

**B.Sc. II year Environmental Science  
Semester IV**

**Gondwana University, Gadchiroli  
Semester Pattern Syllabus for  
B. Sc. II year, Semester III and IV  
Environmental Science**

## General Instructions

- The examination of Semester III shall comprise of two theory papers of 3 hours duration of 50 marks each. Ten marks will be allotted for internal assessment for each theory paper.
- The examination of Semester IV shall comprise of two theory papers of 3 hours duration of 50 marks each. Ten marks will be allotted for internal assessment for each theory paper.
- Practical examination will be of 5 hours duration and separately for each semester having 30 marks each.
- Students should pass separately in Theory and Practical Examination.
- The syllabus is based on 6 theory periods and 6 practical periods per week.

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<b>Distribution of Practical Marks (Semester III and IV)</b>	
1 Two experiments	20 marks (10 marks each)
2 Certified practical record book	04 marks
3 Certified tour report/field diary	03 marks
4 Viva-voce	03 marks
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<b>Total 30 marks</b>	
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# GONDWANA UNIVERSITY, GADCHIROLI

## Faculty of Science

### B. Sc. II year Semester III and IV Environmental Science

Year	Semester	Paper	Paper title	Marks		Total Marks	Total Marks
				Theory	Internal		
<b>B.Sc. II Year</b>	<b>III</b>	I	Pollution Science	50	10	60	150
		II	Natural Resources and GIS	50	10	60	
		Practical	Practical	30	-	30	
	<b>IV</b>	I	Pollution Control Technologies	50	10	60	150
		II	Forest & Wildlife	50	10	60	
		Practical	Practical	30	-	30	

Note: The Syllabus is based on 6 theory periods per week and 6 practical periods per week per batch.

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**Semester IV**  
**Paper I**  
**Pollution Control Technologies**

**Unit I: Air Pollution Control**

- 1. Industries and Zoning Criteria:** Classification of industries and their areas. Zoning criteria, present zoning practices in India. Pollution prevention: cleaner technologies—change in raw material, process change.
- 2. Control Devices for Particulates:** Atmospheric cleansing process, approaches to contaminated control. Dry collection devices: gravitational settling chambers, centrifugal collectors, fabric filters (bag house filters), electrostatic precipitators (ESP); wet collectors: cyclonic scrubbers, spray chambers, venture scrubbers, packed towers, construction and working.
- 3. Control Devices for Gases:** Adsorption, absorption, condensation, combustion. Flue gas desulfurization (FGD) and NO<sub>x</sub> removal. Euro norms and Bharat norms. Role of IPCC in Climate Change. Antidote to MIC.

**Unit II: Water Pollution Control**

- 1. Basics of Water Pollution Control:** Prevention of water pollution. Impurities in water: suspended and dissolved. Principle and process of sedimentation, coagulation, filtration and disinfection.
- 2. Thermal Pollution Control:** Definition. Cleaner technologies for coal fired thermal power plants: pre-combustion, combustion and post combustion techniques. Cooling ponds, spray ponds and cooling towers. Utilization of fly ash.  
**Oil Pollution Control:** Nutrient enrichment, seeding with naturally occurring microorganisms, and seeding with genetically engineered microorganisms. Ballast water management.
- 3. Water Pollution Remedial Technologies:** Groundwater: conventional pump-and-treat system, soil vapour extraction, *in-situ* bioremediation, permeable reactive barriers. Surface water: restoration of lake, sustainable conservation of water resources (lakes).

**Unit III: Noise and Radiation Pollution Control**

- 1. Noise Pollution Control:** Noise control at source; receiver end and along the sound path. Noise barriers, mufflers or silencers, vibration isolation, damping, lagging, protection of the personal- ear plugs, ear muffs, helmets; acoustic absorptive material. Methods of reducing highway noise.
- 2. Radiation Pollution Control:** Preventive measures from radiation. Control of occupation radiation. Minimizing X-ray hazards. Disposal methods: dilution and dispersal, delay and decay, concentrate and contain method, other recent methods for disposal of critically dangerous radioactive wastes.
- 3. Control of Occupational Health Hazards:** Occupational health plan, objectives. Types of personal protective equipments, personal safety from illumination, ventilation, vibration, humidity, overhead equipments handling, control of fire, analysis of accidents, remedies, safety education, first aid: principles, methods and training.

## **Unit IV: Soil and Pesticide Pollution Control**

**1. Soil Pollution Control:** *In-situ* soil remediation: flushing, soil vapour extraction, sparging. Ecofarming and ecotechnology, integrated nutrient management, integrated pest management.

