ferrel's law and Coriolis's effect
- Global air circulation system and heat transport from equator to poles
- Heat budget

2.6 Wind

- Formation
- Classification

2.7 Clouds

- Formation
- Classification
- Aerosols
- Condensation nuclei
- Precipitation mechanism
- Cloud seeding

Unit 3: weather and Climate

3.1 Definitions and scope of Climatology

3.2 Weather and climate

3.3 Components of Climate system

3.4 Classification of Climate

-Koeppen's classification and Thornthwaite's scheme

-Climatic types and zones

3.5 Climate of India

-Indian Monsoon (onset of Monsoon and retreat of monsoon, rain bearing systems, Break in the monsoon, MONEX)

-Climatic regions of India

3.6 Oceanic and Continental influence (Air- Sea interaction)

3.7 Global climatic phenomena

-El Nino & La Nina

3.8 Climate Change

-Causes and factors

-Global actions on climate change

-Effect of climate change in ecosystems

3.9 Weather and Climate monitoring equipment (Familiarization only)

3.10 Meteorological data collection and analysis (Rainfall, Evaporation, Temperature, Relative humidity, wind speed, wind direction, Wind-rose etc)

3.11 Applied Meteorology

-influence of Weather and Climate on agriculture

- Heat Islands

-Influence of meteorological factors on air pollutants (Diffusion, Turbulence, Transportation, and Plume rise and stability conditions)

Unit 4: Geomorphology

4.1 Geomorphology: an introduction

4.2 River Basins

-River erosion, transportation and deposition

-Slope process

-Terrain evaluation

-Linear, Aerial and Relief

-watershed (Definition and Delineation)

-Drainage

- Area
- Drainage pattern
- Their significance

4.3 Coastal Geo-morphology (Formation of lakes, Backwaters & Estuaries)

4.5 Case Studies with reference to Kerala

4.6 Water

- Hydrological cycle
- Global water balance
- Types of water
- The surface water
 - Relationship of surface and ground water
 - Stream flow
 - Fluvial analysis
 - Computation yield from catchments (Hydrograph method – introduction)
 - Sediment yield from catchments
 - An overview of water resources of Kerala
- Ground water
 - Origin, Movement and Storage
 - Hydrological classification of water bearing formations
 - Interaction of rivers and lakes with surface and ground water
- Water Conservation (Introduction only)

Unit 5: Oceanography

5.1 Oceans: an introduction

5.2 Chemistry of Oceans

5.3 Ocean circulation

5.4 Coastal geomorphology

- Coastal processes
- Waves and Currents
- Coast line: types and classification

-beaches

-Beach drift and shore line processes (Erosion, Accretion and Depositional)

-Erosion and depositional features with reference to Kerala

5.5 Influence of environmental changes in sea level rise

5.6 modeling of coastal processes 9Introduction only)

5.7 Coastal protection methods (Conventional & environment friendly)

5.8 Tides and tidal environment

-Tidal inlets

-Bays

-Lagoons

Estuaries

References:

1. **Barry, R G and Chorley R J** (1998). Atmosphere, weather and Climate (7th Edn). Routledge, London
2. **Brady N C** (1996) The Nature and Properties of Soil (10th Edn). Prentice hall of India Pvt. Ltd, New Delhi
3. **Clark J R** (1995) Coastal Zone Management- Hand Book, CRC –Lewis Publishers
4. Critchfield H J (1997) General Climatology (4th Edn) Prentice hall of India Pvt. Ltd, New Delhi
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10. **Menon P A** (1995) Our Weather National Book Trust India, New Delhi
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13. **Park C** (1997) The Environment –Principles and Applications. Routledge, London
14. **Pinet P R** (1992) Oceanography- An Introduction to Planet Oceanus. West Publishing Company, New York
15. **Strahler A N and Strahler A H** (1973) Environmental Geoscience – Interaction Between Natural Systems and Man. Hamilton Publishing Company, Santa Barbara, California
16. **Todd D K** (1995) Ground Water Hydrology (2nd Edn) John Wiley & Sons New York.

COURSE CODE- ES1PG 3

ENVIRONMENTAL CHEMISTRY, INSTRUMENTATION AND ANALYTICAL TECHNIQUES

Number of Hours / Week: 3

Credits: 4

Objectives:

The course content envisages to:

- ◆ Review some of the fundamental concepts of chemistry
- ◆ Impart a basic understanding of the chemistry of air water and soil in an environmental perspective

- ◆ Introduce various analytical techniques in chemistry
- ◆ Explain the principle, instrumentation and application of various instruments in environmental sample analysis

Unit 1: Fundamental Concepts (a basic understanding only expected)

1.1 Chemical equations and Stoichiometry

1.2 Chemical Kinetics

- Control of reaction
- First, second and zero order reactions

1.3 Thermodynamics-

- Energy, enthalpy, entropy
- Gibbs energy and chemical potential

1.4 Chemical equilibria

1.5 Acid-base equilibria

1.6 Redox reactions and redox potential

1.7 Radionuclides

1.8 unsaturated and saturated hydrocarbons

Unit 2: Chemistry of Air

2.1 History of evolution of the earth's atmosphere

2.2 Role of chemical constituents in atmospheric processes (water, CO₂, NO_x, SO_x, O₂ & Ozone)

2.3 Ozone layer

- Chemistry of the Ozone layer
- Ozone depletion and the chemicals that cause ozone depletion

2.4 Green house gases and green house effect

2.5 Photochemical smog

- Origin and Occurrence, Oxidizing and reducing smog
- Ecological effects

2.6 Acid rain and its ecological effects

Unit 3: Chemistry of Water

3.1 Composition and structure of pure water

3.2 Physical properties of water and aqueous solutions

3.3 Solubility of solids, liquids and gases in water

3.4 Chemical reactions and equilibria in water–carbonate equilibria, metal ion equilibria, redox equilibria

3.5 Natural organic components in water

- Concepts of DO, BOD and COD

Unit 4: Chemistry of Soil

4.1 Introduction

4.2 Weathering and pedogenesis

4.3 Factors of soil formation

4.4 Development of soil profile

4.5 Structure of Soil

4.6 Gross composition-Texture and structure, method of analysis of texture (International pipette method)

4.7 Organic and inorganic components of soil

4.8 Physico-Chemical characteristics of soil

4.9 Ion-exchange and adsorption processes in the soil

4.10 Soil quality parameters and assessment

4.11 Classification of types of soil (Reference to India and Kerala)

4.12 Fate of chemicals in the soil

Unit 5: Analytical Techniques and Instrumentation – I (Principles and application)

5.1 Gravimetric Methods

- Principle and application of gravimetric methods in determination of total, dissolved, suspended, Volatile and fixed solids present in water and waste water.

- Estimation of moisture content of soil, phytomass, compost and vermi-compost using moisture balance

5.2 Volumetric Methods

- Importance of volumetric analysis
- Standardization of reagents using volumetric titrations

5.3 Electrochemical Methods

- pH meters – Glass and Reference electrodes
- Ion selective electrodes
- Electrical conductivity measurements: Conductivity Meters

5.4 Photometric methods

- Nephelometry and Turbidometry
- Spectrophotometry
 - Optical design of filter photometer, single beam spectrophotometer, double beam –
 - UV – Visible – Spectrophotometer
- Flame photometry (FP)
- Atomic Absorption Spectrophotometry (AAS)
- X-ray Fluorescence
- X-ray Diffraction

5.5 Dosimetry

- Geiger Muller Counter
- Scintillation counter

Unit 6: Analytical Techniques and instrumentation-II (Principles and application)

6.1 Chromatography

- Paper chromatography
- Thin layer chromatography
- Column chromatography
- Gas liquid chromatography
- GC-MS
- High Performance Liquid Chromatography (HPLC)

6.2 Electrophoresis

- Gel electrophoresis

- Immuno electrophoresis (ELISA, Blotting Techniques, RFLP, etc)

6.3 Microscopy

- Light microscope, Bright field, Dark field, Phase contrast and Fluorescent microscope

- Electron Microscopy – Transmission Electron Microscope (TEM) and Scanning Electron Microscopy (SEM)

