GONDWANA UNIVERSITY, GADCHIROLI

Faculty of Science

Semester Pattern Syllabus
M. Sc. II year
Semester III and IV
Environmental Science

<table>
<thead>
<tr>
<th>Year</th>
<th>Semester</th>
<th>Paper no.</th>
<th>Paper Title</th>
<th>Marks</th>
<th>Total marks</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>I</td>
<td>Water Treatment and Supply</td>
<td>80 20 100</td>
<td></td>
</tr>
<tr>
<td>M.Sc. II</td>
<td>III</td>
<td>II</td>
<td>Wastewater Treatment</td>
<td>80 20 100</td>
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<tr>
<td>Year</td>
<td></td>
<td>III</td>
<td>Air Pollution Control</td>
<td>80 20 100</td>
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<td></td>
<td></td>
<td>IV</td>
<td>Solid and Hazardous Waste Management</td>
<td>80 20 100</td>
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<td></td>
<td></td>
<td>Practical I Water Treatment and Supply</td>
<td>80 20 100</td>
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<tr>
<td></td>
<td></td>
<td>Practical II Wastewater and Air Pollution</td>
<td>80 20 100</td>
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<td></td>
<td>IV</td>
<td>V</td>
<td>EIA and Environmental Laws</td>
<td>80 20 100</td>
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<tr>
<td></td>
<td></td>
<td>VI</td>
<td>Pollution Control and Industrial Safety</td>
<td>80 20 100</td>
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<td></td>
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<td>VII</td>
<td>Environmental and Energy Management</td>
<td>80 20 100</td>
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<td></td>
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<td>VIII</td>
<td>Sustainable Environment</td>
<td>80 20 100</td>
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<td></td>
<td></td>
<td>Practical I Environmental Management and Sustainable Environment</td>
<td>80 20 100</td>
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<tr>
<td></td>
<td></td>
<td>Project</td>
<td>Project (Dissertation)</td>
<td>80 20 100</td>
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Note: The syllabus is based on 4 theory periods per week per paper of one hour duration and 8 practical periods per week per batch.
**General Instructions:**

- The examination shall comprise of four papers in this semester and one practical and a dissertation (project work).
- Practical examination will be of twelve hours duration and will be extended over two days.
- Each theory paper will be of three hours duration and shall carry 80 marks.
- The examinee shall be required to pass in theory and practical’s, separately.

<table>
<thead>
<tr>
<th>Distribution of Practical Marks (Semester IV, practical I)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 One major experiment</td>
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<tr>
<td>2 Two minor experiments</td>
</tr>
<tr>
<td>3 Certified practical record book</td>
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<tr>
<td>4 Certified tour report/field diary</td>
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<tr>
<td>5 Viva-voce</td>
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</tbody>
</table>

**Total** 80 marks
Scheme of Teaching and examination under credit grade semester pattern for M.Sc. II year (Semester III and IV) Environmental Science

<table>
<thead>
<tr>
<th>Semester</th>
<th>Theory Paper/Practical</th>
<th>Teaching Scheme (Hrs/week)</th>
<th>Examination Scheme</th>
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<td>III</td>
<td>I</td>
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<td>III</td>
<td>IV</td>
<td>4</td>
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</tr>
<tr>
<td>III</td>
<td>Practical I</td>
<td>--</td>
<td>8</td>
</tr>
<tr>
<td>III</td>
<td>Practical II</td>
<td>--</td>
<td>8</td>
</tr>
<tr>
<td>III</td>
<td>Seminar</td>
<td>2</td>
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<tr>
<td>Total</td>
<td></td>
<td>18</td>
<td>16</td>
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<tr>
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<td>IV</td>
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<td>VII</td>
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<td>IV</td>
<td>VIII</td>
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<td>IV</td>
<td>Practical I</td>
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<tr>
<td>IV</td>
<td>Project</td>
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<td>IV</td>
<td>Seminar</td>
<td>2</td>
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<tr>
<td>Total</td>
<td></td>
<td>18</td>
<td>8</td>
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Semester IV
Paper V
EIA and Environmental Laws

Unit I: Fundamentals of Environmental Impact Assessment

1. **Basic concept of EIA**: Introduction, salient features of EIA, EIA procedure (Initial Environmental examination IEE, Analytical Functions of EIA, (Scope of EIA, Identification of Impact, prediction, Impact evaluation & analysis).

2. **EIA as planning tool**: Role of EIA in the planning and decision making process. Public participation in EIA, definition and concepts, objectives, techniques, advantages and limitations. Strategies for environmental management plan and green belt development. Role of mathematical models in EIA. Role of statutory agencies in EIA clearance.

