



# University of Rajasthan Jaipur

## SYLLABUS

### M.Sc. Environmental Science

(Annual Scheme)

M.Sc. (Previous) Examination 2024

M.Sc. (Final) Examination 2025

*P. Jais*  
By Registrar  
(Academic)  
University of Rajasthan  
Jaipur

**ENVIRONMENTAL SCIENCE (Annual Scheme)**

***M.Sc. Previous***

*Note: Each paper will have 9 questions out of which a student has to attempt 5 questions including the question no. 1, which will be compulsory, and one question selecting from each unit. The question no. 1 will carry 20 marks and will be of short objective type of questions, such as multiples choice types questions (10 questions of 1/2 marks each), one line answer type ( 5 questions of 1 mark each) fill in the blanks type( five question of 1 mark each), one word type ( 5 questions of 1 mark each ).*

**Paper I: Fundamentals of Ecology and Environmental Science**

Duration 3 hrs.

Max. Marks:100

Min. Pass Marks:36

Unit-1 : History and scope of ecology and environmental science, Human ecology and human settlements, evolution, origin of life and speciation, population ecology, interactions and ecological model, definition and components of environment, conceptual development of ecological terminology, ecological landmark, relationship of ecology with other branches of science, interrelatedness, importance of environmental science for human beings.

Unit -2: Ecosystem concept: Biotic and abiotic components of ecosystem, ecotones and biomes, ecological pyramids of number, biomass and energy. Food Chain, food web and trophic levels, ecological amplitude and ecological niches.

Unit -3: Ecological energetic: first and second laws of thermodynamics and flow of energy in ecosystem. Biogeochemical cycling: Carbon, Nitrogen, Phosphorus and Sulphur and hydrological cycles and microbial ecology.

Unit -4: Primary and secondary productivity of different ecosystems in the world, methods of measurements of productivity and the factors affecting productivity, Ecosystem services.

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## **Paper II: Ecosystem- Structure, Functions and Diversity**

Duration 3 hrs.

Max. Marks:100

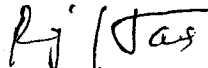
Min. Pass Marks:36

Unit-1: The ecological principles and factors determining survival of life on earth, The global ecosystem and the place of man in it; human food chain and the energy requirements for the maintenance of human ecosystems on earth. The concept of global "ecological balance" and the threats of its imbalances due to rising human population, mathematical modeling of ecosystem.

Unit -2 : Forest ecosystem- Forest as an ecosystem, distribution of forests, types of forests, economics and ecology of forest, role of forests in protection of species regulation of climate and production of various produce. Depletion of biodiversity from forest and the world forest conservation policies.

Unit-3: Grassland ecosystem - Distribution and types of grasslands, rangelands and biodiversity in grassland, and productivity in grasslands. Wetland Ecosystem- Distribution, energetic and productivity in wetlands, biodiversity and economic importance of wetlands.

Unit-4: Desert Ecosystem and Wastelands-Desert as ecosystems, hot and cold deserts, productivity, characteristics and global distribution of deserts. Desertification process, ecological, geological, geographical and geomorphological aspects of Thar desert, adaption in desert, fauna and flora, Vegetation types of Thar Desert, change in land use pattern due to introduction of canals and environmental consequences. Types and distribution of wastelands in India. Aquatic Ecosystem: Lentic and lotic ecosystem, structure, energy flow and productivity in estuaries, marine ecosystem, structure biodiversity and productivity in marine ecosystem.

  
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### **Paper III: Environmental Pollution and Health**

Duration 3 hrs.

Max. Marks:100

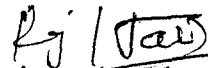
Min. Pass Marks:36

**Unit -1 : Air Pollution :** Air pollution and Human Health, Atmospheric composition and stratification. Types of air pollutants, sources of emissions of air pollutants, atmospheric physics and chemistry of air pollution, methods of detection and measurement of air pollution. Effect of air pollution on vegetation, man, animals, materials and environment; Global warming, levels of emissions of greenhouse gases, greenhouse effect, climate change, sea level rise, implication of global warming on mainland (agriculture, residential places and diseases). Ozone depletion, chemistry of depletion, chemicals affecting stratospheric ozone layer, consequences of ozone depletion, acid rain: chemistry, causes and effects of acid rain.

**Unit-2: Water Pollution:** Potable-water standards, types of water pollutants and their sources, impacts of water pollution on human, plants and animals. Waterborne diseases:diarrhea, dysentery, typhoid, viral hepatitis and their control. Marine pollution causes, impacts and consequences of marine pollution, Economics of water. Waste water and their categories, management of water resources.