6.4 Flow Cytometry

6.5 Micrometry

6.6 Microtechniques

- Fixation, Sectioning, Histological and Histochemical staining

References

1. **APHA** (1998) Standards Methods for the examination of water and Waste water, 20th Edn, Washington DC
2. **Bailey R A** et.al. (1978) Chemistry of the Environment, Academic Press, New York
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16. **Skoog D A and Leary J J** (1992) Principles of Instrumental Analysis, 4th edn, Saunder's College Publishing, Fortworth
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18. **Suchla G (Ed)** (1987) Vogel's Qualitative Inorganic Chemistry, ELBS
19. **Togyessy J (Ed)** (1993) Chemistry and Biology of Air, Water and Soil, Elsevier Amsterdam
20. **Willard H H , Merritt L L , deen J A and Settle F A** (1986) Instrumental Methods of Analysis (Indian Reprnt), CBS Publishers and Distributers, New Dehi

COURSE CODE- ES1PG 4

BIODIVERSITY CONSERVATION, ENVIRONMENTALLAWS, EDUCATION AND POLICIES

Number of Hours / Week: 3

Credits: 3

Unit 1: Concept of Biodiversity Conservation

1.1 Biodiversity: An introduction

- Definition

- Types of biodiversity
- Composition and levels of biodiversity

1.2 Ecological Foot Prints (Biodiversity and extinction of life)

1.3 Values and distribution pattern of biodiversity- Biodiversity Hotspots

1.4 Assessment, Characterization and Monitoring of Biodiversity- needs and methods (general discussion only)

1.5 Biodiversity depletion-causes and consequences

1.6 Recent International, National and Regional Biodiversity Initiatives (CBD, Global Biodiversity Strategy, GEF Initiatives, National Biodiversity Action Plans, Biodiversity Registries)

1.7 Conservation of Biodiversity

1.8 Biodiversity with special reference to Kerala

1.9 Invasion of Alien Species

Unit 2: Environmental Conventions and Summits

2.1 UNCED and its conventions on Climate change, biodiversity, desertification, and tropical forests

- Stockholm Convention – 1972 & Antarctica Convention etc
- Ramsar Convention
- Hague declaration-1989
- Rio declaration 1992 and Agenda 21
- Rio+5, Rio+10 and Rio+20
- Earth Summit
- Kyoto Protocol
- Montreal Protocol
- Manila Declaration
- Global Environment Monitoring System (GEMS)

Unit 3: Environmental Legislation

3.1 Role of UN in environmental policies and law

3.2 Fundamental principles of environmental laws

3.3 The Water (Prevention and Control of Pollution) Act 1974

- 3.4 The Air (Prevention and Control of Pollution) Act 1981
- 3.5 Wildlife Protection act, 1972
- 3.6 The Forest (Conservation) Act 1980
- 3.7 The environment (Protection) act 1986
- 3.8 Biodiversity Act 2002
- 3.9 Rules and notifications made under Hazardous waste management
 - Hazardous micro organisms
 - Biomedical waste
 - Recycles plastics
 - Ozone depleting substances

Unit 4: National and International Agencies

- 4.1 UNEP, UNDP, WWF, UNCED, IUCN, GEF & WCN
- 4.2 Earthwatch
- 4.3 UN organizations
- 4.4 Co-operation on ozone layer, migratory species, wetlands, mangroves and oceans etc

Unit 5: Information, Education and communication

- 5.1 Environmental education and awareness
- 5.2 information Networks- ENVIS centres & INFOTERA etc
- 5.3 Role of NGOs in the implementation of environmental policies, communication and management
- 5.4 Various national and international NGOs
- 5.5 Peoples Participation and various movements for environmental protection

References

1. **Chakrabarti N K** (1994) Environment Protection and the law, Ashish publishing house, New Delhi
2. **Chapman J. L and Reiss M J** (1992), Ecology-Principles and Applications, Cambridge University Press, Cambridge
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5. **Heywood V H**(Ed)(1995), Global Biodiversity Assessment (UNEP), Cambridge University Press, Cambridge
6. **Kevin J Gaston and John J Spicer** (2004) Biodiversity an introduction, 2nd edn, Blackwell Publishing
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COURSE CODE- ES1PGE1

**RESEARCH METHODOLOGY AND STATISTICS IN ENVIRONMENT SCIENCE AND
MANAGEMENT**

Number of Hours / Week: 3

Credits: 4

The course would help students to:

- ◆ Understand various research methodologies and enable them to carryout research projects
- ◆ Learn statistical methods for data interpretation and analysis
- ◆ Understand basics of mathematics for thr modeling studies
- ◆ Learn statistical soft wares

Unit 1: RESEARCH METHODOLOGY

1.1 Meaning- Objectives-motivation-Significance of research, types of research, Research methods and methodology, Research and Scientific Method, Criteria of Good research, Problems of researcher

1.2 Selection of the problem: Criteria for selection of problem and evaluating problems, Statement of problem formulation and definition

1.3 Research design: Meaning, need for research design, Features and important concepts relating to research design, Different research design, Basic principles of experimental design

1.4 Survey of literature: Different methods of surveying literature, different sources of information, internet, search engines, websites, recording surveying information

1.5 Hypothesis: Nature, types and sources of hypothesis, characteristics of a good hypothesis

1.6 Methods and design of research: Classification of research methods, different types of variables

1.7 Sampling: Unit of sampling, population: techniques, characteristics of good samples, Sampling errors and ways to reduce them.

1.8 Collection and analysis and interpretation of data: Procedure of data collection scoring of data, tabulation, editing and analysis and interpretation of data.

1.9 Research report: Composition, pagination, Title pages, Systems of indicating references, Bibliography, Appendices.

Unit 2: Basic Mathematics

Introduction

Functions and Progressions-Definition of constant, parameter variable and functions, sequence and series, Arithmetic and geometric progressions

Matrix algebra and applications- matrix theory, addition and multiplication of matrix, inverse of matrix, solution of simultaneous equation using matrix inversion, introduction to vectors (addition and multiplication)

Basic calculus and applications- Limit and continuity, concept of derivative, rule of differentiation.

Unit 3: Fundamental Statistics

3.1. Introduction-Importance and limitation

3.2 Classification and tabulation of data

3.3 Graphical Representation

3.4 Measures of Central tendencies- Mean Median and mode

3.5 Measures of dispersion- Range, Standard Deviation and Co-efficient of Variation

3.6 moments, Skewness and Kurtosis

3.7 Correlaton and Regression- Scatter diagrams-Karl Pearsons Coefficeint of Correlation-Rank Correlation-Linear and Curvilinear regressions

3.8 Probablity-Frequency approach-addition and multiplication theorems-Bionomial, Poisson and normal distribution-Probit analysis (Graphic Method only)

3.9 Testing of Hypothesis: Null and Alternative Hypothesis- Two types of error-Level of significance test based on t, Z, Chi-square and analysis of Variance-one-way, two-way, three-way analysis

Unit 4 Application of Computer in Statistics

Data analysis using packages-SPSS

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11. **Prabhakar VR**, Research methodology and system analysis. Anmol, New Delhi.
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SYLLABUS

Second Semester

M.Sc. Environment Science and Management

COURSE CODE- ES2 PG 5

ENVIRONMENTAL POLLUTION AND CONTROL TECHNIQUES

Number of Hours / Week: 3

Credits: 4

Unit 1: Environmental Concerns (Introduction)

1.1 Growing environmental concerns (History from 17th to 21st century)

1.2 Major environmental issues in India and Kerala

1.3 Readings in Environment Perspectives (eg. Silent Spring, Our Common Future etc- assignments only)

Unit 2: Air Pollution

2.1 Air Pollutants: Type, source and nature

- Primary and Secondary pollutants
- Natural and Anthropogenic sources
- Gaseous, solid-particulate and bio pollutants

2.2 Impact of air pollutants on

- Human beings
- Animals
- Plants
- Materials, buildings and climate

2.3 Methods of monitoring and control of air pollutants

- Air quality standards
- Air quality monitoring studies: wind roses, air sampling, analysis for NO_x, SO_x, CO and particulate matter
- Control measures

Unit 3: Water Pollution

3.1 Water pollution: Types, sources and impacts

- Surface water, ground water pollution
- Domestic, industrial, agricultural and natural sources
- Impacts on human beings, animals, plants and environment

3.2 Water quality studies

- Water quality parameters- physical, chemical and biological parameters
- Water sampling- types, selection of sampling points, equipment used, sample preservation, maintenance of chain of custody records

