



UNIVERSITY OF JAMMU
SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-I]

Examinations to be held in December 2025, 2026 & 2027

Course No.:P2ESTC101

Credits: 4

Duration of Examination: 3 hrs

Title: Ecology and Environment

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

Objectives:

To equip students with theoretical knowledge and practical skills in ecology and environmental sciences, fostering interdisciplinary thinking, critical analysis, and problem-solving abilities to address complex environmental challenges. The module will help students in comprehensive understanding of fundamental ecological principles, the structure and function of ecosystems, and the intricate relationships between living organisms and their environment, laying the groundwork for advanced environmental studies.

UNIT 1: ECOLOGICAL PRINCIPLES AND ENVIRONMENTAL INTERACTIONS

- 1.1. Definitions and scope of ecology, levels of organization in ecology, habitat, niche, and ecological amplitude
- 1.2. Components of ecosystem, biotic and abiotic
- 1.3. Food chains, food webs, ecological pyramids, energy flow
- 1.4. Nutrient cycles, ecosystem dynamics and feedback mechanisms

UNIT 2: POPULATION AND COMMUNITY ECOLOGY IN A CHANGING ENVIRONMENT

- 2.1. Population growth models, carrying capacity, environmental resistance and limiting factors, r/K selection theory
- 2.2. Competition, predation, parasitism, mutualism, niche differentiation and resource partitioning
- 2.3. Ecological succession, climax community, stability, and resilience, role of disturbance and anthropogenic succession
- 2.4. Community patterns and environmental gradients, ecotone, and edge effect, diversity indices

UNIT 3: LANDSCAPE, ECOSYSTEM AND GLOBAL ECOLOGY

- 3.1. Landscape metrics, edge effects and connectivity, land use change and ecological implications with reference to the Himalaya
- 3.2. Major ecosystem types, forest, grassland, desert, wetland, alpine and aquatic ecosystems
- 3.3. Functional traits and ecosystem processes, primary productivity and carbon sequestration
- 3.4. Ecosystem services, classification and valuation, ecosystem-based adaptation

UNIT 4: HUMAN ECOLOGY AND ANTHROPOGENIC IMPACTS

- 4.1. Human-environment relationships, socio-ecological systems, carrying capacity
- 4.2. Ecological footprint analysis,
- 4.3. Urban sprawl; ecological implications urban biodiversity and green infrastructure
- 4.4. Ecosystem disruption due to mining, dams, roads, ecological dimensions of air, water, and soil pollution

UNIT 5: APPLIED ECOLOGY

- 5.1. Field sampling; quadrats, transects, tagging, biodiversity monitoring and bioindicators
- 5.2. Ecosystem management, participatory forest and community-based conservation
- 5.3. Climate-vegetation feedback, phenology and ecosystem shifts, ecosystem vulnerability
- 5.4. International priorities on ecology and environment, ecology-informed policy making

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Title: Ecology and Environment

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

LITERATURE RECOMMENDED

1. Benton, A. H. and Werner, W. E. (1976). *Field Biology and Ecology*. Tata McGraw Hill Publishing Company Ltd. New Delhi
2. Chapman, J. L. and Reiss, M. J. (1999). *Ecology-Principles and applications*. Cambridge University Press
3. Dash, M. C. (1993). *Fundamentals of Ecology*. Tata McGraw Hill Publishing Company Ltd. New Delhi.
4. De, A. K. and De, A. K. (2009). *Environment and Ecology*, New Age International (P) Ltd. Publisher, New Delhi
5. Fauric, C.; Ferra, C.; Medori, P. and Devaux, J. (2001). *Ecology. Sciences & Practice*. Oxford & IBH Pub. Co. Pvt. Ltd. (New Delhi).
6. Kormondy, E. J. (1986). *Concept of Ecology*. Prentice Hall of India, New Delhi.
7. Odum, E. P. and Barrett, G. W. (2017) (5thEd.). *Fundamentals of Ecology*. Cengage Learning (RS); 30.16 Edition Publishers, Dehradun.
8. Southwick, H. C. (1976). *Ecology & Quality of our Environment* Van No. Strand Reinhold Company, New York.

SCHEME OF EXAMINATION

The theory paper will carry 100 marks and the distribution of marks in each theory paper shall be as under:

MCQ on LMS+Subjective Test	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Minor I (after 30 days)	20%	1 hour	10 (MCQs on LMS) 10 (Subjective-type)
Minor II (after 60 days)	21-40%	1 hour	10 (MCQs on LMS) 10 (Subjective-type)
Major test (after 90 days)	100%	3 hours	60
	Total		100

Minor Examination: Question paper will have two parts viz., Part-I (MCQs on LMS) and Part-II (subjective-type). Part-I is compulsory and will consist of ten (10) multiple choice questions of one (01) mark each. Part-II will consist of three (03) short answer type questions of five (05) marks each, out of which two questions are to be attempted.

Major Examination: Question paper will have two sections, Section-A and Section-B. Section-A will be compulsory, comprising of eight (08) short answer type questions (minimum 01 from each unit) of three (03) marks each. Section B will consist of three (03) long answer type questions from last three units with internal choice of twelve (12) marks each.

Dattia

Rajesh

Rakesh

Van

Andi Sarker

Raj



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[SEMESTER-I]

Examinations to be held in December 2025, 2026 & 2027

Course No.: P2ESTC102

Credits: 4

Duration of Examination: 3 hrs

Title: Aquatic Environment

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

Objectives:

The course has been designed to provide information on various aspects of aquatic environment, its chemistry, changing physico-chemical profile, biotic characteristics, and applicability of the information for the exploitation of different water resources and also for their better management and conservation. Students will learn about the physical and chemical aspects of aquatic systems and the life cycles, and adaptations of aquatic organisms.

UNIT 1: AQUATIC ENVIRONMENT: PRINCIPLES AND CHEMICAL PROCESSES

- 1.1 Hydrology: Definition, terms, and concepts to describe physical hydrological processes including evaporation, transpiration, precipitation, infiltration
- 1.2 Hydrological cycle and water budget, global water balance
- 1.3 Chemical speciation in aquatic systems: Cations (Ca^{2+} , Mg^{2+} , Na^+ , K^+),
- 1.4 Chemical speciation in aquatic systems: Anions (CO_3^{2-} , HCO_3^- , SO_4^{2-} , Cl^- , etc.)

UNIT 2: LENTIC ENVIRONMENT- LAKES AND WETLANDS

- 2.1 Lakes: Origin and classification
- 2.2 Lake stratification and mixing; eutrophication and restoration of eutrophic waterbodies
- 2.3 Characteristics of lakes (physical, chemical and biological)
- 2.4 Wetlands: Definition, types, classification and management

UNIT 3: LOTIC ENVIRONMENT-STREAMS AND RIVERS

- 3.1 Types of rivers; types of flow and flow characteristics
- 3.3 Stream structure and classification: stream order, channel features, zonation
- 3.3 Characteristics of lotic waters (physical, chemical and biological)
- 3.4 Conservation of rivers with focus on national river conservation plan; Case studies: Ganga Action Plan, Yamuna Action Plan and Namami Gange

UNIT 4: GROUNDWATER HYDROLOGY

- 4.1 Groundwater occurrence and types of groundwater
- 4.2 Principles of groundwater flow: Darcy's Law and hydraulic potential
- 4.3 Groundwater and its chemical constituents: organic, inorganic and dissolved gases
- 4.4 Springs: origin, classification, characteristics and importance

UNIT 5: ESTUARINE AND MARINE ENVIRONMENT

- 5.1 Estuary: Definition, types and classification
- 5.2 Environmental factors within estuaries
- 5.3 Introduction to marine environment and its zonation
- 5.4. Classification of marine biota and factors affecting marine environment

LITERATURE RECOMMENDED

1. Abbasi, S. A. (1997). *Wetlands of India*. Discovery Publishing House. New Delhi.
2. Aggarwal, S. C. (1999). *Limnology*. APH Publication Corporation, New Delhi.
3. Allan, J. D. (1995). *Stream Ecology-Structure and function of running waters*. Chapman and Hall Publication, UK.
4. Cole, G.A. and Weihe, P. E. (2016). *Limnology*. 5th Ed., Waveland Press. Inc., Long Grove, IL, 60047-9580(e-book).
5. Dodds, W. and Whiles, M. (2010). *Freshwater Ecology*. 2nd Ed. Academic Press.
6. Goldman, C. R. and Horne, A. J. (1994). *Limnology*. McGraw Hill Int. Book Co., New Delhi.

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[SEMESTER-I]

Examinations to be held in December 2025, 2026 & 2027

Course No.:P2ESTC102

Credits: 4

Duration of Examination: 3 hrs

Title: Aquatic Environment

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

7. Hutchinson, G. E. (2004). *Treatise on Limnology*. Vol. I, part-2, Vol. II. John Willey and Sons, New York.
8. Jhingran, V. G. (1992). *Fish and Fishes of India*. Hindustan Publishing Corporation, India.
9. Keddy, P.A. (2010). *Wetland Ecology- Principles and Conservation*. 2nd Ed. Cambridge University Press, Cambridge, UK. ISBN 978-521-51940-3(e-book)
10. Mortimer, C.H. (2003). *Lake Michigan in Motion: Responses of an Inland Sea to Weather, Earth-Spin and Human Activities*. University of Wisconsin Press.
11. Rushton, K.R. (2003). *Groundwater Hydrology- Conceptual and computational Models*. John Wiley and Sons, West Sussex, England. ISBN 0-470-85004-3.
12. Schwoerbel, J. (1991). *Handbook of limnology*. Scientific Publication. Jodhpur.
13. Speight, M. and Henderson, P. (2010). *Marine Ecology- Concepts and applications*. Wiley Blackwell. A John Wiley & Sons, Ltd. Publication, UK.
14. Wetzel, R. G. (2001). *Limnology: Lakes and River Ecosystem*. Academic Press, London.

SCHEME OF EXAMINATION

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[SEMESTER-I]

Examinations to be held in December 2025, 2026 & 2027

Course No.: P2ESTC103

Title: Remote Sensing and GIS Applications

Credits: 4

Maximum Marks : 100

Duration of Examination: 3 hrs

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

Objectives:

Remote Sensing and Geographical Information System (GIS) have developed remarkably as an important tool for scientific management of resources and environment. The technology is instrumental in facilitating the mapping and monitoring of changes in the environment. Remote Sensing application for natural/ physical resources assessment is helpful to improve student's ability to achieve the goal of optimum land use planning for sustainable resource management. This course has been designed with the objectives to acquaint the students with basic principles of Remote Sensing and GIS and their applications in various fields especially environment.

UNIT 1: FUNDAMENTALS OF REMOTE SENSING

- 1.1. Remote sensing - Concept, and principles, electromagnetic radiations, remote sensing regions and bands
- 1.2. Data characteristics: Spectral signatures, response patterns, and image resolution (spatial, spectral, temporal, and radiometric)
- 1.3. Aerial photography: History, characteristics and attributes. Drone / UAV mapping and surveying
- 1.4. Indian remote sensing satellites: History, characteristics, and applications

UNIT 2: DATA ACQUISITION AND IMAGE INTERPRETATION

- 2.1. Platforms and sensors: Classification and characteristics
- 2.2. Remote sensing data acquisition, image rectification, and restoration
- 2.3. Image processing and classification: Supervised and unsupervised classification
- 2.4. Remote sensing data interpretation: Nature and elements of interpretation (Land use, landforms, drainage, erosion, fire details)

UNIT 3: ADVANCES IN REMOTE SENSING AND ITS APPLICATIONS

- 3.1. Microwave remote sensing: Introduction, fundamentals, and functions
- 3.2. RADAR and LiDAR: components, operating principles, and imaging systems
- 3.3. Multispectral and hyperspectral remote sensing
- 3.4. Thermal remote sensing

UNIT 4: GEOGRAPHICAL INFORMATION SYSTEM (GIS) AND GLOBAL POSITIONING SYSTEM (GPS)

- 4.1. Geographical Information System: Concept, components, geographical data (spatial and non-spatial); spatial data models (raster and vector)
- 4.2. Fundamentals of mapping in GIS: Map projections, datum, coordinate systems, georeferencing; types of maps (reference maps, topographic sheets, and thematic maps); data input and output in GIS, map generation
- 4.3. Introduction to GIS software: Overview of QGIS; installation and interface; basic tools and functions, map outputs
- 4.4. Global Positioning System (GPS): Concept, functioning, integration with GIS

UNIT 5: APPLICATIONS OF REMOTE SENSING AND GIS

- 5.1. Remote Sensing and GIS in meteorology: Weather monitoring and climate change
- 5.2. Biodiversity monitoring and mapping: Terrestrial carbon estimation, forest stock and density mapping, change detection, biodiversity characterization, forest fire risk zonation
- 5.3. Remote Sensing and GIS in urban planning: Urban sprawl monitoring, analysis, and planning
- 5.4. Role of GIS in disaster prediction and management: Vulnerability analysis of infrastructure and settlements, planning relief operations and disaster management

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Credits: 4

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Title: Remote Sensing and GIS Applications

Maximum Marks : 100

a) Minor Test-I : 20 Marks

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LITERATURE RECOMMENDED

1. Campbell, J. B. (2002). *Introduction to Remote Sensing*. 5th ed. Taylor & Francis, London.
2. Chang, K.T. (2003). *Introduction to Geographic Information Systems*. Tata McGraw Hill Publications Co., New Delhi.
3. Cracknell, A. et al. (1990). *Remote Sensing Yearbook*, Taylor and Francis, London.
4. Curran, P.J. (1985). *Principles of Remote Sensing*, Longman, London.
5. Deekshatulu, B.L. Rajan, Y.S. (ed.) (1984). *Remote Sensing*. Indian Acad. of Science, Bangalore.
6. Demers, M. N. (2000). *Fundamentals of Geographic Information Systems*. John Wiley & Sons, Singapore.
7. Floyd, F., Sabins, Jr. (1986). *Remote Sensing: Principles and Interpretation*, W.H. Freeman, New York.
8. Fraser Taylor, D.R. (1991). *Geographic Information Systems*. Pergamon Press, Oxford.
9. Guham, P. K. (2003). *Remote Sensing for Beginners*. Affiliated East-West Press Pvt. Ltd., New Delhi.
10. Hallert, B. (1960). *Photogrammetry*, McGraw Hill Book Co. Inc.
11. Harry, C.A. (ed.) (1978). *Digital Image Processing*, IEEE Computer Society.
12. Hord, R.M. (1982). *Digital Image Processing of Remotely Sensed Data*, Academic Press, New York.
13. Leuder, D.R. (1959). *Aerial Photographic Interpretation: Principles and Application*. McGraw Hill, New York.
14. Lillesand, T.M. and Kiefer, R.W. (2000). *Remote Sensing and Image Interpretation*. 4th ed. John Wiley and Sons, New York.