**2. Pesticide Pollution Control:** Chemical and biological methods to degrade pesticides. Biopesticide: classification of biological pest control agent, manufacturing process, stabilization of biopesticides formulation, mode of action, selectivity of bacteria. Plant products: Insecticide, neem pesticides, unique multifactor action of neembitters, effects on viruses and organisms.

**3. Pesticide Pollution Control Technologies:** Conventional method: incineration and thermal desorption, soil flushing and washing, phytoremediation and bioremediation, land farming. Reclamation of degraded lands.

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**Semester IV**  
**Paper II**  
**Forest & Wildlife**

**Unit I: Forest**

- 1. Forest Science:** Definition. Concepts. Need and scope of the subject. Forest as an ecosystem. Productivity, Nutrient cycling.
- 2. Forest Measurement:** Diameter, girth, height and volume of trees, annual increment, sampling methods and sample plot. Forest cover monitoring through remote sensing and geographical information systems. Surveying and forest engineering.
- 3. Forest Destruction:** Forest fires: causes (natural and anthropogenic), classification of forest fires, types of forest fires. Deforestation: causes and factors. Distinction between deforestation and degradation. Timber extraction. Dams and their effects on forest.

**Unit II: Forest Conservation**

- 1. Silviculture:** General silvicultural principles. Ecological and physiological factors influencing vegetation, nursery system, silviculture practices in specialized ecosystem like terrestrial and mangroves. Silviculture of trees: traditional and advanced methods.
- 2. Tree Improvement:** General concept, methods, and techniques. Stand structure and dynamics. Sustained yield, rotation of growing through management, forest working plan. Integrated approach management and forest mensuration.
- 3. Forest Conservation:** Social forestry, agro-forestry, *Van mohotsav*, Forest (Conservation) Act, 1980. Forest as a carbon sink. Carbon sequestration. National Forest Policy (NFP) of India. Afforestation. Tissue culture technique for forest conservation.

**Unit III: Wildlife**

- 1. Wildlife:** Concept. Definition. Diversity of wildlife. Importance of wildlife. Examples of protected wildlife species. Wildlife in India. Endangered flora and fauna in India. Categories of threatened species: rare, endangered, vulnerable, extinct, species in wildlife of India.
- 2. Wildlife Destruction:** Threats to wildlife: habitat destruction, developmental projects, urbanization, industrial pollution and wildlife, agricultural expansion, excessive harvesting and poaching, man-animal conflict.
- 3. Wildlife Conservation:** National parks, wildlife sanctuaries, biosphere reserve. Project tiger. Project Elephant. Habitat preservation, breeding in captivity. *Ex-situ* and *in-situ* conservation. Wildlife Protection Act 1972.

**Unit IV: NGO and People's Action**

- 1. NGO and Society:** Society Act 1860. People's participation in global, national and grassroots level. Working with local communities. Community diversity. Belief and value system. Relation with resource use and management.

**2. NGO and Environment:** International NGO's: Greenpeace, WWF, IUCN, UNESCO, Man and Biosphere Programme. National NGO's: Centre for Science and Environment, Bombay Natural History Society, *Tarun Bharat Sangh*, *Kerala Sastra Sahitya Parishad*.

**3. People and Forest:** Joint Forest Management (JFM): scope of livelihood generation under JFM. Non Timber Forest Produce (NTFP): types, classification, importance of sustainable resource management. Eco villages. Self sufficient villages.