- Analysis of water sample for pH, EC, turbidity, TDS, acidity, alkalinity, hardness, chloride, salinity, DO, CO₂, BOD, COD, nitrogen, phosphate and sulphate.
- Water sampling for microbiological analysis
- Water quality standards

3.3 Water Pollution: Assessment and control

- Pollution due to municipal sewage dumping, industrial effluent discharge and solid waste dumping- leachate infiltration
- Assessment of the level of pollution based on BOD, COD , nitrogen, phosphate and microbiological analysis
- Wastewater treatment: Primary , Secondary and tertiary

: Aerobic and Anaerobic

Unit4: Soil Pollution

4.1 Sources of soil pollution

- Natural sources: natural calamities
- Anthropogenic sources: Agricultural practices, industrial & municipal discharges, municipal solid waste dumping-landfill lechates, radioactive leakage, mining activities

4.2 Soil pollution monitoring

- Physico-chemical and bacteriological sampling and analysis of soil quality
- Synthetic fertilizers (N, P ,K) and their interactions with different components of soil
- Soil pollution control measures

Unit 5: Noise Pollution

5.1 Sources and impacts of noise

- Anthropogenic, natural sources
- Impacts of noise pollution

5.2 Monitoring noise pollution and abatement measures

- Measurement of noise: decibels and noise levels
- Effect of meteorological parameters on noise propagation- noise attenuation
- Noise exposure levels and standards
- Control measures

Unit 6: Radioactive, Thermal and Marine Pollution

6.1 Types and sources of radioactivity

- Radioactivity: Natural and manmade
- Measurement of radiation

6.2 Nuclear power plants

- Radioactive pollution from nuclear power plants
- Radioactive pollution episodes
- Precautions and control measures

6.3 Thermal pollution

- Thermal and nuclear power plants as source of thermal pollution
- Impacts of thermal pollution on flora and fauna

6.4 Marine pollution

- Sources: Natural and Anthropogenic source
- Pollution status of coastal and ocean waters

6.5 Impact and control of marine pollution

- Effect of marine pollution- specifically oil spills- on ocean flora and fauna
- Biotechnological methods in combating oil spills
- Biofouling: impact and management strategies
- Criteria employed for the disposal of pollutants in marine ecosystems

REFERENCES

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2. Abbasi S A 1998 Water Quality sampling and Analysis. Discovery publishing house, New Delhi
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4. Abbasi S A, Krishnakumari P K and Khan F I 1999 Hot Topics, Oxford University Press, Chennai
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COURSE CODE- ES2 PG 6
ENVIRONMENTAL MICROBIOLOGY

Number of Hours / Week: 3

Credits: 4

Unit 1: Bacteria

1.1 Morphology and Ultra structure of Bacteria

Plasma membrane, cell wall, flagella, pili, capsule, slime layer, glycocalyx
,nucleoid, ribosomes and cytoplasmic inclusions,Basis of Gram staining

1.2 Nutrition- Autotrophy and heterotrophy,Different types of media

1.3 Microbial growth- cytological and population growth

Growth curve,Continous culture systems- chemostat and trubidostat ,Factors
affecting growth of bacteria ,Physical and chemical control of bacterial growth

Antibacterial agents and chemotherapy

1.4 Identification of bacteria using different schemes,Overview of Bergey's manual of
determinative bacteriology

Unit 2: Fungi, Protozoans and Viruses

2.1 Fungi-Morphology and structure of fungal hyphae and mycelium,Physiology, nutrition, reproduction and life cycle,Culturing and Identification of Fungi

2.2 Protozoan- Ecology of free living, symbiotic and parasitic Protozoans,Reproduction and life cycle.

2.3 Viruses-Chemical composition ,structure, architecture of viruses

Multiplication and life cycle,Bacteriophages- Lytic and lysogenic cycle

Unit 3: Microorganisms and the Environment

3.1 Physiological status of microorganisms in the environment

Role of microbes in Bio-Geo chemical cycles,Organic substrate use by microorganisms

3.2 Foreign derived microorganisms- Survival and fate

3.3 Genetically engineered microorganisms-fate and effects

3.4 Microorganisms in extreme environments

3.5Nature of marine and fresh water environments

Biofilms and Microbial mats

3.6 Water and disease transmission

Microbial analysis of water quality

3.7 The environment of soil microorganisms

Soil microorganisms association with plants-the rhizosphere, mycorrhizae, actinorrhizae, tripartite association, fungal and bacterial endophytes of plants, Agrobacterium

Pesticides and microorganisms

Soil microorganisms interactions with the atmosphere

Unit 4: Molecular Biology, Genetic Engineering and Tissue Culture

4.1 Genetic control of metabolism-Gene regulation in prokaryotic and eukaryotic microbes

4.2 Recombinant DNA (rDNA) techniques

DNA extraction and purification, DNA sequencing- polymerase chain reaction (PCR) technique; Plasmid vectors, Gene cloning

4.3 Tissue Culture

Introduction to Plant cell, protoplast fusion: cell and tissue culture techniques

Unit 5: Emerging Trends in Environmental Biotechnology

5.1 Agrobiotechnology

Plant genetic engineering – role of rDNS technique

Plant cell, tissue culture and protoplast fusion in developing transgenic plants with diseases resistance and other improved characteristics: Flavr Savr Tomatos, Golden rice

Biopesticides and Biofertilizers

5.2 Ecological Engineering

Aquatic macrophyte based wastewater treatment systems (AMS)- constructed/ artificial wetlands

Nutrient film techniques (NFT)

5.3 Municipal solid waste management

- Role of composting and vermicomposting

5.4 Biodegradable plastics-Biopolymers-PHBs and PHAs

5.5 Phyto-reactors-Plants used to produce genetically engineered products

Unit VI:Biotechnological Methods in Pollution Control

6.1 Air pollution control

Bioscrubbers, biofilters, and membrane bioreactors.

Bio-desulphurisation of coal.

Green belts.

6.2 Bioremediation

Soil/ land contaminated with oil spills, and synthetic organic compounds (xenobiotics) such as PCBs, PAHs., Bioremediation technology, bioremediation of marine oil spills., Phytoremediation

6.3 Biosensors.-Concept, principle, and development of biosensors.

Biosensors for environmental monitoring-BOD, ammonia, and nitrite.

REFERENCE

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COURSE CODE- ES2 PG 7

ENVIRONMENTAL TOXICOLOGY AND OCCUPATIONAL HEALTH MANAGEMENT

Number of Hours / Week: 3

Credits: 4

Unit 1: introduction

1.1 Environmental toxicology as a science

1.2 Biological and chemical factors influencing toxicity

1.3 inorganic and organic toxicants- entry into the environment, cycles and residence time

1.4 Toxicity of pesticides, insecticides heavy metals, radioactive minerals, fluriodes, chemical fertilizers etc

Unit 2: Toxicants and Ecosystem

- 2.1 Toxicants and communities in ecosystem
- 2.2 Multilevel trophic interactions and non-trophic interactions
- 2.3 Functional changes in the ecosystem
- 2.4 Effect of interspecific interactions in the environment
- 2.5 Bio-concentration, Bio-accumulation and bio-magnification and its impacts
- 2.6 Impact of toxicants/pollutants at cellular and molecular level of plants and animals with special reference to human
- 2.7 Sensitivity of ecosystems and ecotones

Unit 3: Toxicity Testing and Indicators

- 3.1 Principles of toxicity testing
- 3.2 Methods of toxicity evaluation at cellular and molecular level by in vitro and in vivo methods
- 3.3 Monitoring approaches- indicator populations and indicator species
- 3.4 Lacustrine communities as indicators of ecosystem stress
- 3.5 Bacterial, algal and invertebrate microbiotests
- 3.6 Model ecosystems- microcosms and mesocosms
- 3.7 Bio-sensors and Bio-markers- Concept and approach, advantages and disadvantages
- 3.8 Molecular marker to toxicants- metabolites as indicators, protein induction, cytochrome P450 enzymes, stress proteins and metallothioneins

Unit 4: Occupational Hazards and Safety

- 4.1 Environmental and occupational safety- Definitions, concept and scope
- 4.2 Occupational exposure
- 4.3 Occupational hazards and diseases
- 4.4 Control of toxic materials and protection measures
- 4.5 Toxicity of biohazard
- 4.6 Toxicity of air, water and soil