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Dattia

Raj

Deekshatulu

Van

Anda Sutar

Raj



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[SEMESTER-I]

Examinations to be held in December 2025, 2026 & 2027

Course No.: P2ESTC104

Credits: 4

Duration of Examination: 3 hrs

**Title: Solid Waste Management:
Circular Economy and Valorization**

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

Objectives:

The course will equip the students with the knowledge and skills to understand the fundamentals of solid waste management and the principles of circular economy. It will acquaint them with various processes of waste valorization, to convert waste into valuable resources, thereby promoting sustainability, resource efficiency and integrating waste management with Sustainable Development Goals (SDGs). The students through analysis of real-world case studies shall identify tools and policy instruments for effective waste planning and governance.

UNIT 1: SOLID WASTE MANAGEMENT AND CIRCULAR ECONOMY

- 1.1. Solid Waste: sources, characteristics, and classification, waste segregation, collection, storage, and transfer
- 1.2. Waste processing: Size and volume reduction, waste minimization; waste management hierarchy
- 1.3. Concept of circular economy, 7R's and zero waste
- 1.4. Legal and policy framework for waste management: Indian Waste Management Rules (2016) and subsequent amendments for Municipal Solid Waste, Plastic Waste, Extended Producer Responsibility (EPR)

UNIT 2: TECHNOLOGIES FOR WASTE PROCESSING AND VALORIZATION

- 2.1. Material Recovery and Recycling: metals, plastic, paper, and glass
- 2.2. Waste conversion technologies: Thermal, chemical, and biological
- 2.3. Waste to energy conversion (WTE) and its environmental consideration; Refuse Derived Fuel (RDF) and co-processing
- 2.4. Green Technologies in Waste Management (WM) and valorization

UNIT 3: HAZARDOUS WASTE: MANAGEMENT AND VALORIZATION

- 3.1. Hazardous waste: definition, classification, sources and types, Basel convention and Hazardous waste and electronic waste management rules (2016) and subsequent amendments
- 3.2. Waste minimization and resource recovery; treatment technologies, storage, transportation, disposal, and monitoring
- 3.3. E-waste and battery recycling technologies; Critical Raw Material (CRM) recovery
- 3.4. Emerging trends and techniques: Circular economy and hazardous waste, nanotechnology in waste treatment; digital tools and Artificial Intelligence in waste tracking

UNIT 4: LANDFILLS: DESIGN, OPERATION AND MONITORING

- 4.1. Landfills: Definition and classification, site selection, design, and operation
- 4.2. Liner system (Clay, geomembrane, and composite); cover system (daily, intermediate, and final)
- 4.3. Monitoring of landfill leachate, gas and ground water; Leachate collection and treatment system
- 4.4. Landfill closure and environmental monitoring, Rehabilitation of open dump sites, case studies, Smart landfill technologies and circular economy integration

UNIT 5: GOVERNANCE, INNOVATIONS AND FUTURE TRENDS

- 5.1. Tools and indicators for Circular Economy Assessment
- 5.2. Innovations in WM: Circular design and eco-innovation
- 5.3. Policy, institutional framework and financial tools for waste management
- 5.4. Extending lifecycle of products, best practices in WM and case studies, entrepreneurship, and opportunities in waste Management

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[SEMESTER-I]

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Circular Economy and Valorization

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LITERATURE RECOMMENDED

1. Asnani, P. U. (2006). Solid waste management. India Infrastructure Report 570.
2. Bagchi, A. (2004). Design of Landfills and Integrated Solid Waste Management. John Wiley & Sons.
3. Elena Cristina Rada, E. C. (2017). Waste Management and Valorization: Alternative Technologies, CRC Press.
4. Ghosh, S. K. (2020). Waste Management as Economic Industry Towards Circular Economy Editor: Publisher: Springer.
5. Hasan, S. E. (2022). Introduction to Waste Management: A Textbook. John Wiley & Sons.
6. Manual on Municipal Solid waste Management (2000). CPHEEO, Ministry of Urban Development, Govt. of India, New Delhi.
7. McDougall, F. R., White, P. R., Franke, M., & Hindle, P. (2008). Integrated Solid Waste Management: A Life Cycle Inventory. John Wiley & Sons.
8. Tchobanoglous, G. et al. (2023). Integrated Solid Waste Management: Engineering Principles and Management, McGraw - Hill. US EPA. (1999). Guide for Industrial Waste Management. Washington D.C.
9. Van Ewijk, S., & Stegemann, J. (2023). An introduction to waste management and circular economy. UCL Press.
10. White, P.R., Franke, M. & Hindle P. (2001). Integrated Solid waste Management: A Lifecycle Inventory. Blackie Academic & Professionals.
11. Zhu, D., Asnani, P.U., Zurbrugg, C., Anapolsky, S. & Mani, S. (2008). Improving Municipal Solid Waste Management in India. The World Bank, Washington D.C.

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[Handwritten signatures: Dattia, Singh, Pakeeshat, Van, Anand Singh, Kaur]



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[SEMESTER-I]

Examinations to be held in December 2025, 2026 & 2027

Course No.: P2ESTE105

Credits: 4

Duration of Examination: 3 hrs

Title: Traditional Knowledge System

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

Objectives:

This course is designed to introduce students to the Indian Knowledge systems, help them in understanding the concept and assess the relevance of traditional knowledge in modern science, technology, and sustainable development. The course aims to foster appreciation for ancient Indian scientific achievements, including medicine, metallurgy, agriculture, and environmental management and learn about indigenous technologies that would help in conserving traditional knowledge and integrating it with modern practices.

UNIT 1: INTRODUCTION TO TRADITIONAL KNOWLEDGE

- 1.1. Traditional knowledge: concept, nature, characteristics, scope and importance
- 1.2. Importance and need for protecting traditional knowledge
- 1.3. Indigenous vs. traditional knowledge: historical evolution and social impact
- 1.4. Role of government and legal framework in protection, global economic value of traditional knowledge

UNIT 2: SACRED ECOLOGY AND ENVIRONMENT

- 2.1. Sacred ecology: Introduction and scope
- 2.2. Sacred forests, sacred groves, sacred hills and mountains
- 2.3. Traditional Ecological Knowledge (TEK), Resilience to climate change
- 2.4. Sacred ecology and SDGs (especially SDG 13 and 15); Integration of sacred ecology in environmental education and policy

UNIT 3: TRADITIONAL WATER WISDOM

- 3.1. Indigenous knowledge systems and hydrological understanding; Regional adaptations and cultural significance
- 3.2. Historical evolution of water management in ancient civilizations: Harappan and traditional water management system of Gujarat
- 3.3. Traditional rainwater harvesting system typology based on region and structure type; Communities involved in water management
- 3.4. Decline of traditional systems and urbanization pressures, revival initiatives and importance, challenges, and modern integration

UNIT 4: FOUNDATION OF SUSTAINABILITY IN INDIAN TRADITIONAL KNOWLEDGE

- 4.1. Sustainability, resilience, Ethics of intergenerational equity and harmony with nature; Indian philosophical perspectives on nature and sustainability (e.g., Vasudhaiva Kutumbakam, Pancha Mahabhutas)
- 4.2. Oral traditions, community memory, and transmission; Community-led resource management and food security
- 4.3. Traditional Medicine for health and well-being: Ayurveda, Unani, Siddha and Sowa Rigpa, Sushruta Samhita—ancient surgical techniques, Diet and Lifestyle: Dinacharya & Ritucharya); Yoga & Ayurveda: integration of physical and mental wellness.
- 4.4. Ancient wisdom for achieving sustainable development goals (SDGs)

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[SEMESTER-I]

Examinations to be held in December 2025, 2026 & 2027

Course No.: P2ESTE105

Credits: 4

Duration of Examination: 3 hrs

Title: Traditional Knowledge System

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

UNIT 5: TRADITIONAL KNOWLEDGE IN CONTEMPORARY WORLD AND PROTECTION

- 5.1. Integration of traditional knowledge in modern education and innovation
- 5.2. Exploring the potential of Traditional knowledge in addressing contemporary challenges (Climate Change, water scarcity, biodiversity conservation, food security, organic farming etc.)
- 5.3. Intellectual Property Rights and protection of indigenous knowledge
- 5.4. The protection of Traditional Knowledge Bill, (2016), Geographical Indications Act (2003)

LITERATURE RECOMMENDED

1. Agrawal, A. (1995). Dismantling the divide between indigenous and scientific knowledge. *Development and Change*, 26(3), 413-439.
2. Fredrick W. B. (2013). *The Iconography of Water: Well and Tank Forms of the Indian Subcontinent*, DK Printworld, New Delhi, 2013
3. Mosse, D. (1999). Colonial and Contemporary Ideologies of 'Community Management': The Case of Tank Irrigation Development in South India. *Modern Asian Studies*, 33(02), 303-338
4. Pahl-Wostl, C. (2007). Transitions towards adaptive management of water facing climate and global change. *Water Resources Management*, 21(1), 49-62.
5. Raymond, C. M., Fazey, I., Reed, M. S., Stringer, L. C., Robinson, G. M., & Evelyn, A. C. (2010). Integrating local and scientific knowledge for environmental management. *Journal of Environmental Management*, 91(8), 1766-1777.
6. Roux, D. J., Rogers, K. H., Biggs, H., Ashton, P. J., & Sergeant, A. (2006). Bridging the science management divide: Moving from unidirectional knowledge transfer to knowledge interfacing and sharing. *Ecology and society*, 11(1), 4 (online).

SCHEME OF EXAMINATION

The theory paper will carry 100 marks and the distribution of marks in each theory paper shall be as under:

MCQ on LMS+ Subjective Test	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Minor I (after 30 days)	20%	1 hour	10 (MCQs on LMS) 10 (Subjective-type)
Minor II (after 60 days)	21-40%	1 hour	10 (MCQs on LMS) 10 (Subjective-type)
Major test (after 90 days)	100%	3 hours	60
	Total		100

Minor Examination: Question paper will have two parts viz., Part-I (MCQs on LMS) and Part-II (subjective-type). Part-I is compulsory and will consist of ten (10) multiple choice questions of one (01) mark each. Part-II will consist of three (03) short answer type questions of five (05) marks each, out of which two questions are to be attempted.

Major Examination: Question paper will have two sections, Section-A and Section-B. Section-A will be compulsory, comprising of eight (08) short answer type questions (minimum 01 from each unit) of three (03) marks each. Section B will consist of three (03) long answer type questions from last three units with internal choice of twelve (12) marks each.





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SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-I]

Examinations to be held in December 2025, 2026 & 2027

Course No.: P2ESPC111

Title: Lab Course-1 (Based on P2ESTC101)

Credits : 2

Maximum Marks : 50

Duration of Examination: 4 hrs

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with experimental work based on Course No. P2ESTC101

1. Documenting species, mapping trophic levels and constructing food chains/webs.
2. Construction of biomass and number pyramids from field data.
3. Estimation of primary productivity using the light and dark bottle method (aquatic) or Harvest method (terrestrial).
4. Quadrat and transect sampling for plant density, frequency, and abundance.
5. Calculation of Shannon-Wiener, Simpson, alpha, beta, and gamma diversity.
6. Use of GIS/Google Earth to assess land use changes and habitat fragmentation.
7. Estimation of tree biomass and carbon stock in a forest plot.
8. Comparative analysis of conventional vs organic/agroecological farms.
9. Interview and TEK documentation from local farmers.
10. Phenological observations of key indicator species.

SCHEME OF EXAMINATION

Practical Test	Time allotted for the examination	% Weightage (Marks)		Remarks
Mid Term appraisal	4 hours	25% (Total Marks=13)		After completion of 40% of syllabus Written Exam (9 marks) + Viva-voce (4 marks)
External Examination	4 hours	75%	50% (Total Marks=25)	Written Exam (20 marks) + Day to Day performance and Attendance (5 marks)
			25% (Total Marks=12)	Viva-Voce (8 Marks) + Practical file (4 marks)
Total		50		

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TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-I]

Examinations to be held in December 2025, 2026 & 2027

Course No.: P2ESPC112

Title: Lab Course-2 (Based on P2ESTC102)

Credits: 2

Maximum Marks : 50

Duration of Examination: 4 hrs

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with the experimental work based on Course No. PSESTC102

1. Sampling techniques for collecting surface and ground water samples for physico-chemical analysis.
2. To find out the amount of DO from water samples by Winkler method and plot the DO variations in lake water at different depths
3. To find out the amount of Cl^- in water samples by volumetric method.
4. To find out the amount of CO_3^{2-} and HCO_3^- from given water samples by volumetric method.
5. To find out the amount of Ca^{2+} and Mg^{2+} from given water samples by volumetric method.
6. To measure the flow of river/stream using the float method.
7. To study the temperature variations in lotic and lentic water bodies at different depths.
8. To find out the transparency of water by the Secchi Disc method.
9. To identify the given specimen of macrophytes and write their morphological characteristics.
10. Environmental monitoring and assessment of any of the fresh water sources (river / stream / lake / pond / spring).
11. To map visited aquatic ecosystems (pond/lake/springs/) on google earth.