### **Books for Reference:**

1. Ecology and Environment- P. D. Sharma, Rastogi Publication, 2001.
2. Environmental Biology and Toxicology- P. D. Sharma, Rastogi Publication, 2004.
3. Animal Ecology and Environmental Biology- H.R. Singh, Vishal Publication.
4. Animal Physiology and Ecology- P.S. Varma, V.K. Agrawal, B.S. Tyagi, S. Chand, 2002.
5. Environmental Biology- P.S. Varma and V.K. Agrawal, S. Chand, 2001.
6. Ecology- E.P. Odum, Oxford and IBH Publishing.
7. Environmental Ecology- P.R. Yadav, Shubhrata R. Mishra, Discovery Publishing House, 2004.
8. Fundamentals of Environmental Biology- S. Arora, Kalyani Publishers, 1985
9. Plant Ecology and Soil Science- R.S. Shukla and P.S. Chandel, S. Chand Publication, 2001.
10. Environmental Management- Dr. Anand S. Bal, Himalaya Publication, 2009.
11. Maintaining Biodiversity in Forest Ecosystem- Malcolm L. Hunter Jr., Cambridge University Press, 1999
12. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology- P.S. Verma, V.K. Agarwal. S. Chand Publication, 2005.
13. Non Conventional Energy Sources- G. D. Rai, Khanna Publishers, Delhi
14. Environmental Science- W. Cunningham and Saigo, McGraw Hill, New York.
15. A Textbook of Environment- Agrawal, Mcmillan publication, Mumbai
16. Environmental Chemistry- S. S. Dara, S. Chand and Company, New Delhi 2002.
17. Environmental Engineering- Gerard Kiely, The McGraw-Hill Company
18. Environmental Science and Engineering- J Glynn Henry and G W Heinke, PHI Learning Private Limited
19. Environmental Chemistry- B.K. Sharma, Goel Publication, Meerut.
20. Air Pollution- M.N. Rao, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003
21. Air Pollution- A .C. Stern, Academic Press Inc.
22. Environmental Problems and solution- Asthana, S. Chand and Co., New Delhi.
23. Environmental Science- S. C. Santra, New Central Book Agency Pvt. Ltd., 2006.
24. Fundamental Concepts of Environmental Chemistry- G. S. Sodhi, Narosa Publishing House, New Delhi, 2002
25. A Textbook of Environmental Science- R.N. Trivedi, Anmol Publications Private Limited, 1997
26. Man and Environment- P. R. Trivedi, Gurdeep Raj, Akshadeep Publishing House, New Delhi, 1997.
27. Fundamental Concepts in Environmental Studies - Dr. D. D. Mishra, S. Chand Publication, 2009.
28. Environmental Chemistry- A. K. De, New Age International Publishers, 2001.
29. Industrial Safety and Environment- Anupama Prasar. S. K. Kataria & Sons, Delhi
30. Environmental Chemistry- P. S. Sandhu, New Age International Publishers, Mumbai



## Semester IV Practical

### Section A: Water and Energy

1. Study of lake water for pH, temperature, phosphate, nitrate, sulphate for status of a lake
2. Study of irrigation water for its suitability for crops
  - a. Analysis of  $\text{Na}^+$  content in irrigation water
  - b. Analysis of chloride in irrigation water
  - c. Analysis of hardness in irrigation water
  - d. Analysis of alkalinity in irrigation water
3. Study of agricultural and wasteland for fertility and productivity
  - a. Analysis of soil sample (agriculture and wasteland) for organic carbon and organic matter
  - b. Analysis of soil sample for NPK
  - c. Analysis of soil sample for micronutrients (Fe, Zn, Mn)
4. Study of purity of unleaded petrol of selected petrol pump
5. Demonstration on non conventional energy resource system (solar cooker, solar water heater)
6. Study of biogas plant/anaerobic reactor for efficiency
  - a. Analysis of biogas slurry for pH
  - b. Analysis of biogas slurry for acidity
  - c. Analysis of biogas slurry for alkalinity
  - d. Analysis of biogas slurry for solids (total solids, total suspended solids, volatile solids)
  - e. Analysis of biogas slurry for volatile acids
  - f. Analysis of biogas slurry for methane by Orsat apparatus
7. Determination of impurities in raw water and treated water w.r.t. suspended solids and dissolved solids.
8. Determination of coagulant dose by Jar test apparatus w.r.t. suspended solids or turbidity removal.
9. Determination of suspended solids before and after filtration unit in water treatment unit.
10. Determination of free chlorine in municipal treated water sample.
11. Proximate analysis of coal for moisture content, volatile matter and carbon content.
12. Collection and determination of groundwater (bore well) having depth of 50 m, 100 m and 200 m for fluoride, iron, nitrate, hardness and chloride.
13. Determination of optimum dose of lime and alum for removal of fluoride in water.
14. Studies of lake restoration : Collection and analysis of lake water (inlet and outlet) for removal of nutrients (sulphate, phosphate, nitrate)
15. Analysis of lake water sample before and after exposure to heavy metal contaminated sample
  - i) iron and manganese, ii) nutrients (nitrogen, sulphate and phosphate)
16. Collection and analysis of forest floor soil, its comparison with agriculture and wasteland soil w.r.t. pH, calcium, magnesium hardness, alkalinity, conductivity, bulk density, NPK, iron, zinc and manganese.
17. Separation of metal ion copper by solvent extraction method (Cu-DDC)
18. Separation of metal ion nickel by solvent extraction method (Ni-DMG)

## **Section B: Natural Resources**

1. Analysis of alpha, beta and gamma diversity of an ecosystem
2. Demonstration on survey methods including participatory learning methods
3. Demonstration on human aspects of conservation
4. Visit to a wetland areas
5. Documentation of treats to a wetland
6. Analysis of vermicompost for physiochemical analysis (pH, EC, nitrogen, percent carbon, phosphorous)
7. Determination of NPK of contaminated soil
8. Demonstration of land use patterns of the region
9. Study of medicinal plants of local area
10. Demonstration of soil testing of agricultural land before and after cropping
11. Demonstration on commonly found in wildlife of National Park in the region
12. Measurement of solar constant

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