Unit 5: Health and Hygiene

5.1 Health and Hygiene- Epidemiology and health ecology

5.2 Epidemiological diseases due to pollution problems with special reference to Kerala and India

5.3 Health effects of cosmetics and drugs

5.4 Occupational and industrial health management

5.5 Health risk assessment of toxic chemicals

5.6 Ecological risk assessment in environmental management

5.7 Legislative perspective in ecological risk assessment

5.8 Human health risk assessment

5.9 Modeling in risk assessment

REFERENCE

1. Ballantyne B, Marris T and Turner P (ED) 1995. General and applied toxicology (Abridged edition) Macmillan Press
2. Cairns Jr, J and Niedrelehner B R (Ed) 1994, Ecological Toxicity testing- Scale, complexity, relevance. Lewis publishers
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COURSE CODE- ES2 PG 8
ROMOTE SENSING AND GIS

Number of Hours / Week: 3

Credits: 3

Unit 1: Fundamentals of Environmental Appraisal Tolls

1.1 Scales

- Definition, types of scales, representation and conversion (introduction only)

1.2 Maps

- Definition and classification
- Map conversions (Grids, Contours, Isobars, Etc)

- Measurements of area and distance (Square and Planimeter Methods)

1.3 Topographical Maps

- Cadastral maps
- Toposheets (Interpretation and studies)

1.4 Surveying

- Definition and classification
- Survey instruments (Introduction to Compass, Theodolite, Clinometer, Abney Level, Cartographic equipments)
- Preparation of maps (Basics of cartography)

1.5 Photogrammetry

- Definition and types (Aerial and terrestrial photographs)
- Method and equipments used in Aerial Photo Interpretation (Introduction only)

Unit 2: Remote Sensing: Introduction

2.1 Definition

2.2 History and Scope of Remote Sensing

2.3 Meaning and Scope of remote Sensing

2.4 Indian Remote sensing Programmes

Unit 3: Remote Sensing: II

3.1 Electromagnetic Spectrum

3.2 Sensors and Platforms

3.3 Types of platforms, scanners and data products

3.4 Image processing, Photo-interpretation and Photogrammetry

3.5 Applications of remote Sensing

Unit 4: Geographical Information System (GIS) – I

- 4.1 History and Development
- 4.2 Concepts, Components and Organisation of GIS
- 4.3 Introduction to mapping and GIS
- 4.4 Remote Sensing, GPS and GIS

Unit 5: Geographical Information System (GIS) – II

- 5.1 Fundamentals of computing GIS
- 5.2 Theory of GIS
- 5.3 Spatial Data concepts
- 5.4 Processing and visualization
- 5.5 Information analysis and digital data processing
- 5.6 Introduction to GIS packages
- 5.7 Geographical analysis
- 5.8 Applications of GIS

REFERENCE

1. Begni Gérard, Escadafal Richard, et al, (2005). Remote sensing: a tool to monitor and assess desertification. Les dossiers thématiques du CSFD
2. Daplyn P , Cropley J, Treagust and Gordon A (1994) The use of Geographical Information Systems in Socio-economic Studies. The Natural Resources Institute
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COURSE CODE- ES2 PGE3

ENVIRONMENTAL ECONOMICS AND SUSTAINABLE DEVELOPMENT

Number of Hours / Week: 3

Credits: 4

Unit 1: Environmental Economics-Introduction

- 1.1 Definition and scope of Environmental Economics
- 1.2 Foundations of Environmental economics
- 1.3 Growth-mechanistic model to holistic approach

1.4 Welfare economics as the basis of Environmental economics

Unit 2: Environmental Economics- Basics and trends

2.1 Efficiency in private market- consumption, production

2.2 Market failure- the public goods problem and private goods- properties and types, non-excludability and non – rivalry of public goods, optimal provision of public goods, free riding, allocation of property rights-Coase Theorem, partial and pure public goods

2.3 Externalities- marginal private cost, marginal social cost, marginal external cost, problem of second best and solution to externality.

2.4 Principle of maximum social welfare- Pareto Criterion

Unit 3: Resource Economics

3.1 Economics of Natural Resources

3.2 Resource Pricing Techniques

3.3 Size and density of population, population and income inequality, poverty, poverty and environment (at the global and national levels) HDI – new concepts of development

3.4 Concepts of overpopulation and over consumption- North Vs South. Demonstration effects, Globalization and new strategy of marketing

3.5 Energy production availability and consumption, sources and impact of energy tapping- traditional and modern alternate sources of energy for sustainable development.

Unit 4: Industrial development & Environment

4.1 Traditional Industries- cottage and small scale production, marketing and natural resource use techniques and rural setup

4.2 Modern large scale industries- nature process and techniques of production- impact on environment

4.3 Problems related to modernization and urbanization-pollution, health etc

4.4 Green Policies of industrialization – Green technology, Green Productivity and Green Marketing etc

Unit 5: Environment Cost- Benefit Analysis (CBA)

5.1 Social CBA

5.2 Economic CBA

5.3 Environmental pollution-control, private cost and social cost

5.4 Financial analysis of projects

5.5 Theoretical rationale for and application of CBA

Unit 6: Sustainable Development

6.1 Definition, origin, evolution and development- World Commission on Environmental Development (WCED), Multidimensional and Multidisciplinary aspects- Ethical-Cultural-Spiritual-Technological, Political and Educational aspects.

6.2 Strategies and Indicators of SD

6.3 Sustainable human development index, Sustainability pillars

6.4 Gandhian model of SD

6.5 Education for sustainable development

6.6 Sustainable Production and Consumption

REFERENCE

1. Bowers J (1997) sustainability and Environmental Economics. Longman. Singapore
2. Brown L R (2001) Eco-Economy. Earth Scan Publications London
3. Caprei F (1984) The turning Point. Flemingo Pub. Lon
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SYLLABUS

Third Semester

M.Sc. Environment Science and Management

COURSE: ES 3 PG 9

ENVIRONMENTAL ENGINEERING

Number of Hours / Week: 3

Credits: 4

Unit I: Introduction

1.1 Environmental Engineering and Environmental Systems

1.1.1 Water resource management

1.1.2 Air resource management

- 1.2 Solid waste management systems
- 1.3 Mass-balance approach to problem solving

Unit II: Water Resource Management: Water and Wastewater Treatment

2.1 Water quality studies

- 2.1.1 Sampling techniques
- 2.1.2 Sampling devices
- 2.1.3 Sample preservation
- 2.1.4 Physical-chemical and biological examination of water
- 2.1.5 Water quality standards

2.2 Water Treatment

2.2.1 Filter plants

- 2.2.1.1 Mixing and flocculation, Coagulation, Jar test
- 2.2.1.2 Softening- lime soda and ion exchange processes
- 2.2.1.3 Filtration- slow, rapid and high-rate sand filters
- 2.2.1.4 Disinfection-Chlorination, Ozonation and UV application

2.3 Wastewater Treatment

2.3.1 Municipal sewage treatment

- 2.3.1.1 Basic treatment processes and flow sheets
- 2.3.1.2 Waste flow rates and their assessment

2.3.2 Unit operations of pre-treatment and primary treatment

- 2.3.2.1 Bar racks, grit chambers, comminutors, equalization and sedimentation
- 2.3.2.2 Design concepts

2.3.3 Secondary treatment: Biological unit processes

- 2.3.3.1 Nature and kinetics of biological growth
- 2.3.3.2 Aerobic activated sludge processes and its various modifications
- 2.3.3.3 Oxidation ponds

2.3.3.4 Attached growth systems-trickling filters

2.3.3.5 Rotating biological contactors (RBCs)

2.3.4 Anaerobic wastewater treatment systems

2.3.4.1 Evolution of high-rate anaerobic reactors-CSTRs

2.3.4.2 Up-flow anaerobic filters (UAFs)

2.3.4.3 UASBs, Expanded /Fluidized bed reactors

2.3.5 Chemical unit processes

2.3.5.1 Precipitation

2.3.5.2 Coagulation

2.3.5.3 Disinfection

2.3.6 Tertiary/ advanced treatment systems

2.3.6.1 Filtration

2.3.6.2 Adsorption

2.3.6.3 Nitrogen and phosphorous removal

2.3.6.4 Biological nutrient removal (BNR) systems

2.3.7 Land treatment- slow rate, overland flow, rapid infiltration

Unit III: Air resource Management and Air Pollution Control

3.1 Control of particulate matters

3.2 Control of gaseous contaminants

3.3 Automobile emission control

3.4 Dispersion modeling- Gaussian dispersion model

Unit IV: Solid waste Management: Municipal Solid waste

4.1 Types, sources and properties

4.2 Techniques for treatment / processing of solid waste-Recovery, reclamation, recycle and reuse of resources.

4.3 Disposal methods for solid waste residues.-Incineration,sanitary land fills.

4.4 Hazardous waste management.

Unit V : Risk Assessment

5.1 Risk assessment and disaster management for industries-case histories of major chemical disasters,basic components of hazard control system,techniques of risk assessment-