SCHEME OF EXAMINATION

Practical Test	Time allotted for the examination	% Weightage (Marks)		Remarks
Mid Term appraisal	4 hours	25% (Total Marks=13)		After completion of 40% of syllabus Written Exam (9 marks) + Viva-voce (4 marks)
External Examination	4 hours	75%	50% (Total Marks=25)	Written Exam (20 marks) + Day to Day performance and Attendance (5 marks)
			25% (Total Marks=12)	Viva-Voce (8 Marks) + Practical file (4 marks)
Total		50		

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UNIVERSITY OF JAMMU
SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-I]

Examinations to be held in December 2025, 2026 & 2027

Course No.: P2ESPC113

Title: Lab Course-3 (Based on P2ESTC103)

Credits : 2

Maximum Marks : 50

Duration of Examination: 4 hrs

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with the experimental work based on Course No. P2ESTC103

1. Virtual tour on Google Earth to understand the local landforms and landuse.
2. Interpretation of satellite images (true and false colour composites).
3. Interpretation of topographical sheets.
4. Introduction to GPS, ground truthing and collection of GPS readings.
5. Introduction to QGIS interface, adding raster/vector layers, and viewing attribute tables.
6. Digitization of point, line, and polygon features from a georeferenced map and editing attribute data in QGIS.
7. Performing spatial analysis operations like buffer creation and overlay analysis in QGIS.
8. Preparation of a thematic map with proper map layout design, legend, scale, and export (as JPG/PNG/TIFF/PDF).
9. Exposure to Google earth Engine and the understanding case studies referring to Global Forest Cover Change, Global Surface Water and Tiger Habitat Monitoring
10. To find the height of a tree using Hypsometer.

SCHEME OF EXAMINATION

Practical Test	Time allotted for the examination	% Weightage (Marks)		Remarks
Mid Term appraisal	4 hours	25% (Total Marks=13)		After completion of 40% of syllabus Written Exam (9 marks) + Viva-voce (4 marks)
External Examination	4 hours	75%	50% (Total Marks=25)	Written Exam (20 marks) + Day to Day performance and Attendance (5 marks)
			25% (Total Marks=12)	Viva-Voce (8 Marks) + Practical file (4 marks)
Total		50		

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[SEMESTER-I]

Examinations to be held in December 2025, 2026 & 2027

Course No.: P2ESPC114

Title: Lab Course-4 (Based on P2ESTE104)

Credits: 2

Maximum Marks : 50

Duration of Examination: 4 hrs

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with experimental work based on Course No. P2ESTE104

1. To determine sources and composition of municipal solid waste (MSW) by collection and segregation of solid waste samples (organic, plastic, paper, glass, metal)
2. Measurement of moisture content of solid waste.
3. Measurement of calorific value of solid waste.
4. Classification of solid waste into biodegradable, recyclable, and inert categories.
5. To observe real-world operations of waste handling and disposal by visiting a municipal composting facility or hazardous waste incinerator and preparation of a detailed field report and process flow diagram.
6. Field visit to plastic recycling unit and preparation of a detailed field report and process.
7. Landfill Model Construction: To understand the design, operation, and environmental impacts and controls of sanitary landfills.
8. To simulate the identification, segregation, labelling, storage, and emergency response procedures for hazardous waste in compliance with safety regulations.
9. To design municipal waste management plan of campus/residential area/ housing colony.
10. Analyze and document case studies of successful waste management projects from India/world to learn best practices.

SCHEME OF EXAMINATION

Practical Test	Time allotted for the examination	% Weightage (Marks)		Remarks
Mid Term appraisal	4 hours	25% (Total Marks=13)		After completion of 40% of syllabus Written Exam (9 marks) + Viva-voce (4 marks)
External Examination	4 hours	75%	50% (Total Marks=25)	Written Exam (20 marks) + Day to Day performance and Attendance (5 marks)
			25% (Total Marks=12)	Viva-Voce (8 Marks) + Practical file (4 marks)
Total		50		

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[SEMESTER-I]

Examinations to be held in December 2025, 2026 & 2027

Course No.: P2ESPE115

Title: Lab Course-5 (Based on P2ESTE105)

Credits: 2

Maximum Marks : 50

Duration of Examination: 4 hrs

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with experimental work based on Course No. P2ESTE105

1. Explore vernacular building techniques (e.g., mud houses, stepwells) and Hands-on: Build a small model using local materials.
2. Visit to sacred groves to explore their ecological and cultural significance.
3. Field visit to a traditional water harvesting system to observe, document, and understand the design, function, and cultural relevance of traditional water harvesting systems, and evaluate their role in modern water conservation.
4. To observe, document, and evaluate the ecological, hydrological, and cultural significance of natural springs in traditional water management—especially in hilly or tribal regions.
5. To visit traditional farms to identify, document, and analyze traditional farming techniques in a local context and assess their ecological, economic, and cultural relevance today.
6. Exploring Traditional Architecture and its relevance in modern day sustainable architecture.
7. Mapping and documentation of sacred ecological practices
8. Field visit to an Ayurvedic center or medicinal plant garden. Identify and document any ten local medicinal plants.
9. Documentation of case studies from India where traditional knowledge has been successfully integrated into green solutions.

SCHEME OF EXAMINATION

Practical Test	Time allotted for the examination	% Weightage (Marks)		Remarks
Mid Term appraisal	4 hours	25% (Total Marks=13)		After completion of 40% of syllabus Written Exam (9 marks) + Viva-voce (4 marks)
External Examination	4 hours	75%	50% (Total Marks=25)	Written Exam (20 marks) + Day to Day performance and Attendance (5 marks)
			25% (Total Marks=12)	Viva-Voce (8 Marks) + Practical file (4 marks)
Total		50		

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TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-II]

Examinations to be held in May 2026, 2027 & 2028

Course No.: P2ESTC201

Credits: 4

Duration of Examination: 3 hrs

**Title: Environmental Pollution:
Chemistry and Control**

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

Objectives:

The objective of this course is to make the students understand environmental pollution and its types: air, water, soil, and noise, Identify primary and secondary pollutants and their sources. This course is designed to equip the students with the knowledge and skills to understand the chemical reactions in the atmosphere, hydrosphere, and lithosphere and develop analytical and monitoring skills for environmental pollution.

UNIT 1: AIR POLLUTION

- 1.1. Overview of air pollution: types and classification, criteria pollutants
- 1.2. Transport and fate of air pollutants; Gaussian plume model
- 1.3. Air quality standards (WHO, NAAQS); Air Quality Index (AQI)
- 1.4. Air pollution control technologies; gaseous and particulate pollutants

UNIT 2: WATER POLLUTION

- 2.1. Overview of water pollution: Types and classification
- 2.2. Transport and fate of water pollutants
- 2.3. Groundwater contamination and modeling
- 2.4. Water pollution control technologies; sewage treatment plants, effluent treatment plants

UNIT 3: SOIL / LAND POLLUTION

- 3.1. Overview of soil pollution: Types and classification
- 3.2. Fate and transport of soil pollutants
- 3.3. Pollutant Interaction with soil minerals and organic matter
- 3.4. Control, remediation and management strategies for soil/land pollution

UNIT 4: MISCELLANEOUS POLLUTION TYPES

- 4.1. Sources, impact and control of thermal and light pollution
- 4.2. Oil pollution: sources of oil spillage and impact, factors affecting fate of oil spillage
- 4.3. Noise pollution: types, sources, consequences; measurement of noise pollution. threshold hearing level and abatement measures
- 4.4. Radioactive Pollution: types, sources, consequences; disposal and management of radioactive waste

UNIT 5: POLLUTION MONITORING AND CONTROL: FUTURE TRENDS

- 5.1. Isotope tracing for source identification of pollutants
- 5.2. IoT and AI in Pollution monitoring studies; GIS applications
- 5.3. Use of drones and machine learning for pollution pattern detection
- 5.4. Climate-smart pollution control strategies

LITERATURE RECOMMENDED

1. De A.K. (2001). *Environmental Chemistry*, New Age International Publishers, New Delhi.
2. Andrew D. Eaton, Lenore S. Glesceri, Eugene W. Rice and Arnold E. Greenberg (Eds) (2005). *Standards Methods for the Examination of Water and Wastewater Analysis. 21st Edition*, APHA, Washington DC.
3. Dara S. S (1998). *A Textbook of Environmental Chemistry and Pollution Control*, S. Chand & Company Ltd, New Delhi.
4. Fifield F. W. (2000). *Environmental Analytical Chemistry*. 2nd edition, Blackwell Publishers.

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[SEMESTER-II]

Examinations to be held in May 2026, 2027 & 2028

Course No.: P2ESTC201

Credits: 4

Duration of Examination: 3 hrs

Title: Environmental Pollution:
Chemistry and Control

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

5. Howard S Peavy (2003). *Environmental Engineering*, Tata Mc Graw Hill Publishing Company Ltd., New Delhi.
6. Julian E Andrews et al (2004). *An Introduction to Environmental Chemistry*, Blackwell Publishing.
7. Sawyer C.N., Mc Carty P. L., and Parkin, G. F (2003). *Chemistry for Environmental Engineering and Science*, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
8. S. E. Manahan (2009). *Fundamentals of Environmental Chemistry*, CRC Press, USA.
9. Stanley E. Manahan (2010). *Environmental Chemistry*, 9th Edition, CRC Press, London.
10. Lawrence K. Wang, Yung-Tse Hung, Nazih K. Shamma (2009) *Handbook of Advanced Industrial and Hazardous Wastes Treatment*. CRC Press.
11. Lawrence K. Wang, Norman C. Pereira, Yung-Tse Hung (2005) *Advanced Air and Noise Pollution Control*. Springer.
12. Martin B. Hocking (2005) *Handbook of Chemical Technology and Pollution Control*. Elsevier.
13. Spellman, F. R, 2021. *The Science of Environmental Pollution*, 4th Edition, CRC Press
14. Masters, G. M. (2014). *Introduction to Environmental Engineering and Science*, 3rdEdn. Englewood Cliffs, NJ: Prentice Hall.

SCHEME OF EXAMINATION

The theory paper will carry 100 marks and the distribution of marks in each theory paper shall be as under:

MCQ on LMS+ Subjective Test	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Minor I (after 30 days)	20%	1 hour	10 (MCQs on LMS) 10 (Subjective-type)
Minor II (after 60 days)	21-40%	1 hour	10 (MCQs on LMS) 10 (Subjective-type)
Major test (after 90 days)	100%	3 hours	60
	Total		100

Minor Examination: Question paper will have two parts viz., Part-I (MCQs on LMS) and Part-II (subjective-type). Part-I is compulsory and will consist of ten (10) multiple choice questions of one (01) mark each. Part-II will consist of three (03) short answer type questions of five (05) marks each, out of which two questions are to be attempted.

Major Examination: Question paper will have two sections, Section-A and Section-B. Section-A will be compulsory, comprising of eight (08) short answer type questions (minimum 01 from each unit) of three (03) marks each. Section B will consist of three (03) long answer type questions from last three units with internal choice of twelve (12) marks each.

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TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-II]

Examinations to be held in May 2026, 2027 & 2028

Course No.: P2ESTC202

Credits: 4

Duration of Examination: 3 hrs

Title: Biodiversity and Wildlife

Ecology

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

Objectives:

Biodiversity and its components help in maintaining the ecological balance of nature and provides immense resources to various stakeholders. There is a growing concern of biodiversity loss across the globe. The course is intended to teach students regarding the status of biodiversity, its distribution, threats it encounters and the mitigative measures for its conservation and management at regional, national, and international levels.

UNIT 1: FUNDAMENTALS OF BIODIVERSITY

- 1.1. Biodiversity: Definition, concept, and types of biodiversity
- 1.2. Patterns and distribution of biodiversity at spatial and temporal scales
- 1.3. Evolution of biodiversity: Factors promoting biodiversity, global biodiversity, hotspots / coldspots and endemism
- 1.4. Ecosystem services and values of biodiversity: Intrinsic, consumptive, productive use, social, ethical, aesthetic and option values

UNIT 2: BIODIVERSITY: THREATS AND CONSERVATION

- 2.1. Causes, patterns, and consequences of biodiversity loss
- 2.2. Biodiversity conservation: Methods, practices, and strategies
- 2.3. Biodiversity management: Ecosystem restoration and management practices
- 2.4. National and international efforts for biodiversity conservation

UNIT 3: INTRODUCTION TO WILDLIFE

- 3.1. Wildlife: Definition, concept, and importance of wildlife
- 3.2. Plant systematics: Characteristics and broad classification of plants (algae to angiosperms)
- 3.3. Animal systematics: characteristics and broad classification of animals (invertebrates and vertebrates)
- 3.4. Wildlife forensics: Protocols for species identification

UNIT 4: WILDLIFE ECOLOGY AND MANAGEMENT

- 4.1. Concept of population ecology, habitat ecology, landscape ecology, nutritional ecology vis- a- vis terrestrial wildlife
- 4.2. Monitoring wildlife: Sampling design for population estimation
- 4.3. Human wildlife interactions: Implications and mitigative strategies
- 4.4. Wildlife conservation and management: Techniques and strategies

UNIT 5: STATUS AND DISTRIBUTION OF WILDLIFE IN INDIA

- 5.1. Zoo-geographic regions vis-a-vis mammalian distribution in India
- 5.2. Protected Area Network in India with special reference to Jammu and Kashmir
- 5.3. Species of global concern (RET species) in India and Jammu and Kashmir
- 5.4. Citizen science and its role in wildlife conservation in India: Introduction to eBird and iNaturalist

LITERATURE RECOMMENDED

1. Cain, James W., Paul R. Krausman (2022). *Wildlife Management and Conservation: Contemporary Principles and Practices*, John Hopkins University Press.
2. Decker, D. J.; Riley, S. J. and Siemer, W. F. (Eds.) (2012). *Human Dimensions of Wildlife Management*. JHU Press.