**Unit-3: Noise Pollution and Land Pollution:** Sources and causes of noise pollution, methods of detection of noise levels, biomedical aspects of noise pollution. Sources and causes of land degradation and land pollution. Impacts of land pollution, physio-chemical and bacteriological sampling as analysis of soil quality, soil pollution control, Interaction of industrial waste with soil components.

**Unit-4: Radiation pollution and thermal pollution:** Radiation characteristics, radiation pollution, causes and impacts of radiation pollution. Thermal pollution, causes and impacts of thermal pollution, magnitude of thermal pollution in India.

  
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## **Paper IV: Environmental Education and Policy**

Duration 3 hrs.

Max. Marks:100

Min. Pass Marks:36

Unit -1: Eco politics and Environmental activism, the birth of Eco politics and environmental movements and environmentalism, Chipko, Appiko, Silent Valley, Doon Valley, Narmada Dam, Tehri Dam, Almetti Dam etc, the Stockholm Conference on Human Environment of 1972 and the Rio Earth Summit of 1992.

Unit -2: NGO's and Environmental Conservation, National NGO's, KSSP etc., Environmental conservation measures taken, i.e. Role of Ecological Task Force.

Unit -3: Role of International Organizations in Environmental conservations and Environmental politics : Role of International Union for conservation of Nature and natural resources (IUCN), World-wide Fund for Nature (WWF), UNEP, UNESCO, GEF, IGBP etc., Environmental politics for afforestation, abatement of Industrial pollution, automobile pollution, pollution due to power generation etc.

Unit -4: Environmental laws and International conventions, environmental provisions in the constitution of India, environmental laws for the protection of air, water, forest and wildlife in India. Various conversations and treaties for protection of global environment. The Basel convention 1989, London convention 1972, The United Nations Convention and climate change 1992. The Montreal Protocol 1989, Biodiversity convention 1993.

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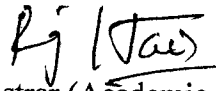
**M. Sc. PREVIOUS (PRACTICAL):**

Duration 5hrs.

Max.Marks :200

Min. Pass Marks:72

1. Study of functioning and operations of important instruments and equipments.
2. Frequency, density, IVI, leaf area estimation, Studies of Forest, desert and aquatic ecosystems.
3. Estimation of Biomass in different ecosystem.
4. Study of soil, physical characteristics, texture study and chemical analysis.
5. Estimation of suspended particulate matter, CO, SO<sub>x</sub>, NO<sub>x</sub>.
6. Water analysis; physical, Chemical and Biological Parameters.
7. Studies of
  - a. Distribution of forests and wildlife
  - b. Status of Flora and Fauna ( Biodiversity)
  - c. Soil types, erosion
  - d. Ground water potential
  - e. Rainfall
  - f. Mineral distribution
  - g. Deserts lands and wetland distribution
  - h. Wasteland distribution

  
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## M.Sc. FINAL

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### Paper I: Waste Treatment and Management

Duration:3 hrs.

Max. Marks:100

Min. pass. Marks:36

Unit-1: Urban waste management, characteristics and nature of solid waste; generation, transportation, disposal and treatment of solid waste. Recovery, recycling and reuse of waste.

Unit-2: Industrial waste management-generation of industrial waste, minimization of waste generation, recycling and recovery of materials, industrial waste treatment. (Chemical) waste management, classification of toxic waste, treatment of toxic waste and safe disposal.

Unit-3: Nuclear waste treatment -Reprocessing of nuclear waste, recovery of nuclear filling material for reuse, treatment and safe disposal of nuclear waste.

Unit-4: Hazardous waste management -Classification, nature and characteristics of hazardous waste, Techniques of hazardous waste treatment, Disposal of hazardous waste.

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8

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## **Paper II: Natural Resources and Biodiversity Conservation**

Duration: 3 hrs.

Max. Marks: 100

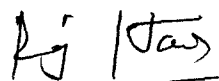
Min. pass. Marks: 36

Unit-1: Classification of resources: Renewable resources, Nonrenewable resources, Classes of earth resources, resource regions: Definition and criteria, resource conservation.

Unit-2: Natural resources-non mineral resources, Land, Soil, Water, Inland Water, plants, animals, microorganisms, the forest produce and the marine resources, Agricultural resources, Natural resources-mineral resources and fuel resources. Minerals and metals, fossil fuel, coal, petroleum, natural gas.