PHA,HAZOP,MAXCRED,emergency control and disaster plan

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ES 3 PG 10

ENVIRONMENTAL PLANNING AND MANAGEMENT

Number of Hours / Week: 3

Credits: 4

Unit I: Introduction

- 1.1 Basic Principles of Environment Management.
 - 1.1.1 Environment Planning and Management
 - 1.1.2 Environmental Audit
 - 1.1.3 Environmental quality standards (ISO standards)

Unit II: Environment Impact Assessment

- 2.1 Introduction
 - 2.1.1 Definition, aim, principles and concepts, scope
- 2.2 Methods and steps
 - 2.2.1 Adhoc method
 - 2.2.2 Checklist Method
 - 2.2.3 Werner Prestroit study
 - 2.2.4 Smith study
 - 2.2.5 Interaction Matrices- Network and overlays approach.

Unit III: EIA Process

- 3.1 Methods for preparing EIA
 - 3.1.1 Socio-economic aspects
 - 3.1.2 Making inventories
 - 3.1.3 Sampling and Data process
- 3.2 Impact Prediction
 - 3.2.1 Positive and negative impacts
 - 3.2.2 Primary and secondary impacts

3.2.3 Impact on physical, social and biotic environments

Unit IV: EIA for different Environmental Programme

4.1 Industries

4.2 Urban Development

4.3 Land use

4.4 Energy Projects

4.4.1 Hydel, Thermal Nuclear, Oil & Gas, Solar and wind

4.5 EIA Case Studies

Unit V: Environmental Planning and Management

5.1 Principles of EPM

5.1.1 Principles, concepts and scope of environmental planning

5.1.2 Ecological aspects of EPM

5.1.3 Steps in Environmental Planning

5.1.4 Identification and formulation of strategies of EPM

5.2 Environmental Analysis and EPM

5.2.1 Physical planning in relation to environment and land-use classification

5.2.2 EPM for

5.2.2.1 Town and urban lands

5.2.2.2 Rural and agricultural lands

5.2.2.4 Lands reclaimed

5.2.2.5 Wetlands

5.2.2.6 Mining areas

5.2.2.7 Industrial areas

5.2.2.8 Transportation and urban planning

REFERENCES

REFERENCES

1. **Abbast, S.A.** (2001). *Water Resources Projects and their Environmental Impacts* *Discovery Publishing House, New Delhi*
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8. Peter Wathern (2001) *Environment Impact Assessment: Theory and Practices*

ES 3 PG 11

RESOURCE MANAGEMENT

Number of Hours / Week: 3

Credits: 4

Unit I: Sustainable Management- Introduction

- 1.1 Concepts and dimension
- 1.2 Theories and definitions
- 1.3 Role of environmental Planning and Management in Sustainable Development

Unit II: Management of Biological Resources

- 2.1 Resource Management
 - 2.1.1 Agriculture and land resources
 - 2.1.2 Irrigation
 - 2.1.3 Water resources (aqua culture, sea farming)
 - 2.1.4 Wild life resources
 - 2.1.5 Forest resources
 - 2.1.6 Mineral resources
 - 2.1.7 Coastal zone
- 2.2 Coastal Zone Management
 - 2.2.1 Law Sea and Coastal Regulation Zone (CRZ) act
 - 2.2.2 Problems associated with Coastal ecosystem
 - 2.2.3 Coastal Zone Management plans for Kerala
 - 2.2.4 Remote sensing techniques for marine resource management
- 2.3 Biological Resource for health Management
 - 2.3.1 Medicinal Plants
 - 2.3.2 Identification of Problems and development

2.3.3 Sustainable Management strategies for biological resource with particular reference to Kerala

Unit III: Management of Ecosystems

3.1 Management strategies for various ecosystems-grassland, wetland, estuaries, mangroves , coastal, forest and mountain

3.2 Ecotourism

3.3 Eco-development for management

3.4 Social and human interference management

3.5 Case studies

REFERENCES

1. Environmental Problem of the Marine and Coastal areas of India-A Natural Report (1985) UNEP
2. **Ferguson, I.S.** (1996) Sustainable Forest Management. *Oxford University Press*, Oxford
3. **Gangstad, E.O.** (1990) Natural Resource Management of Water and land. *Van Nostrand Reinhold*, New York.
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12. **Troeh, F.R, Hobbs. J.A, Dahue, R.L** (1999).Soil and water conservation *Printice hill*.
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14. William E Graw etal (2009) Ecology and Natural Resource Management

COURSE CODE- ES3 PG 12
ENERGY RESOURCE MANAGEMENT

Number of Hours / Week: 3

Credits: 3

Unit 1: Introduction

- 1.1 Fundamentals of energy, work, power and units
- 1.2 Energy transformations- laws of thermodynamics
- 1.3 Flow of energy and cycle of matter in the human ecosystem
- 1.4 Energy for household uses, industrial and agricultural uses
- 1.5 History and geography of energy development and energy related pollution
- 1.6 Concepts of Conventional, Non-conventional, Renewable, Non-renewable and Alternate energy resources

Unit 2: Non-renewable Energy Resources

- 2.1 Fossil fuels: coal, peat, oil, oil shale, tar sands, natural gas
- 2.2 Non- fossil fuels: Nuclear power, Hydal power
- 2.3 Ecological and social impacts (advantages and disadvantages) of major thermal and nuclear power plants
- 2.4 Emerging policies in energy management
- 2.5 Management of energy projects and its environmental impacts
- 2.6 Environmental impacts of non-renewable energy resources

Unit 3: Renewable Energy Resources

- 3.1 Solar Energy: Techniques for harvesting solar energy, direct utilization of solar energy by thermal conversion, thermo-mechanical conversion, Helio-electric conversion, Photo-voltaic

conversion, indirect utilization through water power- Ocean Thermal energy Conversion (OTEC), solar ponds

3.2 Wind Resources: Mapping of wind resources area, wind power stations, wind turbines-types, efficiency; Betz limit, Wind Rose

3.3 Geothermal Sources, Tidal energy and ocean waves-Possibilities and limitations

3.4 Biomass based energy- Biogas systems, petroplants, dendrothermal energy, algal fuels

3.5 Environmental impacts of renewable energy resources

Unit 4: Energy Resources in India

4.1 Fuel wood

4.2 Fossil fuel-coal, oil natural gas

4.3 Hydropower

4.4 Nuclear power

4.5 Renewable energy resources in India: thermal energy, solar energy, wind energy, biomass based energy and other renewable energy sources (tidal, ocean waves and geothermal)

Unit 5: Energy, Environment and Development

5.1 Environmental problems associated with energy generation and consumption process

5.2 Energy pricing techniques for controlling environmental problems (air pollution)

5.3 Energy Efficiencies

5.4 Energy Security

Unit 6: Energy Auditing

6.1 Types of audits- walk through energy audit, intermediate energy audit, and comprehensive energy audit

6.2 Recommended [practices

6.3 Performing the energy audit-details-computer simulation

REFERENCES

1. Biomass Energy Systems (1997) Tata Energy Research Institute (TERI) New Delhi
2. Goldemberg J, Johansson T B, Reddy A K N and Williams R H 1988, Energy for Sustainable World. Wiley Eastern Ltd, New Delhi
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8. Mittal K M. 1997 Non- conventional Energy systems: Principles, progress and prospects
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10.) Ziliang Zong (2008) , Energy Efficient Resource Management, Auburn University

COURSE CODE ES 3 PGE 5

DISASTER MANAGEMENT

Number of Hours / Week: 3

Credits: 4

Unit I: Introduction

Introduction to Disaster Management

Distinguishing between an emergency and a disaster situation

Types of natural and non-natural disasters

Implications of disasters on environment

Environmental Planning and management for environmental hazards

Unit II Disaster Management Cycle

Introduction

Disaster Management Cycle

Disaster Mitigation

Mitigation strategies

Hazard identification and vulnerability analysis

Mitigation measures,

Unit III: Disaster Preparedness, Response and Recovery

Introduction, Disaster Preparedness

Disaster Risk Reduction (DRR)