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TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-II]

Examinations to be held in May 2026, 2027 & 2028

Course No.: P2ESTC202

Credits: 4

Duration of Examination: 3 hrs

Title: Biodiversity and Wildlife Ecology

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

3. Fryxell John M., Anthony R.E., and Grame Coughley (2014) *Wildlife Ecology, Conservation, and Management*, Wiley Blackwell
4. George A. Feldhamer, Joseph F. Merritt, Carey Krajewski, Janet L. Rachlow (2020). *Mammalogy – Adaptation, Diversity, Ecology (Fifth Edition)*, John Hopkins University Press.
5. Gopal, R. (2021). *Fundamentals of Wildlife Management*. Natraj Publishers
6. Hosetti, B. B. (2014). *Concepts in Wildlife Management*. 3rd Ed., Daya Publishing House.
7. Kant, S. and Alavalapati, J. (Eds.) (2014). *Handbook of Forest Resource Economics*. Routledge.
8. Koprowski, J. L. and Krausman, P. R. (Eds.) (2019). *International Wildlife Management: Conservation Challenges in a Changing World*. JHU Press.
9. Krausman, P. R.; Cain III, J. W. and Cain, J. W. (Eds.) (2013). *Wildlife Management and Conservation: Contemporary Principles and Practices*. JHU Press.
10. McComb, B. C. (2015). *Wildlife Habitat Management: Concepts and Applications in Forestry*. CRC Press.
11. Nova J. Silvy (2020). *The Wildlife Techniques Manual – Volume 1: Research. Volume 2: Management.: Volumes 1 and 2 (Eighth Edition)*, Johns Hopkins University Press

SCHEME OF EXAMINATION

The theory paper will carry 100 marks and the distribution of marks in each theory paper shall be as under:

MCQ on LMS+ Subjective Test	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Minor I (after 30 days)	20%	1 hour	10 (MCQs on LMS) 10 (Subjective-type)
Minor II (after 60 days)	21-40%	1 hour	10 (MCQs on LMS) 10 (Subjective-type)
Major test (after 90 days)	100%	3 hours	60
	Total		100

Minor Examination: Question paper will have two parts viz., Part-I (MCQs on LMS) and Part-II (subjective-type). Part-I is compulsory and will consist of ten (10) multiple choice questions of one (01) mark each. Part-II will consist of three (03) short answer type questions of five (05) marks each, out of which two questions are to be attempted.

Major Examination: Question paper will have two sections, Section-A and Section-B. Section-A will be compulsory, comprising of eight (08) short answer type questions (minimum 01 from each unit) of three (03) marks each. Section B will consist of three (03) long answer type questions from last three units with internal choice of twelve (12) marks each.

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TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-II]

Examinations to be held in May 2026, 2027 & 2028

Course No.: P2ESTC203

Credits: 4

Duration of Examination: 3 hrs

Title: Physical Environment

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

Objectives:

This course is designed to provide students with a foundational understanding of the Earth's internal structure and the geomorphological processes that drive the formation, transformation, and modification of landforms. It explores the dynamic systems—both endogenic and exogenic—that shape the physical landscape. The course also introduces the fundamental principles of climatology, focusing on the distribution of atmospheric temperature and pressure and global and local wind systems. By integrating earth system science with climatological perspectives, this course enables students to critically analyze the interactions between natural processes and human environments, laying the groundwork for informed environmental decision-making and sustainable management practices.

UNIT 1: BASICS OF GEOSCIENCE

- 1.1. Concept of seismology, types of seismic waves and their role in the study of Earth's interior
- 1.2. Different zones in the Earth's interior and their composition based on diverse criteria
- 1.3. Characteristics and classification of sedimentary and igneous rocks
- 1.4. Characteristics and classification of metamorphic rocks; Rock cycle

UNIT 2: EARTH SYSTEM PROCESSES

- 2.1. Folds: Structure, components and types
- 2.2. Faults: Structure, components and types
- 2.3. The Earth's magnetic field - Magnetic reversal and magnetic anomaly
- 2.4. Volcanism - Components and types of volcanoes, volcanic materials, process and effects of volcanism

UNIT 3: GEOMORPHOLOGICAL SYSTEMS

- 3.1. Fluvial system - Factors affecting stream erosion and deposition, erosional and depositional landforms
- 3.2. Underground water system - Water table, landforms formed by groundwater action
- 3.3. Aeolian system - Mechanism of wind erosion, erosional and depositional landforms
- 3.4. Glacial system - Mechanism of glacial erosion, erosional and depositional landforms

UNIT 4: CLIMATOLOGY: BASICS AND TEMPERATURE DISTRIBUTION

- 4.1. Composition and layered structure of the atmosphere
- 4.2. Insolation: Definition, factors governing insolation
- 4.3. Heat budget of the Earth
- 4.4. Factors determining the horizontal distribution of temperature

UNIT 5: ATMOSPHERIC PRESSURE AND WIND SYSTEMS

- 5.1. Factors controlling pressure, horizontal distribution of pressure
- 5.2. Factors controlling wind
- 5.3. Wind system: classification, types of planetary winds
- 5.4. Local winds and types

LITERATURE RECOMMENDED

1. Bierman, P. R. and Montgomery, D. (2014). *Key Concepts in Geomorphology*, Macmillan Higher Education Company, New York.
2. Huggett, R. J. (2016). *Fundamentals of Geomorphology*. Routledge, London.
3. Keller, E. A. (1999). *Introduction to Environmental Geology*. Prentice-Hall, New Jersey.

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SYLLABUS FOR

TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-II]

Examinations to be held in May 2026, 2027 & 2028

Course No.: P2ESTC203

Credits: 4

Duration of Examination: 3 hrs

Title: Physical Environment

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

4. Press, F., Siever, R., Grotzinger, J. and Jordan, T. H. (2003). *Understanding Earth*. 4th Ed. W. H. Freeman & Co. U.S.A.
5. Singh, S. (2020). *Physical Geography*. Pravalika Publications, Prayagraj.
6. Smithson, P.; Addison, K. and Atkinson, K. (2008). *Fundamentals of the Physical Environment*. 4th Ed., Routledge Publishers, London.
7. Strahler, A. H. (2013). *Introducing Physical Geography*. 6th Ed., John Wiley & Sons, New York.
8. Thornbury, W.D. (2018). *Principles of Geomorphology*. New Age International Publishers, New Delhi.
9. Barry, R. G. and Carleton, A. M. (2001). *Synoptic and Dynamic Climatology*, Routledge, London.
10. Critchfield, J. H. (1993). *General Climatology*. Prentice-Hall, New Delhi, India.
11. Gilbert, L. (2019). *Climatology and Weather forecasting- An Integrated Approach*. Syrawood Publishing House, U.S.A.
12. Lutgens, F. K.; Tarbuck, E. J. and Tasa, D. (2009). *The Atmosphere: An Introduction to Meteorology*, Prentice-Hall, Englewood Cliffs, New Jersey.
13. McKnight, T. L. (1993). *Physical Geography - A Landscape Appreciation*. Prentice-Hall, New Jersey.
14. Smithson, P.; Addison, K. and Atkinson, K. (2002). *Fundamentals of the Physical Environment*. Routledge Publishers, London.

SCHEME OF EXAMINATION

The theory paper will carry 100 marks and the distribution of marks in each theory paper shall be as under:

MCQ on LMS+ Subjective Test	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Minor I (after 30 days)	20%	1 hour	10 (MCQs on LMS) 10 (Subjective-type)
Minor II (after 60 days)	21-40%	1 hour	10 (MCQs on LMS) 10 (Subjective-type)
Major test (after 90 days)	100%	3 hours	60
	Total		100

Minor Examination: Question paper will have two parts viz., Part-I (MCQs on LMS) and Part-II (subjective-type). Part-I is compulsory and will consist of ten (10) multiple choice questions of one (01) mark each. Part-II will consist of three (03) short answer type questions of five (05) marks each, out of which two questions are to be attempted.

Major Examination: Question paper will have two sections, Section-A and Section-B. Section-A will be compulsory, comprising of eight (08) short answer type questions (minimum 01 from each unit) of three (03) marks each. Section B will consist of three (03) long answer type questions from last three units with internal choice of twelve (12) marks each.



UNIVERSITY OF JAMMU
SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-II]

Examinations to be held in May 2026, 2027 & 2028

Course No.: P2ESTC204

Credits: 4

Duration of Examination: 3 hrs

Title: Environmental Geochemistry

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

Objectives:

This course is designed to introduce students to the principles of environmental geochemistry and elemental cycles in Earth's reservoirs and basics of soil science. It aims to provide a comprehensive understanding of geochemical processes in soil formation, mineral weathering, and water systems and develop an understanding on soil genesis and evolution, the key physical and chemical properties of soils, evaluate relationship between soil properties and nutrient cycling. Students will also be able to analyze the sources, pathways, and effects of contaminants.

UNIT 1: FUNDAMENTALS OF ENVIRONMENTAL GEOCHEMISTRY

- 1.1. Principles and scope of Environmental Geochemistry; Earth's geochemical reservoirs and elemental cycles (carbon, nitrogen, sulfur, phosphorus)
- 1.2. Geochemical distribution of elements in rocks: major, minor, trace elements; Weathering processes and elemental redistribution: chemical, physical, and biological weathering
- 1.3. Mineralogical controls: primary and secondary minerals, mineral structure, stability, and solubility
- 1.4. Types of geochemical reactions (acid-base, complexation, precipitation-dissolution), Redox processes in natural systems

UNIT 2: SOIL GENESIS, CLASSIFICATION, AND PHYSICAL PROPERTIES

- 2.1. Soil concepts: pedological and edaphological concepts
- 2.2. Factors influencing soil genesis; Soil profile development and horizon differentiation
- 2.3. Soil architecture and physical properties (textural classes, pore space, particle density etc.)
- 2.4. International soil classification systems: World Reference Base (WRB), USDA Soil Taxonomy, and ICAR classification. Major soil types of India

UNIT 3: SOIL CHEMISTRY AND GEOCHEMICAL INTERACTIONS

- 3.1. Soil organic matter: Origin, structure, properties and decomposition.
- 3.2. Soil mineralogy: role of clay minerals, silicate groups, and their geochemical reactivity; Soil-organic matter interactions: complexation, adsorption-desorption mechanisms
- 3.3. Soil pH and buffering capacity; role in nutrient solubility and availability. Soil temperature: thermal properties, seasonal variation, influence on chemical processes
- 3.4. Soil colloids: types (inorganic and organic), surface charge, cation and anion exchange capacity (CEC & AEC)

UNIT 4: SOIL CHEMISTRY OF AERATION, ACIDITY, AND NUTRIENT DYNAMICS

- 4.1. Soil aeration and gas exchange: mechanisms, factors, and influence on microbial and root activities
- 4.2. Soil acidity: sources (active, exchangeable, residual), acidification processes, and liming materials
- 4.3. Chemistry of salt-affected soils: saline, sodic, saline-sodic soils; formation, diagnostics, and management
- 4.4. Soil macro and micronutrients; Nitrogen and Sulfur economy of soils, soil fertility evaluation and integrated nutrient management

UNIT-V: CONTAMINANT GEOCHEMISTRY AND POLLUTION

- 5.1. Sources, behaviour, and fate of major environmental pollutants (heavy metals, PAHs, pesticides)
- 5.2. Sources of trace elements in soils, trace element problems in crops and livestock. Assessment of metal pollution in soils, sources and types of metal pollution.
- 5.3. Geochemical pathways of contaminants; Acid mine drainage, saline intrusion, radionuclide geochemistry
- 5.4. Risk assessment and geochemical criteria for remediation

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UNIVERSITY OF JAMMU
SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-II]

Examinations to be held in May 2026, 2027 & 2028

Course No.: P2ESTC204

Credits: 4

Duration of Examination: 3 hrs

Title: Environmental Geochemistry

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

LITERATURE RECOMMENDED

1. Carter, M. R. (Ed.). (1993). *Soil sampling and methods of analysis*. CRC Press.
2. Conklin, A. R. (2013). *Introduction to soil chemistry: Analysis and instrumentation*. John Wiley & Sons.
3. Essington, M. E. (2015). *Soil and water chemistry: an integrative approach*. CRC press.
4. Foth, H. D. (1978). Fundamentals of Soil Science. *Soil Science*, 125(4), 272.
5. Horton, R. E. (1941). An approach toward a physical interpretation of infiltration-capacity. *Soil Science Society of America Journal*, 5(C), 399-417.
6. Mason, B., & Moore, C. B. (1985). Principles of geochemistry.
7. McSween, H. Y., Richardson, S. M., & Uhle, M. E. (2003). *Geochemistry: pathways and processes*. Columbia University Press.
8. Millar, C. E., & Turk, L. M. (2002). *Fundamentals of soil science*. Daya Books.
9. Sparks, D. L. (2003). *Environmental soil chemistry*. Academic press.
10. White, R. E. (2013). *Principles and practice of soil science: the soil as a natural resource*. John Wiley & Sons.
11. White, W. M. (2020). *Geochemistry*. John Wiley & Sons.