Unit-3: Alternatives of resources and non-conventional energy sources, solar, wind, hydel, tidal and geothermal energy resources, the nuclear fuels, biomass energy, hydrogen as fuel etc.

Unit-4: In-situ biodiversity and conservation, conservation of biodiversity in Biosphere Reserves, Reserve Forests, National Parks, Tiger Projects, Sanctuaries, places around shrines, sacred grooves etc. Biotechnology and its application in biodiversity conservation, Ex-situ conservation of biodiversity, gene bank, germ plasm storage, live museum etc.

  
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## Special Paper: A-Environmental management and Planning

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### Paper IIIA: Environmental Impact Assessment, (EIA) and Sustainable Development

Duration:3 hrs.

Max. Marks:100

Min. pass. Marks:36

Unit-1: Procedures and methodologies of EIA, cost-benefit analysis and auditing, origin of the concept of Environmental Impact Statement; preparation, procedure of EIA in different countries and methodologies of preparation of EIA. Environmental Auditing (EA) and its applications.

Unit-2: EIA, EA and Environmental modelling of thermal power project, EIA and EA methodologies of thermal power projects, mitigation of impacts and economically sound and ecologically sustainable development.

Unit-3: EIA and EA of nuclear power projects, EIA and EA methodologies of nuclear power project, siting ,mitigation of adverse impacts.EIA and EA of other developmental projects, EIA and EA of tourism, transportation, irrigation, dams, agriculture and industries.

Unit-4: EIA and EA of mining projects, river projects, procedures and methodologies of EIA and EA of mining and river valley project.

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## **Paper IV A: Environmental Pollutions Management and control Technology**

Duration:3 hrs.

Max. Marks:100

Min. pass. Marks:36

Unit-1: Air Pollution management and control technology-air pollution sampling and measurement, air pollution control methods and equipments, control of specific gaseous pollutants.

Unit-2:Water pollution management and control technology waste water sampling and analysis, waste water treatment, primary waste water treatment, secondary waste water treatment and advanced waste water treatment. Marine pollution management and control technology, sampling and measurement of marine pollution, control of marine pollution.

Unit-3:Land pollution management-methods of collection, sampling, disposal, reuse and recovery of materials.

Unit-4:Energy:Impacts of production and use of energy and impact reduction technologies, Energy production by thermal power, nuclear power and their impacts. Technology for reduction of environment impact of power generation.

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## B-Human Ecology and Population Studies

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### **Paper IIIB: The Human Population Culture and Environment**

Duration:3 hrs.

Max. Marks:100


Min. pass. Marks:36

**Unit-1:**The Human Environment: The natural and man-made environment, impact of human activities on the environment and its ecological consequences; environmental problems threatening human existence on earth; impact of degraded environment on the quality; strategies for management of human environment for survival with dignity and comfort.

**Unit-2:**Human Population and their Environmental Impact: The growing human population on earth and its environmental consequences, population and resource-the relationship between population explosion, poverty and pollution; population policies and strategies for population control. Ecological Adaptation of Man: The ecological adaptations of man, its survival value; human behavioral changes-a bio indicator of environmental pollution, role of heredity and environment in human growth and development.

**Unit-3:** Human Culture and its Environmental Imperatives: Cultural evolution of man and the impact of human culture on the environment; the environmental impact of "modernization", culture of "over-consumerism" and the extravagant life style; the conflict between human "need" and "greed" the traditional human culture including tribal cultures and practices and their ecological significances; role of human faith and tradition in ecosystem preservation.

**Unit-4:** The Human Ecosystem: Manmade ecosystem on earth-urban, rural, agricultural and industrial ecosystem components of the human ecosystem and its link with the natural ecosystem, human ecosystem as highly energy and resource intensive and the threat to its stability, the future of human ecosystem on earth.

  
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### **Paper IVB: Social Impact Assessment and Sustainable Development**

Duration:3 hrs.

Max. Marks:100


Min. pass. Marks:36

Unit-1: Technological Revolution: Industrialization, Farmization, and Urbanization. Ecological-Economics: The dilemma of human development- Economy Vs Ecology, economic development vis-a-vis ecological destruction. Need for a system of environmental "auditing and accounting "in all developmental projects.

Unit-2: Sustainable Development : The Brundtland Commission Report (1987) about sustainable development; the strategies for sustainable industrialization; sustainable agriculture, sustainable urbanization, and sustainable transport system; need for change in developmental philosophy based on human needs and not greed, equity in resource distribution and consumption; revival of traditional system of development with modern scientific knowledge, the Gandhian philosophy of development and its relevancy to the modern human society.