3. **EIA for industry**: EIA process to project, planning and implementation, guideline for preparation of Environmental Base Map (EBM). Identification of study area, classification of environmental parameters, formation of EIA study team, Preparation of EIA Report- Essential steps to complete an environmental impact assessment, EIA format by CPCB, Environmental monitoring and management plan, final content of Environmental Impact Statement.

Unit II: EIA Methodologies

1. **Methodology**: General criteria for the selection of EIA methodology (impact identification, impact measurement, impact interpretation and evaluation, impact communication)


Unit III: Constitution and Environment

1. **Constitutional law**: Environmental concerns in constitution such as State, fundamental rights, directive principles, fundamental duties, judicial activism, VII schedule, provisions relating to environment in these.


Unit IV: Environmental Laws

1. **Environmental protection**: Issues and problems, key interactional efforts for environmental protection, Indian movement for environmental protection-Bishnoi tradition, Chipko movement, Silent valley movement, Sardar Sarovar Project.

2. **Basic environmental laws**:
   - 1986- The Environmental (Protection) Act.
   - 2000- The Ozone Depleting Substances (Regulation and Control)

3. **Specific environmental laws**:
   - 1991- The Coastal Regulation Zone Modification.
   - 2002- The Biological Diversity Act.

**Books for Reference:**
Semester IV
Paper VI
Pollution Control and Industrial Safety

Unit I: Industrialization

1. **Basis for industrialization**: Industrial development in India, The role and pattern of industrialization, large and small scale industries, their nature, importance and problems, factors of industrialization.

2. **Industrial economics**: Scope of industrial economics, industrialization and economic development, Industrial sickness: problems and remedial measures.

3. **Industrial policy**: New industrial policy and its appraisal, the legal framework of industrial regulation in India. Categories of industries-red, orange and green.

Unit II: Pollution Control in Industries

1. **General treatment**: Common effluent treatment plant (CETP), principles, on site pretreatment of wastewaters, step wise treatment in CETP.

2. **Pollution control for specific pollutants**: Removal of BOD; biological oxidation units, removal of chromium and mercury, reduction, precipitation, ion exchange, reverse osmosis, lime coagulation and adsorption, removal of mercury from gaseous streams and liquid streams.


Unit III: Operation and Maintenance of Treatment Units

1. **Preliminary treatment units**: Pumps, screen’s, grit chamber, oil and grease trap, equalization tank.


3. **Secondary and tertiary treatment units**: Activated sludge, trickling filter, oxidation ponds, sludge drying bed, ion exchange and reverse osmosis.

Unit IV: Industrial Safety and Security

1. **Industrial accidents**: Nature and causes of accidents, types of accidents, classification of accidents, cost of accidents.

2. **Industrial hazards**: Industrial fatigue nature, types and measurement, heat stress in industry, noise, vibrations, occupational stress and health.

Books for Reference:

1. Environmental Pollution Control Engineering, C. S. Rao, New Age International Publisher, New Delhi, 2009
3. Industrial Safety and Environment, Anupama Prashar, S. K. Katariya and Son’s, Delhi, 2012
Semester IV
Paper VII
Environmental and Energy Management

Unit I: Industry and Environment

1. **Industry and environment**: Need of industries, industrial pollution and development, industrial clusters and pollution. Prominent industries in India and pollution. Types of industrial waste and their impact on air, water, soil with reference to pulp and paper, cement and coal mining.

2. **Industrial pollution control**: Pollution abatement measures, rating of industries. Pollution control strategies-economic incentives, ambient and effluent standards, pollution charges, regulations for controlling environmental pollution.

3. **Greening of industry**: Need of greening industry. Integration of government, market and community. Options for greening industry: cleaner technologies, pollution prevention, end of pipe technology.

Unit II: Corporate Environmental Management


2. **EMS structure**: Environmental policies, environmental auditing, measuring environmental performance, environmental reporting.


Unit III: Energy and Environment


2. **Energy and environment**: Environmental issues, Environmental pollution and energy, Environmental management and energy. Rational use of energy-Meeting future energy needs Government policy for energy efficiency, energy conservation.

3. **Energy pattern**: Sources of primary energy, projections of future energy use pattern, environmental effects of energy use- coal, petroleum, biomass, hydro power, socio economic implications of energy use pattern.
Unit IV: Energy Technology and Management

1. **Renewable technology**: Electricity-conventional fuels, hydro electricity, solar energy, wind electricity, fuel cell, geothermal energy, OTEC, MHD, comparing the different technologies.