SCHEME OF EXAMINATION

The theory paper will carry 100 marks and the distribution of marks in each theory paper shall be as under:

MCQ on LMS+Subjective Test	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Minor I (after 30 days)	20%	1 hour	10 (MCQs on LMS) 10 (Subjective-type)
Minor II (after 60 days)	21-40%	1 hour	10 (MCQs on LMS) 10 (Subjective-type)
Major test (after 90 days)	100%	3 hours	60
	Total		100

Minor Examination: Question paper will have two parts viz., Part-I (MCQs on LMS) and Part-II (subjective-type). Part-I is compulsory and will consist of ten (10) multiple choice questions of one (01) mark each. Part-II will consist of three (03) short answer type questions of five (05) marks each, out of which two questions are to be attempted.

Major Examination: Question paper will have two sections, Section-A and Section-B. Section-A will be compulsory, comprising of eight (08) short answer type questions (minimum 01 from each unit) of three (03) marks each. Section B will consist of three (03) long answer type questions from last three units with internal choice of twelve (12) marks each.

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TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-II]

Examinations to be held in May 2026, 2027 & 2028

Course No.: P2ESTE205

Credits: 4

Duration of Examination: 3 hrs

Title: Environmental Economics and Auditing

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

Objectives:

The course aims to develop understanding of the interrelationship between economics and the environment. It will help students to examine tools and methods of environmental valuation and economic instruments for environmental management. It aims at imparting skills in conducting environmental audits and understanding sustainability reporting. It will promote critical thinking in policy evaluation and decision-making related to sustainable development.

UNIT 1: FUNDAMENTALS OF ENVIRONMENTAL ECONOMICS

- 1.1. Introduction to Environmental Economics: Basic concepts, scope, and relevance to environmental sciences
- 1.2. Economy–Environment Interactions: Natural resources, ecological systems, and economic growth
- 1.3. Market Failures and Externalities: Public goods, external costs/benefits, tragedy of the commons
- 1.4. Sustainable Development: Definitions, indicators, and approaches (weak vs. strong sustainability)

UNIT 2: ENVIRONMENTAL VALUATION AND COST–BENEFIT ANALYSIS

- 2.1. Valuation of Environmental Goods and Services: Use and non-use values, Total Economic Value (TEV)
- 2.2. Valuation Techniques: Contingent valuation, travel cost, hedonic pricing, and choice modelling
- 2.3. Cost–Benefit Analysis (CBA): Discounting, risk, and uncertainty, case studies
- 2.4. Natural capital accounting and green GDP: Concepts and applications at national and international level

UNIT 3: ENVIRONMENTAL POLICY INSTRUMENTS AND GOVERNANCE

- 3.1. Economic Instruments: Taxes, subsidies, tradable permits, pollution charges
- 3.2. Command-and-Control Approaches: Regulations, standards, and enforcement challenges
- 3.3. Environmental Policies in India: Legal framework, EIA policy, fiscal instruments
- 3.4. Global Environmental Governance: Role of UNEP, IPCC, World Bank, WTO, and MEAs

UNIT 4: ENVIRONMENTAL AUDITING AND MANAGEMENT SYSTEMS

- 4.1. Concept and types of environmental audits: Compliance, performance, and risk-based audits
- 4.2. Audit Protocols and Methodologies: ISO 14001, Environmental Management System, Life Cycle Assessment (LCA)
- 4.3. Audit process: Planning, execution, reporting, follow-up
- 4.4. Case studies: Industrial, institutional, and municipal environmental audits

UNIT 5: CONTEMPORARY ISSUES AND PRACTICAL APPLICATIONS

- 5.1. Climate change economics: Carbon markets, green credits, social cost of carbon
- 5.2. Circular economy and resource efficiency: Concepts, metrics, and business models
- 5.3. Sustainability reporting and environmental and Social Governance
- 5.4. Skill Module: Preparation of environmental audit report; group project or fieldwork

LITERATURE RECOMMENDED

1. Gupta, N. (2008). *Environmental Accounting, Auditing and Reporting*. Sultan Chand & Sons.
2. Hanley, N., Shogren, J. F., & White, B. (2013). *Environmental Economics: In Theory and Practice*. Palgrave Macmillan.
3. Pearce, D. W., & Turner, R. K. (1990). *Economics of Natural Resources and the Environment*. Johns Hopkins University Press.

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SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-II]

Examinations to be held in May 2026, 2027 & 2028

Course No.: P2ESTE205

Title: Environmental Economics
and Auditing

Credits: 4

Maximum Marks : 100

Duration of Examination: 3 hrs

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

4. Tietenberg, T. H., & Lewis, L. (2018). *Environmental & Natural Resource Economics*. Routledge.
5. UNEP, ISO, and GRI publications on environmental auditing and sustainability reporting.

SCHEME OF EXAMINATION

The theory paper will carry 100 marks and the distribution of marks in each theory paper shall be as under:

MCQ on LMS+Subjective Test	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Minor I (after 30 days)	20%	1 hour	10 (MCQs on LMS) 10 (Subjective-type)
Minor II (after 60 days)	21-40%	1 hour	10 (MCQs on LMS) 10 (Subjective-type)
Major test (after 90 days)	100%	3 hours	60
	Total		100

Minor Examination: Question paper will have two parts viz., Part-I (MCQs on LMS) and Part-II (subjective-type). Part-I is compulsory and will consist of ten (10) multiple choice questions of one (01) mark each. Part-II will consist of three (03) short answer type questions of five (05) marks each, out of which two questions are to be attempted.

Major Examination: Question paper will have two sections, Section-A and Section-B. Section-A will be compulsory, comprising of eight (08) short answer type questions (minimum 01 from each unit) of three (03) marks each. Section B will consist of three (03) long answer type questions from last three units with internal choice of twelve (12) marks each.

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[SEMESTER-II]

Examinations to be held in May 2026, 2027 & 2028

Course No.: P2ESPC211

Title: Lab Course-1 (Based on P2ESTC201)

Credits: 2

Maximum Marks : 50

Duration of Examination: 4 hrs

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with experimental work based on Course No. P2ESTC201

1. To determine the Biological Oxygen Demand (BOD) in given water sample.
2. To determine the Chemical Oxygen Demand (COD) in given water sample.
3. To determine the nitrate concentration in different water samples (tap/sewage/lake).
4. To estimate Suspended Particulate Matter (SPM) in ambient air.
5. To measure the noise level in different environments by sound level meter (SLM).
6. To compare the results of Environmental parameters (air or water) with permissible limits set by WHO, CPCB, and BIS.
7. To visit the Sewage Treatment Plant (STP) and write about the treatment methods.
8. To visit a drinking water treatment plant and write about the treatment methods.
9. To visit a dumping site and write a note on the environmental pollution problems resulting from the disposal of solid waste.
10. Geotag and map air/water contamination hotspots using QGIS.
11. Finding air quality index based on given data.
12. Exercises based on modeling dispersion of pollutants using Gaussian plume model.

SCHEME OF EXAMINATION

Practical Test	Time allotted for the examination	% Weightage (Marks)		Remarks
Mid Term appraisal	4 hours	25% (Total Marks=13)		After completion of 40% of syllabus Written Exam (9 marks) + Viva-voce (4 marks)
External Examination	4 hours	75%	50% (Total Marks=25)	Written Exam (20 marks) + Day to Day performance and Attendance (5 marks)
			25% (Total Marks=12)	Viva-Voce (8 Marks) + Practical file (4 marks)
Total		50		

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UNIVERSITY OF JAMMU
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[SEMESTER-II]

Examinations to be held in May 2026, 2027 & 2028

Course No.: P2ESPC212

Title: Lab Course-2 (Based on P2ESTC202)

Credits: 2

Maximum Marks : 50

Duration of Examination: 4 hrs

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with experimental work based on Course No. P2ESTC202

1. Make a rapid assessment of terrestrial faunal species (reptiles, birds and mammals) within and nearby areas of the University Campus.
2. Make a rapid assessment of lepidoptera (butterflies and moths) within and nearby areas of the University Campus.
3. Make a (respective ward wise) inventory of urban biodiversity of Jammu
4. Mark the Protected Area Network of Jammu and Kashmir on the map
5. Sampling techniques: Forests and vegetation structure, phytosociology, and ecological classification
6. Wildlife monitoring: Field protocols (transect sampling) for population estimation of mammals, birds, and butterflies
7. Wildlife monitoring: Camera trapping for population estimation of mammals
8. Data collation and analysis using statistical software (occupancy and diversity attributes)
9. Citizen Science in bird monitoring
10. Preparation of People Biodiversity Registers (PBR)
11. Understanding management perspective of a nearby Ex-situ conservation site (Jambu Zoo)
12. Visit to nearby Nature Interpretation Center (Eco-Vista, Raika, Jambu Zoo)

SCHEME OF EXAMINATION

Practical Test	Time allotted for the examination	% Weightage (Marks)		Remarks
Mid Term appraisal	4 hours	25% (Total Marks=13)		After completion of 40% of syllabus Written Exam (9 marks) + Viva-voce (4 marks)
External Examination	4 hours	75%	50% (Total Marks=25)	Written Exam (20 marks) + Day to Day performance and Attendance (5 marks)
			25% (Total Marks=12)	Viva-Voce (8 Marks) + Practical file (4 marks)
Total		50		

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UNIVERSITY OF JAMMU
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TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-II]

Examinations to be held in May 2026, 2027 & 2028

Course No.: P2ESPC213

Title: Lab Course-3 (Based on P2ESTC203)

Credits: 2

Maximum Marks : 50

Duration of Examination: 4 hrs

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with the experimental work based on Course No. P2ESTC203

1. To study types and coding of meteorological laboratories.
2. Selection of site and layout for instruments in an agro meteorological laboratory.
3. To understand the concept of air masses and air front and their representation on weather map.
4. To draw wind roses with given data.
5. Visit to a meteorological observatory at SKUAST-Jammu. To study the components and working of Automatic Weather Station (AWS).
6. Visit to a Doppler Weather Radar (DWR) system at IMD, Jammu.
7. To draw a climograph based on given data.
8. To draw a hythergraph based on given data.
9. To study various landforms shaped by the fluvial erosion and deposition.
10. To compute the sinuosity index of a river segment and analyze the degree of meandering.
11. To calculate intensity of rainfall during successive time periods and categorize the type of rainfall according to intensity.
12. Identification of various symbols used in the weather map.
13. Decoding of synoptic elements plotted on a weather map.

SCHEME OF EXAMINATION

Practical Test	Time allotted for the examination	% Weightage (Marks)		Remarks
Mid Term appraisal	4 hours	25% (Total Marks=13)		After completion of 40% of syllabus Written Exam (9 marks) + Viva-voce (4 marks)
External Examination	4 hours	75%	50% (Total Marks=25)	Written Exam (20 marks) + Day to Day performance and Attendance (5 marks)
			25% (Total Marks=12)	Viva-Voce (8 Marks) + Practical file (4 marks)
Total		50		

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[SEMESTER-II]

Examinations to be held in May 2026, 2027 & 2028

Course No.: P2ESPC214

Title: Lab Course-4 (Based on P2ESTE204)

Credits: 2

Maximum Marks : 50

Duration of Examination: 4 hrs

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with the experimental work based on Course No. P2ESTE204

1. Sampling techniques for collection of soil samples
2. Collection of surface sediments for determination of heavy metal toxicity.
3. Preparation of soil samples for analysis.
4. Particle size analysis of soil sediments
5. To determine water soluble major ions in soil using Ion chromatograph.
6. Acid digestion of soil samples using microwave digestion.
7. Determination of loss on ignition in given soil sample.
8. Estimation of organic carbon in a given soil sample
9. Determination of available nitrogen in soils.
10. Determination of the cation exchange capacity (CEC) of soil.
11. Determination of available phosphorus in soil.
12. Determination of available potassium in soil.
13. Determination of alkali and alkaline earth metals in soil using flame photometry.

SCHEME OF EXAMINATION

Practical Test	Time allotted for the examination	% Weightage (Marks)		Remarks
Mid Term appraisal	4 hours	25% (Total Marks=13)		After completion of 40% of syllabus Written Exam (9 marks) + Viva-voce (4 marks)
External Examination	4 hours	75%	50% (Total Marks=25)	Written Exam (20 marks) + Day to Day performance and Attendance (5 marks)
			25% (Total Marks=12)	Viva-Voce (8 Marks) + Practical file (4 marks)
Total		50		

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[SEMESTER-II]

Examinations to be held in May 2026, 2027 & 2028

Course No.: P2ESPE215

Title: Lab Course-5 (Based on P2ESTE205)

Credits: 2

Maximum Marks : 50

Duration of Examination: 4 hrs

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with the experimental work based on Course No. PSESTE205

1. Identify and classify local natural resources (renewable/non-renewable).
2. Collect and analyze SDG indicators for a region.
3. Study and interpret India's Green GDP or State of Environment reports
4. Review and present summaries of Indian Environmental Policies (e.g., Environment Protection Act, EIA Notification)
5. Develop audit checklists for different sectors (industrial, institutional).
6. Conduct mini audits of selected campus facilities (e.g., energy use, waste management).
7. Calculate carbon footprint using online tools (e.g., carbonfootprint.com).
8. Analyze case studies of Indian companies implementing circular economy practices.
9. Develop business model canvas for a hypothetical circular product.

SCHEME OF EXAMINATION

Practical Test	Time allotted for the examination	% Weightage (Marks)		Remarks
Mid Term appraisal	4 hours	25% (Total Marks=13)		After completion of 40% of syllabus Written Exam (9 marks) + Viva-voce (4 marks)
External Examination	4 hours	75%	50% (Total Marks=25)	Written Exam (20 marks) + Day to Day performance and Attendance (5 marks)
			25% (Total Marks=12)	Viva-Voce (8 Marks) + Practical file (4 marks)
Total		50		

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UNIVERSITY OF JAMMU
SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-III]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P2ESTC301

Credits: 4

Duration of Examination: 3 hrs

Title: Environmental Impact

Assessment and Disaster Management

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

Objectives:

The Environment Impact Assessment is among the tools which in recent years have been employed widely to determine the impacts of various activities on the environment with a view to avoid or mitigate such impacts. Deterioration in environmental quality increased with the increase in human activities. The main purpose of this course is to apprise the students of various principles and methodologies used for Environmental Impact Assessment and the consequences of developmental projects and other human activities, both detrimental and beneficial, on the different parameters of environment in order to enhance their understanding and decision-making ability for optimal management.