Unit-3:Eco politics and Development :Politics and Environment, the North and South Eco political divide on the issue of environment and development, National and International politics on the course of development and environmental conservation; role of politician, parliament and the legislature in environment and development.

Unit-4: Developmental Priorities and Problems and Mankind: Agriculture, Industries, Tourism, Power generation, New Technologies, Energy intensities technology.

  
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## M.Sc. Final (General Papers): Practical

Duration 5hrs.

Max.Marks :100

Min. Pass Marks:36

Collection of waste, from industrial operational units and analysis for BOD, COD, heavy metals and microbes. Waste characterization, composition and management (physico-chemical analysis of wastes).

Inventory preparation for Biodiversity in Rajasthan and study of conservation Practical's.

## M.Sc. Final (Special Papers) Practical

Duration 5hrs.

Max.Marks :100

Min. Pass Marks:36

### Environmental Management and Planning

1. EIA, EMP, EIS preparation and environmental auditing
2. Detection of noise level and its biomedical aspects
3. Ecological monitoring

### Human Ecology and Population Studies

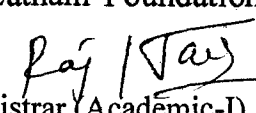
1. SIA preparation
2. Impact of Urbanization on Environment study

Ecological study Tours/Trips:


Mandatory participation of Students in Environment related tour organized by the Department

### Books:

1. Man and Nature Progress, E. Fedorov, Publishers, Moscow, 1980
2. "Will we survive". Anatoly Gromyko, Robert Mc Namare etc. Progress Pub., Moscow, 1989
3. Perspectives in Environmental Psychology, Sinha S.N., G.S. Nathawat and R.K. Sinha (Ed.) Pointer Publisher, Jaipur 1990
4. Ecology and their Endangered Life support system. Odum E.P., 1989, Sunderland, Mass, ISEM
5. "Minding the Earth" Essays on Human Ecology, J.W. Meeker, Latham Foundation ISEM, 1998

  
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6. Studies in Environment and Development, R.S.Singh, Commonwealth Publication, New Delhi
7. Air Pollution Control Theory, M. Crowford, TATA, Mc Graw Hill
8. Ecology in Practice, Castri and Barker, 1984. UNESOO, Paris
9. Wetland Ecology, J.R.Etherington,1983. Arnold-Heinemann
10. Mannual of Pollution Control Laws in India", Goyal & Porwal, Book Corporation, 1986
11. Ecology 2000 : The Changing Face of Earth. Hillary, S.E. 1984. London
12. "Environmental Impacts of Production and uses of Energy", EE. Hinnawai, UNEP, Nairobi, 1981
13. "Environmental Pollution and Managements, I. Mohan, Ashish Publishing, 1989
14. " The Economics of Forestry and Natural Resources", Johanson & Lofgren, Blackwell Oxford, 1985
15. "Desert Ecology" Ishwar Prakash, Scientific Publisher, Jodhpur, 1988
16. "Disease Ecology" A. Learmonth, Slackwell, Oxford, 1988
17. "Noise Pollution: Its Scientific and Legal Perspective", Manjoo Bala Trivedi & Satish Shastri, Divyajyoti Prakashan, Jodhpur, 1988
18. "Conserving India's Natural Heritage", S. Singh, Natraj Publisher, Dehradun, 1986
19. "Environmental and Natural Resources Economics", T. Titenberg, Scott, Foresman and Co., London, 1968
20. Water Pollution and Management Reviews", C.K. Varshneys, South Asia Publ, 1981
21. "State of the world", World watch institute (Washington) Report 1981- 1984; Prentice Hall of India
22. "Development without Destruction: The Challenge to Survival", Rajiv K. Sinha, Environmentalist Pub. Jaipur 1994.
23. "Environmental Crisis & Humans at Risk", Ed. Rajiv K. Sinha, INA Shree Publisher, Jaipur 1996
24. "Our Common Future ", Brutland Commision Report on Environment and Development, Oxford University Press, 1998
25. "One Earth, One Future( Our Changing Global Environment)" National Academy of Sciences, U.S.A. 1991.
26. Human Ecology", Research and Application" Vol.1 & 2Ed., Borden, Jacob & Young Sec. for Human Ecology, Maryland, USA, 1988
27. "Small is Beautiful"- A Study of Economics as if People Mattered, E.F. Schumacher, ABACUS, London, 1973

  
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