2. **Advanced technology**: Biomass, briquetting, combined heat and power, anaerobic digestion, fuel switching, cleaner production, biochar, energy from solid waste, hydrogen- future energy source.

3. **Management**: Energy management in practice, implementing on energy management system, energy auditing, energy economics.

**Books for Reference:**

11. Efficient Use of Energy, I. G. C. Dryden (Butterworth Scientific)
18. Pollution Control Strategies: World Bank Report
Semester IV
Paper VIII
Sustainable Environment

Unit I: Emission Trading

1. **Introduction**: Conventions associated with Kyoto Protocol, prologue to greenhouse gas emissions, UN appointed panel on climate change, emission trading schemes, carbon credit mechanisms, valuation method of emission reduction units, profiles of companies which have benefitted from climate propriety, annexure of the countries

2. **Emission trading**: History and design of the Kyoto Protocol, greenhouse gas trading system; joint implementation (JI); clean development mechanism (CDM); reductions of emissions from deforestation and degradation (REDD).

3. **Emission trading scenario**: Systems for Kyoto Protocol implementation in different countries; the European Union, Indian emissions trading system; results to date.

Unit II: Environmental Accounting

1. **Introduction**: Definition, National account, basic concept, objectives, scope, forms of EA, environmental management account (EMA), environmental financial account, environmental national account, balance sheet w.r.t. profit and loss under environmental accounting

2. **Environmental accounting**: Preparation of integrated environmental and economic accounts (Satellite accounts); Produced asset, non produced economic assets, other non produced environmental assets, system of integrated environmental and economic accounts.

3. **Valuation of natural assets**: Methods of valuation- market value approach, present value approach, net price approach, maintenance cost approach, compensation cost approach, general valuation techniques, application of methods, merits and demerits of environmental accounting.

Unit III: Environmental Philosophy

1. **Environmental ethics**: Introduction, concept, basic facts and Environmental Ethics, values, science and Environmental Ethics, ethical theories applied to the environment, historical causes of environmental decline.


3. **Environmental attitudes**: Categorization of environmental attitudes in development ethics, preservation ethics, conservation ethics, societal environmental ethics, corporate environmental ethics, individual environmental ethics, global environmental ethics, challenges of World Environmental Ethics.

Unit IV: Sustainable Development
1. **Basics of sustainable development:** Definition. Concepts, principles, issues in sustainable development, strategic planning for sustainable development, economic reforms and sustainable development.

2. **Environmental sustainability:** Types of environmental sustainability (Institutional, economical, financial and ecological sustainable agriculture, sustainability of forests and forestry, sustainable earth economy, water resources,

3. **Society and environment:** Involving people, peoples biodiversity register (PBR), process of PBR, biological diversity act, Case study: Mendha-Lekha, village, Gadchiroli district (MS). City planning, garden cities and new towns urban redesign, designing for open space. Intellectual property rights, patenting procedure in India and abroad.

**Books for Reference:**

2. Environmental Accounting, N. Das Gupta, S. Chand and Company Ltd. New Delhi, 2005
3. Peoples Biodiversity Register, Center for Ecology Sciences, Bangalore, 2003
Practical
Semester IV
Practical I
Environmental Management and Sustainable Environment

EIA
1. Demonstration on environmental impact study of development project including management plan.
2. Demonstration and study on EIA methodologies i.e. BEES, Checklist, Adhoc, Matrices, Network.
3. Demonstration on judgment of Supreme Court on environmental issues.
4. Demonstration on environmental audit of an industry.

Solid Waste
1. Determination of moisture content of fly ash.
2. Estimation of calorific value of solid waste.
3. Calculation of volatile matter of solid waste.
4. Prepare bricks of solid waste.
5. Study the solid waste collection and disposal practices in city.
6. Study of solid waste management practices in the area.
7. Estimation of %organic matter, organic carbon, NPK in composted solid waste.
8. Study the design criteria of sanitary landfill.
9. Collect data on sale of plastic bag below permissible size.
10. Study and demonstration on type of biomedical waste generation and its disposal in city.
11. Determination of pesticides and inorganic contamination from wastewater of chemical industry.
12. Identification and categorisation of industries in your area as red, orange and green.

Environmental Management
1. Demonstration on environmental and energy audit of a industry.
3. Demonstration on Total Quality Management in Industry.