UNIT 1: BASIC CONCEPTS OF ENVIRONMENTAL IMPACT ASSESSMENT

- 1.1. Environmental Impact Assessment (EIA): concept, objectives, and origin with respect to India
- 1.2. Legal, policy and regulatory framework of EIA in India
- 1.3. EIA; Types, procedures and methodologies
- 1.4. Environmental components of EIA

UNIT 2: ENVIRONMENTAL APPRAISAL, IMPACT ASSESSMENT AND CLEARANCE

- 2.1. Environmental health impact assessment and risk analysis (air, water and soil quality)
- 2.2. Environmental impact statement and clearance: components and procedures
- 2.3. Social dynamics of environmental impact assessment
- 2.4. Case studies: River valley projects, mining projects, cement industry and civil infrastructure projects (one each)

UNIT 3: ENVIRONMENTAL MANAGEMENT

- 3.1. Environmental Management Plan, an outcome of EIA: components and significance
- 3.2. Environmental Management System and auditing: concept, components and guidelines in India
- 3.3. Environmental priorities *vis-a-vis* Sustainable Development Goals (SDGs) in India
- 3.4. Concept of green / smart cities: attributes and success stories

UNIT 4: DISASTERS – CHARACTERISTICS AND ATTRIBUTES

- 4.1. Disaster: concept of hazards and disasters, types and characteristics
- 4.2. Natural disasters: causes, consequences and management with respect to India
- 4.3. Human induced disasters: causes, consequences and management in global context
- 4.4. Warfare and technological disasters – ecological implications

UNIT 5: DISASTER MITIGATION AND MANAGEMENT

- 5.1. Risk assessment and vulnerability analysis: tools and methodologies
- 5.2. Disaster Management Cycle; Preparedness: nature, concept, and adaptation strategies
- 5.3. Disaster response: disaster response plans, rescue, and relief operations
- 5.4. Disaster management: concept, principles, mitigation approaches and strategies

LITERATURE RECOMMENDED

1. Anjaneyulu Y., Manickam Valli. (2011). *Environmental Impact Assessment Methodologies*, CRC Press.
2. Baldwin, J. H. (1985). *Environmental Planning & Management*. International Book Distributors, Dehradun, India.
3. Bandhu, D.; Bongartz, H.; Ghazuawl, A. C. and Gopal, B. (1994). *Environmental Education for Sustainable Development*. Indian Environmental Society, New Delhi.

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SYLLABUS FOR

TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-III]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P2ESTC301

Credits: 4

Duration of Examination: 3 hrs

Title: Environmental Impact
Assessment and Disaster Management

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

4. Bryant, E. A. (1991). *Natural Hazards*. Cambridge University Press, Cambridge, New York.
5. Cantar, L. W. (1977). *Environmental Impact Assessment*. McGraw Hill, Publications, New York.
6. Carter, W. N. (1992). *Disaster Management: A Disaster Manager's Handbook*. ADB Publication, Manila.
7. Cuny, F. (1983). *Disasters and Development*, Oxford University Press, England.
8. Green, S. (1980). *International Disaster Relief towards a Responsive system*. McGraw Hill Book Co., New York.
9. Gupta, H. (2003). *Disaster Management*. University Press, Hyderabad.
10. John, G. R. and Hooten, D. C. (1990). *Environmental Impact Analysis Handbook*, McGraw Hill Book Company.
11. Judith, P. (1999). *Handbook of Environmental Impact Assessment Vol. I & II*. Blackwell Science.
12. Prakash, I. (1995). *Disaster Management*. Rashtra Prahari Prakashan, Ghaziabad.
13. Sapru, R. K. (1987). *Environmental Management in India*. Ashish Publishing House, New Delhi.
14. Shrivastava A.K., Baxter Nicola, Grimm Jacob (2003). "Environmental Impact Assessment", APH Publishers.
15. UNEP (United Nations: Environmental Programme) (1980). Industry and Environment Series, Vol. 1.
16. United Nations (1994). Trends in Environmental Impact Assessment of Energy Projects.
17. Wathern P. (1990). "Environmental Impact Assessment: Theory and Practice", Routledge Publishers.

SCHEME OF EXAMINATION

The theory paper will carry 100 marks and the distribution of marks in each theory paper shall be as under:

MCQ on LMS+Subjective Test	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
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Minor II (after 60 days)	21-40%	1 hour	10 (MCQs on LMS) 10 (Subjective-type)
Major test (after 90 days)	100%	3 hours	60
	Total		100

Minor Examination: Question paper will have two parts viz., Part-I (MCQs on LMS) and Part-II (subjective-type). Part-I is compulsory and will consist of ten (10) multiple choice questions of one (01) mark each. Part-II will consist of three (03) short answer type questions of five (05) marks each, out of which two questions are to be attempted.

Major Examination: Question paper will have two sections, Section-A and Section-B. Section-A will be compulsory, comprising of eight (08) short answer type questions (minimum 01 from each unit) of three (03) marks each. Section B will consist of three (03) long answer type questions from last three units with internal choice of twelve (12) marks each.

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UNIVERSITY OF JAMMU
SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-III]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P2ESTC302

Title: Research Methodology and Statistics

Credits: 4

Maximum Marks : 100

Duration of Examination: 3 hrs

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

Objectives:

The primary objective of this course is to equip students with the basic understanding of research methodology and statistical techniques applicable to environmental sciences. The course aims to develop students' skills in scientific research design, data collection and analysis, and the use of statistical methods for interpreting complex environmental systems.

UNIT 1: FUNDAMENTALS OF RESEARCH METHODOLOGY

- 1.1. Definition, types of research, significance of research in environmental sciences
- 1.2. Components of research design, hypothesis testing
- 1.3. Scientific literature, digital libraries and databases, review of literature
- 1.4. Scientific writing, structure of a research paper, thesis, and reports, referencing styles

UNIT 2: ENVIRONMENTAL DATA COLLECTION AND SAMPLING TECHNIQUES

- 2.1. Types of environmental data; Qualitative vs quantitative; discrete vs continuous
- 2.2. Scales of measurement: Nominal, ordinal, interval, ratio
- 2.3. Sampling methods; Random, stratified, systematic, and cluster sampling, sample size determination and bias
- 2.4. Data validation and cleaning, use of spreadsheets and data management tools

UNIT 3: DESCRIPTIVE STATISTICS

- 3.1. Measures of central tendency: Mean, median, mode
- 3.2. Measures of dispersion: Range, variance, standard deviation, coefficient of variation
- 3.3. Measures of shape: Skewness and kurtosis
- 3.4. Data summarization techniques (tabulation and visualization)

UNIT 4: INFERENCE STATISTICS

- 4.1. Null and alternative hypothesis
- 4.2. Type I and Type II Errors
- 4.3. t-test (one-sample, independent, paired), p-value
- 4.4. Chi-square test, ANOVA (One-way)

UNIT 5: CORRELATION AND REGRESSION

- 5.1. Pearson and spearman correlation
- 5.2. Simple linear regression: Fitting, interpretation, assumptions
- 5.3. Coefficient of determination (R^2)
- 5.4. Introduction to multiple regression models

LITERATURE RECOMMENDED

1. Kothari, C.R. (2004). *Research Methodology: Methods and Techniques*. New Age International.
2. Zar, J.H. (2010). *Biostatistical Analysis*. Pearson Education.
3. S.C. Gupta (2016). *Fundamentals of Statistics*. Himalaya Publishing House.
4. Prem. S. Maan. (2017). *Introductory Statistics*. Wiley; 9th edition.

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UNIVERSITY OF JAMMU
SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-III]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P2ESTC302

Title: Research Methodology and Statistics

Credits: 4

Maximum Marks : 100

Duration of Examination: 3 hrs

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

SCHEME OF EXAMINATION

The theory paper will carry 100 marks and the distribution of marks in each theory paper shall be as under:

MCQ on LMS+ Subjective Test	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Minor I (after 30 days)	20%	1 hour	10 (MCQs on LMS) 10 (Subjective-type)
Minor II (after 60 days)	21-40%	1 hour	10 (MCQs on LMS) 10 (Subjective-type)
Major test (after 90 days)	100%	3 hours	60
	Total		100

Minor Examination: Question paper will have two parts viz., Part-I (MCQs on LMS) and Part-II (subjective-type). Part-I is compulsory and will consist of ten (10) multiple choice questions of one (01) mark each. Part-II will consist of three (03) short answer type questions of five (05) marks each, out of which two questions are to be attempted.

Major Examination: Question paper will have two sections, Section-A and Section-B. Section-A will be compulsory, comprising of eight (08) short answer type questions (minimum 01 from each unit) of three (03) marks each. Section B will consist of three (03) long answer type questions from last three units with internal choice of twelve (12) marks each.

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Rakesh

Van

Andi Sarker

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UNIVERSITY OF JAMMU
SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-III]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P2ESTC303

Title: Environmental Monitoring and Instrumentation

Credits: 2

Maximum Marks : 50

Duration of Examination: 2 hrs

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

Objectives:

This course will help students to understand the applications of various instrumental and analytical techniques for qualitative and quantitative analysis of different environmental matrices. Students will also learn about various environmental quality standards and the importance of quality control in environmental analysis.

UNIT 1: ENVIRONMENTAL MONITORING

- 1.1. Principles of environmental analysis: quantitative vs. qualitative analysis; QA/QC, Environmental quality standards and environmental monitoring: key aspects, compliance and enforcement
- 1.2. Ambient air quality monitoring: sampling strategies, collection techniques, and analytical methods for gaseous and particulate pollutants
- 1.3. Analytical methods for water quality assessment: sampling, preservation, and determination of physico-chemical parameters
- 1.4. Soil sampling and analysis: sample collection, processing, and evaluation of key environmental indicators

UNIT 2: SPECTROSCOPIC TECHNIQUES

- 2.1. Principle, instrumentation, and environmental applications of Atomic Absorption Spectroscopy (AAS) and UV-Visible Spectrophotometry (UV-VIS)
- 2.2. Principle and working of Fourier Transform Infrared (FTIR) spectroscopy
- 2.3. Principle and applications of Flame Photometry
- 2.4. Application of Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES)

UNIT 3: CHROMATOGRAPHIC AND MICROSCOPIC TECHNIQUES

- 3.1. Planar chromatographic methods: principles, procedures, and environmental applications of Paper Chromatography and Thin Layer Chromatography (TLC)
- 3.2. High Performance Liquid Chromatography (HPLC): working principle, instrumentation, and applications in environmental sample analysis
- 3.3. Ion Chromatography (IC) and Gas Chromatography: principle, instrumentation, and applications
- 3.4. Microscopic Techniques: Compound Microscope, Scanning Electron Microscope

LITERATURE RECOMMENDED

1. A.P.H.A. (2005). *Standard Methods for the examination of water & Wastewater*, 20th Ed. Am. Pub. Hlth. Asso., Washington.
2. Down, R. D., & Lehr, J. H. (Eds.). (2005). *Environmental instrumentation and analysis handbook*. John Wiley & Sons.
3. Khandpur, R. S. (2007). *Handbook of analytical instruments*. McGraw Hill Professional.
4. Rajvaidya, N. and Markenday, D. K. (2005). *Environmental Analysis and Instrumentation (Vol. 2)* APH Publishing Corporation.
5. Skoog, D. A.; Holler, F. J. and Crouch, S. R. (2017). *Principles of instrumental analysis*. Cengage learning.

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UNIVERSITY OF JAMMU
SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-III]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P2ESTC303

Title: Environmental Monitoring
and Instrumentation

Credits: 2

Maximum Marks : 50

Duration of Examination: 2 hrs

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

SCHEME OF EXAMINATION

The theory paper will carry 50 marks and the distribution of marks in each theory paper shall be as under:

MCQ on LMS+ Subjective Test	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Minor I (after 30 days)	20%	1 hour	05 (MCQs on LMS) 05 (Subjective-type)
Minor II (after 60 days)	21-40%	1 hour	05 (MCQs on LMS) 05 (Subjective-type)
Major test (after 90 days)	100%	2 hours	30
	Total		50

Minor Examination: Question paper will have two parts viz., Part-I (MCQs on LMS) and Part-II (subjective-type). Part-I is compulsory and will consist of five (05) multiple choice questions of one (01) mark each. Part-II will consist of three (03) short answer type questions of 2.5 marks each, out of which two questions are to be attempted.

Major Examination: Question paper will have two sections, Section-A and Section-B. Section-A will be compulsory, comprising of four (04) short answer type questions (minimum 01 from each unit) of three (03) marks each. Section B will consist of four (04) long answer type questions of nine (09) marks each with internal choice from last two units.

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UNIVERSITY OF JAMMU
SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-III]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P2ESTE304

Credits: 2

Duration of Examination: 2 hrs

Title: Environmental Microbiology

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

Objectives:

The main objective of this course is to make the students familiar with microorganisms without which humans could not survive as these microbes occur in large numbers in most natural environments and bring about many desirable and undesirable changes. Beside their role in the evolution of life on this planet, microbial activity is linked directly with processing and removal of dead bodies and sewage. The study of this course will help the students to develop a sustainable environment.