The Emergency Operation Plan (EOP)

Disaster Response and Recovery

Modern methods of disaster response

The Recovery Plan

Unit IV: Disaster Education and Public Awareness

Community-based Initiatives

Stakeholders' Roles and Responsibilities, Categories of stakeholders

Government, Non Government Organisations (NGOs), Regional and International Organizations / Donor Agencies, Island Councils / Local Government, Community Workers, National and Local Disaster Managers, Trainers, Policy Makers and Grass-roots people

Advantages and Disadvantages of the Community-Based Approach

Duties of Response Personnel, Pre-Disaster Mitigation Plan

Hazardous Materials

Ways of storing and safely handling hazardous materials

Opportunities and regional planning for hazard management

Unit V: The Role of Technology in Disaster Management

Geographic Information Systems (GIS) and Disaster Management

Remote Sensing and Disaster Management

The Role of Media in Disaster Management

Unit VI Physical and Socio-economic Impacts of Disasters

Disaster Associated Health Issues

Emergency Health Services in Disasters

Infrastructure and procedures in accessing emergency situations

Communicable diseases common in disaster situations

Monitoring and Evaluation of Communicable Diseases Control Programme

Disaster and Development

The impact of disasters on development programmes
Vulnerabilities caused by development

REFERNCES

1. **Abbasi S.A, Krishnakumari P.K and Khan F.I.** (1999), Hot topics, *Oxford University Press*. Chennai.
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5. Maxx Dilley (2005) *Disaster Hotspots*
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7. **Sharma R.K and Gagandeep, Sharma** (2005) *Natural Disaster. , APH Publishing Corporation, New Delhi.*
8. **Srinivas, H.** (2005) *Disasters: a quick FAQ*. Accessed on 24/01/08 at: http://www.gdrc.org/uem/disasters/1-what_is.html

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SYLLABUS

Fourth Semester

M.Sc. Environment Science and Management

Fourth Semester

Course Code: ES 4 PG 13:- Institutional or Industrial Training and Report / Project Work and Thesis (8 Credits)

Course Code: ES 4 PG 14:- Viva voce (2 Credits)

Course Code: ES 4 PG 15:-Field Study of Potential Environmental areas / Major Industries (1 Credit)

M.Sc ENVIRONMENT SCIENCE AND MANAGEMENT

PRACTICAL SYLLABUS

w.e.f 2012-13 Admission

Course Code :ES1PG-P1

PRACTICAL-1

ECOLOGY,BIOMETRY,INSTRUMENTATION,& BASIC WATER QUALITY STUDIES

Ecology:-

- 1.Sampling methods
- 2.Determination of minimum size of quadret for sampling.
3. Determination of minimum number of quadrets to be studied
4. Determination of Frequency,Density, and Abundance of populations in an ecosystem.
- 5.Ecosystem study-Fauna and flora analysis
- 6.Food web construction of an ecosystem
- 7.Windrose

Biometry:-

Data representation-

- 1.Bar diagram,
- 2.Component Bar diagram,,
- 3.Superimposed Bar diagram,
- 4.Line diagram,
- 5.Pie diagram,

Instrumentation:-

- 1.pH Meter
- 2.BOD Incubator
- 3.Lux Meter
- 4.Wet & Dry bulb Hygrometer
- 5.Max-min Thermometer
- 6.TDS Meter
- 7.Sound Level Meter

Basic Water Quality Studies :-

- 1.pH of Water Sample
- 2.Acidity of Water Sample
- 3.Alkalinity of Water Sample

- 4.Total Solids of Water Sample
5. Total Dissolved Solids of Water Sample
6. Total Suspended Solids of Water Sample
- 7.DO of Water Sample
- 8.CO₂ of Water Sample
- 9.Oxygen Pulse

Course Code :ES2PG-P2

PRACTICAL- 2

Microbiology and Environmental Chemistry

Microbiology:-

- 1.Laboratory Rules and Instructions
- 2.Autoclaving
- 3.Hot air oven
4. Laminar Air flow
5. Bacteriological filtration

6. Preparation of Media-nutritional requirements, Nutrient Agar, Nutrient Broth, Soil Extract Agar etc.

7. Purification of mixed culture-Streak plate technique, and Pour plate technique

8. Preparation of slants

9. Gram staining

10. IMViC Test

11. Determination of MPN of Coli-forms

12. Motility Test-Soft Agar Method and Hanging Drop Method

Environmental Chemistry:-

1. Water Quality Studies:-

- a) Salinity of Water Sample
- b) Hardness of Water Sample
- c) Turbidity of Water Sample
- d) BOD of Water Sample
- e) COD of Water Sample
- f) Oil and Grease in Water Sample

2. Soil Quality Studies:-

- a) Moisture content of soil.
- b) pH of Soil
- c) Organic matter in Soil
- d) Chloride content in Soil

Course Code:ES3PGP3

PRACTICAL- 3

Polluion and Toxicology

- 1.Determination of Hexavalent Chromium in water
2. Determination of Inorganic Phosphorus in water
3. Determination of Ferrous Iron in water-Phenaonthrolin method/Thiocynate method
4. Determination of Nitrate- Nitrogen in water-Brucine method
5. Determination of Nitrite -Nitrogen in water
6. Determination of strength of an Acid by Potentiometric titration
7. Determination of strength of an Acid by pHmetric titration
8. Determination of Sulphate in water-using turbidimeter

9. Determination of Sulphate in water-using Spectrophotometer
10. Determination of Electrical Conductivity of water
11. Determination of Total Dissolved Solids in water using TDS Meter

MODEL QUESTION PAPER (2012-13 Admission on wards)

M.Sc. Environment Science and Management

First Semester

COURSE CODE- ES1PG 1

ENVIRONMENT, ECOLOGY AND CONSERVATION BIOLOGY

Time:3Hrs
Weightage:30

**I. Write notes on Any Five
(Wt: 1 each)**

- 1) Energy flow
- 2) Life zone
- 3) Carring capacity

- 4 Genetic drift
- 5) Edge effect
- 6)Allelopathy
- 7) Key-stone species
- 8)Endemism

**II. Write Short Essay on Any Five
(Wt:2 each)**

- 9)Trophic relation
- 10)Compare Natural and Artificial ecosystems
- 11)Ecological efficiencies
- 12)Importance of Mangroves
- 13)Briefly explain phenology with examples
- 14)Geographical speciation
- 15)Describe various methods used to measure primary productivity
- 16)Compare the species diversity indices of Simpson and Shannon-Wiener

**III. Answer Any Three in Detail
(Wt:5 each)**

- 17)Compare r-selection and k-selection strategies of species survivability
- 18)Explain Hardy-Weinberg equilibrium and its application in population genetics
- 19)Describe ecological succession mentioning the various processes involved in it and the types
of ecological succession
- 20)Explain Ecological Niche and add a note on the views of Odum, Hutchinson and Gause
- 21)What is reproductive isolation ? Comment on its role in speciation.
- 22)Comment on Continuum concept.

COURSE CODE- ES1PG 2
ENVIRONMENTAL GEOSCIENCES

Time:3Hrs
Weightage:30

I. Write notes on Any Five
(Wt:1 each)

- 1)Shadow zone
- 2)Bing Bang Theory
- 3)Rock cycle
- 4)Plate tectonics
- 5)Lapse Rate
- 6)Beach Drift

7)Water shed

8)Polar Auroras

**II. Write Short Essay on Any Five
(Wt:2 each)**

9)Hydrological cycle

10)Sea Floor Spreading

11)Slope Process

12)Heat Budget

13)Cloud Seeding

14)Heat Islands

15)Drainage Pattern

16)Differentiate Weather and Climate

**III. Answer Any Three in Detail
(Wt:5 each)**

17)Give an account of the Costal Protection methods

18)Comment on Atmospheric Stability and its significance in pollution aspect

19)Application of climatology in Agriculture

20)Give an account of trace elements and their role in human health aspects

21)Describe in detail the different water bearing formations.

22)Comment on Koeppen's system of classification.