Industrial Safety
1. Graphically highlight industrial clusters in the map of India and study their impacts on environment, economy and society.
2. Socio-economic survey on workers w.r.t. stress, fatigue, vibration in an industry.
3. Collection of data about safety measures, first aid practices in industry.
4. Demonstration on use of fire fighting equipments in an industry.
5. Demonstration on use of safety measures equipments in an industry.
7. Pilot plant study on BOD and COD removal from sewage, industry waste by aeration.
8. Visit to sewage treatment plant for study of working units and maintenance.

Sustainable Environment
1. Demonstration on environmental accounting of profit loss balance sheet.
2. Demonstration on environmental ethics.
3. Case study for PBR of Mendha Lekha village.
4. Study and demonstration on schematic layout of open space, garden in city, design aspect of new garden.
Environmental Engineering

1. Calculation and design of sedimentation tank, clariflocculator, aeration tank, ASP, TF, Disinfection Process, Sanitary Landfills, ESP, and Cyclone.

2. Treatability studies using the activated carbon for the removal of metals, uses of local adsorbent viz. rice husk, brick, and fly ash and evaluation of the absorption capacity using Langmuir or Freundlich adsorption isotherm.
Project Work Instructions for Students

(Total marks: 100. Project work: 80 marks, internal: 20 marks)

Candidates will write a dissertation on issues related to Environmental Science under the guidance of their respective guides. Each student will work independently on the topic. The dissertation must consist of review of literature and produce a deep insight of the subject on the basis of personal research.

Dissertation work will be initiated at the start of M.Sc. II year (IIIrd semester). The students will undertake field work in terms of collection of data and surveys. The dissertation will have to be submitted for appraisal and acceptance by the University to the concerned college. The students should submit their dissertation in the following format.

Chapter I: Introduction with Aims and Objectives: A background with historical information and a review of existing material or data on the subject along with the aims and objectives of the study.

Chapter II: Methodology with Material and Methods: Description of the issue, methodology adopted for the study.

Chapter III: Experimental: Presentation of data collected and detailed analysis of results.

Chapter IV: Result and Discussion: Discussion on the data and results obtained and presentation of method suggested to solve the problem.

Chapter V: Summary and Conclusions: A summary of the dissertation and important conclusions drawn at the end of the investigation.

Bibliography or References: A list of references of cited in the text.

The dissertation should be typed on A4 size bond paper with 1.5 line spacing. Illustrations and photographs should be of high quality. The report should be flawless without any spelling mistakes or grammatical errors. Students will have to submit their dissertation one month before the final practical examination at the end of M.Sc. II year (IVth semester).

The dissertation will carry 100 marks. Assessment of the dissertation will be done at the end of the year. Students have to present a Power Point Presentation. Assessment of the dissertation shall be done by the external examiner appointed by the Gondwana University, Gadchiroli.

A) Industrial training

Students are encouraged to undergo summer/winter in plant training in a suitable industry so as to get firsthand experience of corporate environmental management.

B) Study visits

i) National Environmental Engineering Research Institute (NEERI), Nagpur
ii) Remote Sensing Center, Nagpur
iii) Regional Meteorological Center, Nagpur
iv) Maharashtra Pollution Control Board, Nagpur
v) Industrial visits
C) **Seminar**
   Student may select any environmental related topic of their choice (in consultation with the faculty) and make a power point presentation for 30 minutes. They shall be able to answer questions invited from the audience.

D) **Field diary**
   The student shall prepare their field diary under the following heads
   
i) Issue on local/regional/national problem of environmental interest (Case Studies).
   ii) About famous personalities in environmental movements.
   iii) New Acts and Judgments of environmental interests.

E) **Guest lecture series**
   In each year guest lectures will be given by the faculty and other invited speakers on current topics and environmental issues. The course would run as a guest lecture series (at least five guest lecturers in chosen topics) with compulsory attendance.
Gondwana University, Gadchiroli
Model Question Paper (Theory)

M. Sc. Environmental Science

Time: Three Hours                Maximum Marks:  80

Q. 1: Long Question from unit I                      16 marks
  OR
    a) Short Question from unit I              08
    b) Short Question from unit I              08

Q. 2: Long Question from unit II                        16
  OR
    a) Short Question from unit II             08
    b) Short Question from unit II             08

Q. 3: Long Question from unit III                          16
  OR
    a) Short Question from unit III             08
    b) Short Question from unit III             08

Q. 4: Long Question from unit IV                           16
  OR
    a) Short Question from unit IV              08
    b) Short Question from unit IV              08

Q. 5: Short Answer questions                                                    4x4 = 16
  1) From unit I
  2) From unit II
  3) From unit III
  4) From unit IV

The End