UNIT 1: MICROBIAL ENVIRONMENT

- 1.1. Nature and function of microorganisms in soil
- 1.2. Nature and function of microorganisms in air
- 1.3. Microbes and Biogeochemical cycles: Carbon cycle, sulphur cycle, nitrogen cycle, phosphorus cycle and iron cycle
- 1.4. Potability of water: Microbial assessment of water quality

UNIT 2: FOOD MICROBIOLOGY

- 2.1. Contamination and microbial spoilage of food
- 2.2. Sources and types of microbes in milk, pasteurization of milk
- 2.3. Preservation and dehydration of food
- 2.4. Fermented foods: Vegetables and dairy products

UNIT 3: INDUSTRIAL MICROBIOLOGY

- 3.1. Types of fermentation process, alcoholic fermentation
- 3.2. Production of vinegar, lactic acid and citric acid
- 3.3. Production of antibiotics, amino-acids, vitamins, vaccines, steroid transformation
- 3.4. Microorganisms in bioassays

LITERATURE RECOMMENDED

1. Alemander, M. (1983). *Soil Microbiology*, Wiley Eastern Limited.
2. Frazier, W. C. and Westheff, D. C. (1978). *Food Microbiology*, TATA McGraw Hill Publishing Company Ltd.
3. Frobisher, M.; Hinsdill, R. D.; Crabtree, K. T. and Goodheart; C. R. (1974). *Fundamentals of microbiology*. W. B. Saunders and Company. Heinemann, U.S.A.
4. Pelczar, M. J.; Reid, R. D. and Chan, E. C. S. (1977). *Microbiology*. McGraw Hill, New York.
5. Schlegel, H. G. (1985). *General Microbiology*, Cambridge University Press.

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SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-III]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P2ESTE304

Credits: 2

Duration of Examination: 2 hrs

Title: Environmental Microbiology

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

SCHEME OF EXAMINATION

The theory paper will carry 50 marks and the distribution of marks in each theory paper shall be as under:

MCQ on LMS+ Subjective Test	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Minor I (after 30 days)	20%	1 hour	05 (MCQs on LMS) 05 (Subjective-type)
Minor II (after 60 days)	21-40%	1 hour	05 (MCQs on LMS) 05 (Subjective-type)
Major test (after 90 days)	100%	2 hours	30
	Total		50

Minor Examination: Question paper will have two parts viz., Part-I (MCQs on LMS) and Part-II (subjective-type). Part-I is compulsory and will consist of five (05) multiple choice questions of one (01) mark each. Part-II will consist of three (03) short answer type questions of 2.5 marks each, out of which two questions are to be attempted.

Major Examination: Question paper will have two sections, Section-A and Section-B. Section-A will be compulsory, comprising of four (04) short answer type questions (minimum 01 from each unit) of three (03) marks each. Section B will consist of four (04) long answer type questions of nine (09) marks each with internal choice from last two units.

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UNIVERSITY OF JAMMU
SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-III]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P2ESTE305

Credits: 2

Duration of Examination: 2 hrs

Title: Energy and Environment

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

Objectives:

This course will provide students with a scientific understanding of energy, energy choices, and their implications for sustaining Earth's living systems. In addition, the course will present different conceptual approaches to the ongoing energy problem that confronts human society. Energy conservation, energy efficiency and the transition to renewable and alternative energy sources.

UNIT 1: ENERGY: BASIC CONCEPTS

- 1.1. Energy basics: Units and measures, laws of thermodynamics, carnot efficiency
- 1.2. Earth's energy budget, energy balance of earth, solar electromagnetic spectrum
- 1.3. Major energy flows in global hydrological cycle, ocean, currents and heat flux, atmospheric circulation
- 1.4. World energy use and Indian scenario, trends in energy use of oil, coal and gas

UNIT 2: ALTERNATIVE RESOURCES AND GREEN TECHNOLOGIES

- 2.1. Solar energy: collection and storage, present scenario in India, Indirect and direct solar energy conversion
- 2.2. Wind energy and management, conversion to wind flow, wind energy converters, commercial wind power development, wind energy storage and transfer
- 2.3. Nuclear energy, tidal and wave energy, geothermal energy, bio-gas plants
- 2.4. Geoengineering and green technologies related to energy

UNIT 3: ENERGY AND CLIMATE

- 3.1. Energy and carbon emissions, environmental problems associated with fossil fuels
- 3.2. Global climate change: Greenhouse effect, greenhouse gases: sources, trends, radiative forcing, warming potential of gases
- 3.3. Global warming and climate change: Ecological and socio-economic impacts
- 3.4. Climate mitigation, Technological interventions and eco-innovative solutions

LITERATURE RECOMMENDED

1. Byrne, J. and Rich, D. (Eds.). (2021). *Energy and Environment: The Policy Challenge*. Routledge.
2. Efstathios, E. (2012). *Alternative Energy Sources*. Springer.
3. Elliott, D. (2004). *Energy, Society and Environment*. Routledge.
4. Goldemberg, J. and Lucon, O. (2010). *Energy, environment and development*. Earthscan.
5. Farret, F. A. and Simoes, M. G. (2006). *Integration of Alternative Sources of Energy*. John Wiley & Sons.
6. Hinrichs, R. A. and Kleinbach, M. H. (2012). *Energy: Its Use and the Environment*. Cengage Learning.
7. Hodge, B. K. (2017). *Alternative Energy Systems and Applications*. John Wiley & Sons.
8. Kaltschmitt, M.; Streicher, W. and Wiese, A. (Eds.). (2007). *Renewable Energy: Technology, Economics and Environment*. Springer Science & Business Media.
9. Kruger, P. (2006). *Alternative Energy Resources: The Quest for Sustainable Energy*. Hoboken: Wiley.
10. Michaelides, E. E. S. (2012). *Alternative Energy Sources*. Springer Science & Business Media.
11. Nelson, V. (2009). *Wind Energy: Renewable Energy and the Environment*. CRC press.

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UNIVERSITY OF JAMMU
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TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-III]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P2ESTE305

Credits: 2

Duration of Examination: 2 hrs

Title: Energy and Environment

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

12. Schlager, N. and Weisblatt, J. (2006). *Alternative Energy*. Thomson Gale.
13. Wilson, R. (2012). *Energy, Ecology and the Environment*. Elsevier.
14. Foster, R.; Ghassemi, M. and Cota, A. (2009). *Solar Energy: Renewable Energy and the Environment*. CRC press.

SCHEME OF EXAMINATION

The theory paper will carry 50 marks and the distribution of marks in each theory paper shall be as under:

MCQ on LMS+ Subjective Test	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Minor I (after 30 days)	20%	1 hour	05 (MCQs on LMS) 05 (Subjective-type)
Minor II (after 60 days)	21-40%	1 hour	05 (MCQs on LMS) 05 (Subjective-type)
Major test (after 90 days)	100%	2 hours	30
	Total		50

Minor Examination: Question paper will have two parts viz., Part-I (MCQs on LMS) and Part-II (subjective-type). Part-I is compulsory and will consist of five (05) multiple choice questions of one (01) mark each. Part-II will consist of three (03) short answer type questions of 2.5 marks each, out of which two questions are to be attempted.

Major Examination: Question paper will have two sections, Section-A and Section-B. Section-A will be compulsory, comprising of four (04) short answer type questions (minimum 01 from each unit) of three (03) marks each. Section B will consist of four (04) long answer type questions of nine (09) marks each with internal choice from last two units.

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UNIVERSITY OF JAMMU

SYLLABUS FOR

TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-III]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P2ESPC311

Title: Lab Course-1 (Based on PSESTC301)

Credits: 2

Maximum Marks : 50

Duration of Examination: 4 hrs

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with the experimental work based on Course No. PSESTC301

1. To collect the baseline information on the state of environment (air, water, noise, and land) of University of Jammu
2. To evaluate the potential impacts of an urban infrastructure project such as Tawi barrage and riverfront project, urban drainage system or urban roads and flyovers
3. To assess the state of environmental compliance during the operational phase of any project, say aerial ropeway from Mubarak Mandi to Bagh-e-Bahu
4. To prepare an Environmental Management Plan *vis-a-vis* infrastructural development in University of Jammu
5. To identify and designate the environmentally and culturally sensitive sites in and around Jammu city
6. To analyze the case studies of major natural disasters that hit Jammu and Kashmir in last one decade and prepare a brief report about the causes, effects, lapses (if any) and suggest a way forward for prevention.
7. To prepare a vulnerability/disaster profile of Jammu city with the help of map.
8. To study disaster management cycle with the help of case studies in and around Jammu
9. To conduct disaster related mock drills including first aid training exercise
10. To prepare a disaster preparedness and mitigation plan for University of Jammu

SCHEME OF EXAMINATION

Practical Test	Time allotted for the examination	% Weightage (Marks)		Remarks
Mid Term appraisal	4 hours	25% (Total Marks=13)		After completion of 40% of syllabus Written Exam (9 marks) + Viva-voce (4 marks)
External Examination	4 hours	75%	50% (Total Marks=25)	Written Exam (20 marks) + Day to Day performance and Attendance (5 marks)
			25% (Total Marks=12)	Viva-Voce (8 Marks) + Practical file (4 marks)
Total		50		

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SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-III]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P2ESPC312

Title: Lab Course-2 (Based on PSESTC302)

Credits: 2

Maximum Marks : 50

Duration of Examination: 4 hrs

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with the experimental work based on Course No. PSESTC302

1. Formulate hypotheses and research questions based on real-world environmental issues.
2. Identify and classify different types of environmental data such as qualitative vs quantitative, discrete vs continuous.
3. Perform hands-on simulations of random, stratified, systematic, and cluster sampling designs.
4. Prepare a short research proposal, including objectives, review background, methods, and expected results.
5. Carry out a systematic literature review using academic library and summarize key trends.
6. Deliver oral and poster presentations based on the mini-proposal or literature review.
7. Compute descriptive statistics such as mean, median, standard deviation on a given dataset.
8. Prepare visualizations like histograms and boxplots using Excel on a given dataset.
9. Conduct inferential statistics including t-tests, chi-square tests, and ANOVA on a given dataset.
10. Perform correlation analyses (Pearson and Spearman) and build simple and multiple linear regression models on a given dataset.

SCHEME OF EXAMINATION

Practical Test	Time allotted for the examination	% Weightage (Marks)		Remarks
Mid Term appraisal	4 hours	25% (Total Marks=13)		After completion of 40% of syllabus Written Exam (9 marks) + Viva-voce (4 marks)
External Examination	4 hours	75%	50% (Total Marks=25)	Written Exam (20 marks) + Day to Day performance and Attendance (5 marks)
			25% (Total Marks=12)	Viva-Voce (8 Marks) + Practical file (4 marks)
Total		50		

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SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-III]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P2ESPC313

Title: Lab Course-3 (Based on PSESTC303)

Credits: 2

Maximum Marks : 50

Duration of Examination: 4 hrs

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with the experimental work based on Course No. P2ESTC303.

1. Procedure for preparation of working standard solutions using serial dilution method.
2. Introduction to various analytical instruments in departmental laboratory.
3. Measure the PM₁₀ and PM_{2.5} in the ambient air using low volume air sampler.
4. Measure the indoor particulate matter using handy air sampler.
5. Determine phosphate in given water sample
6. Measure the ambient SO₂ concentration in air using gaseous sampler.
7. Measure the ambient NO₂ concentration in air using gaseous sampler.
8. Determination of heavy metals in given soil and water samples using AAS.
9. To study the principle, construction and working of AAS.
10. To study the principle, construction and working of IC.
11. To study the principle, construction and working of HPLC.
12. To study the principle, construction and working of FTIR.

SCHEME OF EXAMINATION

Practical Test	Time allotted for the examination	% Weightage (Marks)		Remarks
Mid Term appraisal	4 hours	25% (Total Marks=13)		After completion of 40% of syllabus Written Exam (9 marks) + Viva-voce (4 marks)
External Examination	4 hours	75%	50% (Total Marks=25)	Written Exam (20 marks) + Day to Day performance and Attendance (5 marks)
			25% (Total Marks=12)	Viva-Voce (8 Marks) + Practical file (4 marks)
Total		50		

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SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-III]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P2ESPC314

Title: Lab Course-4 (Based on PSESTE304)

Credits: 2

Maximum Marks : 50

Duration of Examination: 4 hrs

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with the experimental work based on Course No. P2ESTE304

1. To study the principle, construction and working of Autoclave.
2. To study the principles, construction and working of BOD Incubator.
3. To study the principle, construction and working of Laminar Air Flow.
4. Preparation and sterilization of culture medium and preparation of petri plate using pour plate method.
5. Cultivation and enumeration of epiphytic microorganisms present of phyllosphere using Leaf impression method.
6. To prepare Gram stain for the study of bacteria.
7. To study the type of bacteria in curd by Gram staining technique.
8. To calculate the number of bacteria per ml. in a given sewage sample by DMC method.
9. To standardize the ocular meter using a stage meter.
10. To study the bacteria of the throat using sterile swab by Gram staining technique.

SCHEME OF EXAMINATION

Practical Test	Time allotted for the examination	% Weightage (Marks)		Remarks
Mid Term appraisal	4 hours	25% (Total Marks=13)		After completion of 40% of syllabus Written Exam (9 marks) + Viva-voce (4 marks)
External Examination	4 hours	75%	50% (Total Marks=25)	Written Exam (20 marks) + Day to Day performance and Attendance (5 marks)
			25% (Total Marks=12)	Viva-Voce (8 Marks) + Practical file (4 marks)
Total		50		

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UNIVERSITY OF JAMMU

SYLLABUS FOR

TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-III]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P2ESPC315

Title: Lab Course-5 (Based on PSESTE305)

Credits: 2

Maximum Marks : 50

Duration of Examination: 4 hrs

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with the experimental work based on Course No. P2ESTE305

1. Study the characteristics and components of a Solar Photovoltaic (PV) Panel to understand solar power generation and efficiency
2. To study the solar energy generation of different buildings of roof-top based solar power plant of University of Jammu
3. Design a micro-hydro setup to convert water flow into electrical energy and measure output.
4. Field visits to a hydro power station to understand the key components and processes involved in generating electricity from water.
5. Field visits to a Biogas plant of University of Jammu to understand the key components
6. Comparative evaluation of lighting technologies based on energy efficiency and luminous efficacy: LED, CFL, and Incandescent bulbs
7. Calorific value and ash content determination of select biomass fuels
8. Energy audit of electrical appliances of different departments.
9. Energy audit of a classroom / office / department of your Institution
10. Estimation of Carbon footprint of individual / household / department
11. Case studies on LEED, BREEAM, and Green Star system.