COURSE CODE- ES1PG 3

ENVIRONMENTAL CHEMISTRY, INSTRUMENTATION AND ANALYTICAL TECHNIQUES

Time:3Hrs
Weightage:30

**I. Write notes on Any Five
(Wt:1 each)**

- 1) Beer-Lambert's Law.
- 2) Gel Electrophoresis.
- 3) Radionuclides
- 4) PAN
- 5) Heat Islands.
- 6) TEM.
- 7) Geiger-Muller counter.

8)Soil profile

**II. Write Short Essay on Any Five
(Wt:2 each)**

9)X-ray diffraction

10)Differentiate photochemical and ordinary smog.

11)Atomic absorption spectrophotometry(AAS).

12)Explain First,Second and Zero order reactions.

13)Redox equilibria.

14)Ion-Selective electrodes.

15)Global warming

16)Flow cytometry.

**III.Answer Any Three in Detail
(Wt:5 each)**

17)Describe in detail the Chromatographic techniques.

18)Give an account of X-ray diffraction.

19)Comment on microtechnics.

20)Significance of BOD and COD in waste water treatment.

21)Comment on Acid rain and its ecological effects.

22)Classification of Soil with reference to India.

COURSE CODE- ES1PG 4

BIODIVERSITY CONSERVATION, ENVIRONMENTALLAWS, EDUCATION AND POLICIES

Time:3Hrs
Weightage:30

**I. Write notes on Any Five
(Wt:1 each)**

- 1) IUCN Red Data Book
- 2) National park
- 3) Kyoto protocol
- 4) Ramsar sites
- 5) MOEF.
- 6) Water Cess Act.
- 7) INFOTERA
- 8) Wetlands

**II. Write Short Essay on Any Five
(Wt:2 each)**

9)Biodiversity depletion

10)Earth summit

11)Chipko Movement

12)Environmental Education

13)Ex-situ Conservation

14)Mangroves

15)Rio +20

16) Invasion of Alien Species

**III. Answer Any Three in Detail
(Wt:5 each)**

17)Biological Hot spots in India

18)Role of NGOs in environmental conservation

19)Application of Sustainable development in environmental management

20)Role of women in energy conservation

21)Environmental legislation in India.

22)Comment on Ecofeminism in conservation aspects

COURSE CODE- ES1PGE1

**RESEARCH METHODOLOGY AND STATISTICS IN ENVIRONMENT SCIENCE AND
MANAGEMENT**

Time:3Hrs
Weightage:30

**I. Write notes on Any Five
(Wt:1 each)**

- 1) What are the different types of research ?
- 2) What are the characteristics of a good sample ?
- 3) Write a note on measures of skewness ?
- 4) What is meant by systematic sampling ?
- 5) Define Matrix?
- 6) What is meant by Derivative of a function ?

- 7) Explain t-test ?
- 8) Define ANOVA?

II. Write Short Essay on Any Five (Wt:2 each)

- 9) What are the basic principles of experimental design ?
- 10) Explain sample errors and what are the different methods to reduce these errors ?
- 11) Write a short note on CPM and PERT ?
- 12) Explain testing of hypothesis?
- 13) What are the different measurers of central tendency ?
- 14) Find the product of matrix A and B

$$A = \begin{bmatrix} 2 & 3 & 4 \\ 1 & 6 & 2 \\ 1 & 3 & 5 \end{bmatrix} \quad B = \begin{bmatrix} 5 & 6 & 4 \\ 2 & -1 & 3 \\ 1 & 6 & 2 \end{bmatrix}$$

- 15) What are the different types of graphical representation of data ?
- 16) Define standard deviation and its merits ?

III. Answer Any Three in Detail (Wt:5 each)

- 17) What is mean by sampling and what are the different types of sampling methods ?
- 18) Twelve rats were given a high protein diet and set of seven rats given a low protein diets the gain in weights in gms observed in the two sets are given below

| | | | | | | | | | | | | |
|--------------------|----|----|----|----|----|----|----|---|----|----|---|----|
| High protein diets | 13 | 14 | 10 | 11 | 12 | 16 | 10 | 8 | 11 | 12 | 9 | 12 |
| Low protein diets | 7 | 10 | 11 | 8 | 10 | 13 | 9 | | | | | |

Examine whether the high protein diet is superior to low protein diet at 5% level of significance

19) Apply suitable test to examine whether the following figures provide evidence of the effectiveness of inoculation.

| | Attacked | Not |
|----------------|----------|-----|
| attacked | | |
| Innoculated | 20 | 300 |
| Not inoculated | 80 | 360 |

20) Estimate the two regression equation

X : 20 22 30 39 42 18 19 35

Y : 36 42 29 43 61 12 9 16

21) Application of computers in statistical problems and briefly explain SPSS ?

22 Explain problems of a researcher ?

Second Semester

COURSE CODE- ES2 PG 5

ENVIRONMENTAL POLLUTION AND CONTROL TECHNIQUES

Time:3Hrs

Weightage:30

I. Write notes on Any Five
(Wt:1 each)

1) PAN

2) Bio-pollutants.

3) Screening.

4) Plume behavior.

5) Synthetic fertilizers.

6)Bio augmentation

7)Decibels.

8)London Smog.

II. Write Short Essay on Any Five (Wt:2 each)

9)Management measures for the disposal of pollutants in marine systems.

10)Tertiary treatment in wastewater treatment.

11)Effects of Acid rain.

12)Radioactivity measurements.

13)Landfill leachates.

14)Formation of photochemical smog.

15)Management of plastic wastes.

16)Classify the different types of air pollutants.

III. Answer Any Three in Detail (Wt:5 each)

17)Comment on coastal problems in India.

18)Write an essay on Radioactive waste pollution and their management.

19)Describe in detail the management techniques for hazardous waste.

20)Explain the role of bioremediation in waste management with suitable examples.

21)Explain the various methods and equipments for the removal of particulate matter
from gaseous streams

22)Comment on Global warming and its impact on the environment.

COURSE CODE- ES2 PG 6
ENVIRONMENTAL MICROBIOLOGY

Time:3Hrs
Weightage:30

I. Write notes on Any Five
(Wt:1 each)

- 1)Taq polymerase
- 2)Glycocalyx.
- 3)Golden rice
- 4)Piezophile
- 5)Microbial mat.
- 6)Bt Cotton
- 7)Phytoreactor
- 8)Actinorrhizae.

II. Write Short Essay on Any Five (Wt:2 each)

- 9) Bergey's manual.
- 10) NFT
- 11) Biodegradable plastics
- 12) Microorganisms in extreme environments.
- 13) Composting.
- 14) Explain the role of microbes in pesticide degradation.
- 15) Gram staining
- 16) Briefly explain Chemostat and Turbidostat

III. Answer Any Three in Detail (Wt:5 each)

- 17) Explain the role of microbes in the biogeochemical cycling.
- 18) Give an account of microbial analysis of water quality.
- 19) Explain gene regulation in prokaryotic microbes.
- 20) Explain PCR technique.
- 21) Describe the different types of soil microorganisms association with plants.
- 22) What are biofertilizers? Explain.

COURSE CODE- ES2 PG 7

ENVIRONMENTAL TOXICOLOGY AND OCCUPATIONAL HEALTH MANAGEMENT

Time:3Hrs
Weightage:30

I. Write notes on Any Five
(Wt:1 each)

1)Minamata Disease

2)BCF

3)Xenobiotics

4)Biomarker

5)Metallothionein

6)Biohazard

7)Epidemiology

8)Microbiotest

II. Write Short Essay on Any Five
(Wt:2 each)

- 9) Stress Protein
- 10) Bioaccumulation
- 11) Describe chemical factors influencing toxicity
- 12) Indicator population
- 13) Occupational Hazards
- 14) Toxicity of fluorides
- 15) Dose-Response Assessment.
- 16) Discuss the principles of testing toxicity.

III. Answer Any Three in Detail (Wt:5 each)

- 17) Describe in detail the biological and chemical factors influencing toxicity.
- 18) Comment on Biomagnification with suitable examples.
- 19) Differentiate Microcosms and Mesocosms.
- 20) Methods of toxicity evaluation at Cellular and Molecular level.
- 21) Comment on Occupational exposure and safety measures
- 22) Legislative perspectives in ecological risk assessment.

COURSE CODE- ES2 PG 8
ROMOTE SENSING AND GIS

Time:3Hrs
Weightage:30

I. Write notes on Any Five
(Wt:1 each)

- 1)Photogrammetry.
- 2)GPS.
- 3)RADAR
- 4)Satellites.
- 5)EDUSAT
- 6)Buffers.
- 7)Geocoding.
- 8)FCC.(False Colour Composite)

II. Write Short Essay on Any Five
(Wt:2 each)

- 9)Differentiate Active and Passive Sensors.

- 10) Comment on Platforms.
- 11) Peculiarities of Electromagnetic spectrum.
- 12) Advantages of aerial photography
- 13) What are the different segments of GPS.
- 14) Digital Data Processing and Image Interpretation techniques
- 15) What are the different types of resolution in Remote sensing.
- 16) What are the Landsat imageries? How they are interpreted?

III. Answer Any Three in Detail (Wt:5 each)

- 17) Application of Remote sensing and GIS in environmental management.
- 18) Write notes on GIS packages
- 19) Application of Remote sensing in Climatology.
- 20) What are the different types of projection techniques.?
- 21) Explain different Survey Instruments.?
- 22) Describe in detail about various geostationary satellites.

COURSE CODE- ES2 PGE2

ENVIRONMENTAL ECONOMICS AND SUSTAINABLE DEVELOPMENT

Time:3Hrs
Weightage:30

**I. Write notes on Any Five
(Wt:1 each)**

- 1)Polluter pay principle.
- 2)Sustainable development.
- 3)GDP.
- 4)HDI(Human Development Index)
- 5)Urbanisation
- 6)CBA.
- 7)WCED
- 8)Economic trade-off

**II. Write Short Essay on Any Five
(Wt:2 each)**

- 9)Gandhian model of sustainable development.
- 10)What are the methods of internalizing the external cost of pollution.

- 11) Discuss important ways of reducing poverty.
- 12) Differentiate common property resource and public property resource.
- 13) Explain the economics of optimum resource utilization.
- 14) Explain the concept of extended producer responsibility with suitable example.
- 15) Explain briefly the scope of environmental accounting.
- 16) Write a note on International trade.

III. Answer Any Three in Detail (Wt:5 each)

- 17) Explain various Small scale and Large scale industries.
- 18) What are the techniques adopted for poverty eradication.
- 19) Theoretical rationale for and application of CBA
- 20) Explain the role of education for sustainable development.
- 21) Describe in detail about Resource Pricing techniques.
- 22) Write an essay on Green economy for sustainable future.

Third Semester

COURSE: ES 3 PG 9

ENVIRONMENTAL ENGINEERING

Time:3Hrs
Weightage:30

I. Write notes on Any Five
(Wt:1 each)

- 1)Photo chemical Smog.
- 2)RBCs.
- 3)Grey water
- 4)MLSS.
- 5)What are heat islands
- 6)Define bulking.
- 7)What is water softing
- 8)What is the basic difference between absorption and adsorption.

II. Write Short Essay on Any Five
(Wt:2 each)

- 9)Mass balance approach to problem solving.

10)UASBs

11)Sanitary land fills.

12)HAZOP

13)Bhopal tragedy

14)Disinfection of drinking water.

15)Ion exchange process in water softening.

16)Water sampling techniques.

III. Answer Any Three in Detail

(Wt:5 each)

17)Explain how risk assessment and disaster management for industries are carried out.

18)Write an essay on Air Pollution control. Add a note on automobile emission control

19)Give a detailed account of the solid waste management techniques.

20)Write an essay on anaerobic waste water treatment systems.

21) Write an essay on Hazardous waste management.

22) Give an account of Noise attenuation and control measures.

ES 3 PG 10

ENVIRONMENTAL PLANNING AND MANAGEMENT

Time:3Hrs
Weightage:30

I. Write notes on Any Five
(Wt:1 each)

- 1)SEA
- 2)ISO 14001
- 3)IEA
- 4)Scoping
- 5)Smith Study
- 6)Overlay method
- 7)Adhoc method
- 8)Magnitude of Impact

II. Write Short Essay on Any Five
(Wt:2 each)

- 9)EIA processes
- 10)Comment on Check list method.
- 11)Describe socio-economic aspects of EIA.

- 12) Write notes on EIA for urban development.
- 13) Scope and relevance of EIA.
- 14) Comment on scope and concept of environmental planning.
- 15) Write notes on EPM for thermal power plants.
- 16) Environmental Impacts of Mining.

III. Answer Any Three in Detail (Wt:5 each)

- 17) Explain various methods of EIA.
- 18) Explain the objectives of environmental audit.
- 19) Role of EIA in environment sustainable management.
- 20) Describe CBA.
- 21) Explain the merits of strategic environment assessment.
- 22) Write an essay on EIA for nuclear power plants. Illustrate with a case study.

ES 3 PG 11

RESOURCE MANAGEMENT

Time:3Hrs
Weightage:30

I. Write notes on Any Five
(Wt:1 each)

- 1) Ramsar Convention
- 2) Tangible Resource
- 3) NTFP
- 4) Wild Life Act
- 5) JFM
- 6) Agroforestry
- 7) Rain Water Harvesting
- 8) Drainage Basin

II. Write Short Essay on Any Five
(Wt:2 each)

- 9) Water shed Management
- 10) Significance of Wetlands
- 11) Impacts of mining
- 12) Differentiate Natural farming and Organic farming
- 13) CRZ Act

14)Seari Farming.

15)Factors causing depletion of forest.

16)Ecotourism

III. Answer Any Three in Detail
(Wt:5 each)

17)Briefly explain the management strategies for Rangeland.

18)Comment on water conservation strategies.

19)Explain sustainable management strategies for biological resources with particular reference to

Kerala

20) Briefly explain Conservation of medicinal plants.

21)Describe the application of Remote sensing in marine resource management.

22)Describe in detail ecodevelopment.

COURSE CODE- ES3 PG 12
ENERGY RESOURCE MANAGEMENT

Time:3Hrs
Weightage:30

I. Write notes on Any Five
(Wt:1 each)

- 1) Betz Limit.
- 2) Dendrothermal Energy.
- 3) Carbon Tax.
- 4) OTEC.
- 5) Wind rose
- 6) Walk-through audit
- 7) Fuel Cell.
- 8) Energy efficiency.

II. Write Short Essay on Any Five
(Wt:2 each)

- 9) Classification of wind turbines.
- 10) Explain the laws of thermodynamics.
- 11) Explain Geothermal energy.
- 12) Photovoltaic conversion of solar energy.
- 13) Comment on Biogas technology.
- 14) Possibilities and limitations of tidal energy.

15)Comment on Energy farming.

16)Comment on Energy security in terms of Nuclear safety.

III. Answer Any Three in Detail

(Wt:5 each)

17)Explain the energy efficient techniques.

18)Comment on Kudamkulam Nuclear Power Plant .

19)Describe in detail the energy pricing techniques.

20) Describe in detail the environmental impacts of non-renewable energy resources.

21)Significance of energy audit in homes and industries.

22)Comment on tidal power potential in India and explain the various tidal power harvesting methods.

COURSE CODE ES 3 PGE 5

DISASTER MANAGEMENT

Time:3Hrs
Weightage:30

I. Write notes on Any Five
(Wt:1 each)

- 1) Seismic waves
- 2) Hazzard
- 3) Epicenter
- 4) Tornadoes
- 5) Cloud bursting
- 6) DRRC(Disaster Risk Reduction)
- 7) Disaster Preparedness
- 8) Disaster Mitigation

II. Write Short Essay on Any Five
(Wt:2 each)

- 9) What is meant by Energy Operation Plan? (EOP)
- 10) Distinguish between Disaster and Emergency ?

- 11) What are the advantages and disadvantages of community based approach in disaster management?
- 12) Role of NGOS in Disaster education and mitigation process?
- 13) Explain disaster management cycles?
- 14) Natural hazards & anthropogenic hazards?
- 15) Physical and socio economic impacts of disasters?
- 16) What are hazard identification & vulnerability analysis?

III. Answer Any Three in Detail (Wt:5 each)

- 17) Describe in detail the application of GIS and Remots Sensing in Disaster Management.
- 18) Role of media in Disaster Management.
- 19) Active Silent volcanoes in India.
- 20) Impacts of disasters on development programme.
- 21) Environmental Planning and Management for environmental Hazards.
- 22) Write an essay on role stakeholders in disaster education and public awareness.