SCHEME OF EXAMINATION

Practical Test	Time allotted for the examination	% Weightage (Marks)		Remarks
Mid Term appraisal	4 hours	25% (Total Marks=13)		After completion of 40% of syllabus Written Exam (9 marks) + Viva-voce (4 marks)
External Examination	4 hours	75%	50% (Total Marks=25)	Written Exam (20 marks) + Day to Day performance and Attendance (5 marks)
			25% (Total Marks=12)	Viva-Voce (8 Marks) + Practical file (4 marks)
Total		50		

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UNIVERSITY OF JAMMU
SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-III]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P2ESRC325

Title: Research Project / Dissertation

Credits: 4

Maximum Marks : 100

Research Project / Dissertation Examination

Report on the following chapters to be submitted at the end of semester. This will be based on the research problem given to each student during the beginning of semester

Chapter Writing	Marks
Introduction	25
Review of Literature	50
Methodology	25
Total Marks	100

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UNIVERSITY OF JAMMU
SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-III]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P2ESMO350

Title: MOOC through SWAYAM

Credits: 4

Maximum Marks : 100

The students shall be required to complete a four-credit MOOC / SWAYAM course, preferably related to their core domain of study. This course shall be compulsory in the second semester. The students are expected to register for the said course in December / January of the first year of the two year PG Programme. The credits earned through the said course shall be reflected in the third semester and shall be in addition to the required core and elective credits during the third semester.

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UNIVERSITY OF JAMMU
SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-IV]

Examinations to be held in May 2027, 2028 & 2029

Course No.: P2ESTC401

Credits: 4

Duration of Examination: 3 hrs

Title: Environmental law and Policy

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

Objectives:

The main objective of this course is to acquaint the students with elementary principles of environmental Laws for ensuring protection of environment, promotion of sustainable development, and ensuring legal accountability. The scientific gains can be put into use only within the parameters of a legal system and science and law must be subservient to the needs of society. Through this course, the students shall learn about the legislative measures and spirit of Indian Constitution for environmental protection. The students would be made familiar with the overall environmental legal regime of the country as well as the international obligations.

UNIT 1: INTRODUCTION TO ENVIRONMENTAL PROTECTION

- 1.1. Introduction to International Environmental Law (IEL); General Principles of IEL
- 1.2. Environmental Protection in India: Origin and sources of domestic environment law and protection policy; Indian Constitution and Environmental Protection
- 1.3. Key international efforts for Environment Protection; Climate change law
- 1.4. Concept of sustainability; Millennium Development Goals vs. Sustainable Development Goals

UNIT 2: KEY ENVIRONMENTAL LAWS IN INDIA

- 2.1. Water (Prevention & Control of Pollution) Act, 1974 and the related rules
 - 2.2. Air (Prevention & Control of Pollution) Act, 1981 and the related rules
 - 2.3. The Environment (Protection) Act, 1986
 - 2.4. Noise pollution (Regulation and Control) Rules, 2000
- (Note: Only relevant provisions of the above Acts supported by cases)

UNIT 3: NATURAL RESOURCE CONSERVATION AND LAW

- 3.1. Wildlife (Protection) Act, 1972 with latest amendments; key institutions for protection of wildlife
 - 3.2. Indian Forest Act, 1927 vs. Forest Conservation Act, 1980
 - 3.3. Biological Diversity Act, 2002
 - 3.4. National Forest Policy, 1988 and National Environment Policy, 2006
- (Note: Only relevant provisions of the above Acts supported by cases)

UNIT 4: REGULATORY LAWS

- 4.1. Public Liability Insurance Act, 1991
- 4.2. National Green Tribunal Act, 2010
- 4.3. Right to Information Act, 2005
- 4.4. Strategies for conservation–Project Tiger, Project Elephant, Project Snow leopard

UNIT 5: JUDICIAL TRENDS & PUBLIC INTEREST INITIATIVES

- 5.1. Introduction to Public Interest Litigation and writ petitions
- 5.2. Judicial remedies in Environmental cases
- 5.3. Indian Penal Code (IPC 1860) vs Bharatiya Nyaya Sanhita (BNS) 2023
- 5.4. Criminal Procedure Code, 1973 vs Bharatiya Nagarik Suraksha Sanhita (BNSS) 2023

LITERATURE RECOMMENDED

1. Divan, S. and Rosencranz, A. (2005). *Environmental Law and Policy in India*, Oxford University Press, New Delhi.
2. Diwan, P. (1997). *Environmental Administration - Law & Judicial Attitude*, Vol. I, II. Deep & Deep Pub. New Delhi.

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UNIVERSITY OF JAMMU

SYLLABUS FOR

TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-IV]

Examinations to be held in May 2027, 2028 & 2029

Course No.: P2ESTC401

Credits: 4

Duration of Examination: 3 hrs

Title: Environmental law and Policy

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

3. Jaswal, P. S. and Jaswal, N. (2014). *Environmental Law*. Allahabad Law Agency, Allahabad.
4. Leela Krishnan, P. (1999). *Environmental Law in India*. Butterworths Publications, New Delhi.
5. Shastri, S.C. (2005). *Environmental Law (2nd Ed.)*, Eastern Book Company, Lucknow.
6. Singh, G. (1995). *Environmental Law: International & National Perspectives*.

ARTICLES:

1. Dari, S. S. and Sharma, R. (2014). An Overview of Environmental Jurisprudence in India. *Journal of General Management Research*. 1(1): 1-13.
2. Faure, M. G. and Raja, A. V. (2010). Effectiveness of Environmental PIL in India: Determining the Key Variables. *Fordham Environmental Law Review*. 21(2) Art.3: 239-292.
3. Jasrotia, A. (2003). Survival of the Earth: Vedic Profundity in Raina, S. C. *et al.* (Ed.) *Law & Development: An anthology of topical legal studies*. Regency Pub. New Delhi. 102-109.

SUGGESTED CASES:

1. Municipal Council, Ratlam vs. Vardhichand AIR 1980 SC 1622
2. Rural Litigation and Entitlement Kendra, Dehradun vs. State of UP AIR 1988 SC 2187.
3. T. Damodar Rao vs. Municipal Corporation of Hyderabad AIR 1987 AP 171.
4. M.C. Mehta vs. Kamal Nath AIR 2000 SC 1997.
5. Indian Council for Enviro-Legal Action vs. Union of India, 1996 (3) SCC 212.
6. Vellore Citizens Welfare Forum vs. Union of India AIR 1996 SC 2715.
7. M. C. Mehta vs. Union of India 1987 (4) SCC 463
8. M. C. Mehta vs. Union of India 1988 (1) SCC 471

SCHEME OF EXAMINATION

The theory paper will carry 100 marks and the distribution of marks in each theory paper shall be as under

MCQ on LMS+ Subjective Test	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Minor I (after 30 days)	20%	1 hour	10 (MCQs on LMS) 10 (Subjective-type)
Minor II (after 60 days)	21-40%	1 hour	10 (MCQs on LMS) 10 (Subjective-type)
Major test (after 90 days)	100%	3 hours	60
	Total		100

Minor Examination: Question paper will have two parts viz., Part-I (MCQs on LMS) and Part-II (subjective-type). Part-I is compulsory and will consist of ten (10) multiple choice questions of one (01) mark each. Part-II will consist of three (03) short answer type questions of five (05) marks each, out of which two questions are to be attempted.

Major Examination: Question paper will have two sections, Section-A and Section-B. Section-A will be compulsory, comprising of eight (08) short answer type questions (minimum 01 from each unit) of three (03) marks each. Section B will consist of three (03) long answer type questions from last three units with internal choice of twelve (12) marks each.

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UNIVERSITY OF JAMMU
SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-IV]

Examinations to be held in May 2027, 2028 & 2029

Course No.: P2ESTC402

Credits: 4

Duration of Examination: 3 hrs

Title: Ecotechnologies for
Contaminant Remediation

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

Objectives:

Biological treatment technologies are increasingly recognized within environmental science as effective and ecologically sound approaches for the remediation of contaminated sites. Based on ecological principles, ecotechnological interventions capitalize on the inherent self-regulating and self-repairing capacities of natural systems to mitigate pollution. This course offers an in-depth exploration of bioremediation and ecotechnologies, with a focus on their applications in the remediation of contaminated environments. Through this course, the students will develop a critical understanding of ecosystem structure and function, the biogeochemical and microbial processes underpinning contaminant transformation, and the environmental and design factors influencing remediation efficacy. Particular attention is given to the development of green infrastructure and nature-based solutions that align with site-specific ecological conditions.

UNIT 1: INTRODUCTION TO ECOTECHNOLOGY

- 1.1. Definition, scope, historical evolution, and conceptual framework
- 1.2. Fundamentals of phytotechnology: Types and mechanisms, advantages, and limitations of plant-based remediation
- 1.3. Concept of Green Infrastructures (GIs) and Nature-based solutions (NbS)
- 1.4. Ecological principles behind Ecotechnology: Self-regulation, ecosystem services, nutrient cycling, Biomimicry, etc.

UNIT 2: BIOREMEDIATION- OVERVIEW AND PROCESSES INVOLVED

- 2.1. Concept, types, advantages, and disadvantages of bioremediation
- 2.2. Applied bioremediation- An overview, the bioremediation laboratory, biotreatability studies
- 2.3. Factors affecting bioremediation and selection of appropriate bioremediation technology
- 2.4. Microbial processes for the remediation of environmental pollutants

UNIT 3: BIOREMEDIATION TECHNOLOGIES

- 3.1. *In-situ* bioremediation: Concept, design, applications, and limitations
- 3.2. Bioventing- Concept, design, applications, and limitations
- 3.3. Air sparging- Concept, design, applications, and limitations
- 3.4. Bioaugmentation- Concept, process, applications, and limitations

UNIT 4: ECOTECHNOLOGY IN PRACTICE-I: CONSTRUCTED WETLANDS (CWs)

- 4.1. Introduction to Constructed Wetland technology for wastewater treatment, Classification and types of Constructed Wetlands
- 4.2. Design and applications of Constructed Wetlands: Horizontal Flow CWs, Vertical Flow CWs
- 4.3. Design and applications of Hybrid Constructed Wetlands
- 4.4. Operation, maintenance, and monitoring of Constructed Wetlands, Global and National Case studies on CW-based wastewater treatment

UNIT 5: ECOTECHNOLOGY IN PRACTICE-II: MISCELLANEOUS

- 5.1 Land farming: Concept, site requirements, application, and limitations
- 5.2 White-rot fungal technology for waste treatment
- 5.3 Design and applications of rain gardens
- 5.4 Design and applications of green roofs and green walls

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UNIVERSITY OF JAMMU

SYLLABUS FOR

TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-IV]

Examinations to be held in May 2027, 2028 & 2029

Course No.: P2ESTC402

Credits: 4

Duration of Examination: 3 hrs

Title: Ecotechnologies for
Contaminant Remediation

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

LITERATURE RECOMMENDED

- Gadd, G. M. (2001). *Fungi in Bioremediation*. Cambridge University Press, ISBN: 0-521-78119-1. <https://clu-in.org/techfocus/default.focus/sec/Bioremediation/cat/Overview/>
- Malaviya, P. and Singh, A. (2012). Constructed wetlands for management of urban stormwater runoff. *Critical Reviews in Environmental Science and Technology*. 42(20): 2153-2214.
- Malaviya, P. and Singh, A. (2012). Phytoremediation strategies for remediation of uranium-contaminated environments: A Review. *Critical Reviews in Environmental Science and Technology*. 42(24): 2575-264
- Rai, J. P. N. and Saraswat, S. (2023). *Green Technologies for Waste Management: A Wealth from Waste Approach* (1st ed.). CRC Press, ISBN: 9781003279136.
- Sharma, R. and Malaviya, P. (2021). Management of stormwater pollution using green infrastructure: The role of rain gardens. *Wiley Interdisciplinary Reviews, Water*. 8(2): e1507.
- Tomasini, A. and Leon-Santesteban, H. H. (2019). *Fungal Bioremediation*. CRC Press, ISBN: 978-1-138-63640-8.
- Varjani, S. J.; Agarwal, A. K.; Gnansounou, E. and Gurunathan, B. (2018). *Bioremediation: Applications for Environmental Protection and Management*. Springer Singapore, ISBN: 978-981-10-7484-4.
- Vinasco, J. P. S. (2021). *Greenhouse Gas Emissions from Ecotechnologies for Wastewater Treatment* (1st ed.). CRC Press, ISBN: 9781003131137.

SCHEME OF EXAMINATION

The theory paper will carry 100 marks and the distribution of marks in each theory paper shall be as under:

MCQ on LMS+ Subjective Test	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Minor I (after 30 days)	20%	1 hour	10 (MCQs on LMS) 10 (Subjective-type)
Minor II (after 60 days)	21-40%	1 hour	10 (MCQs on LMS) 10 (Subjective-type)
Major test (after 90 days)	100%	3 hours	60
	Total		100

Minor Examination: Question paper will have two parts viz., Part-I (MCQs on LMS) and Part-II (subjective-type). Part-I is compulsory and will consist of ten (10) multiple choice questions of one (01) mark each. Part-II will consist of three (03) short answer type questions of five (05) marks each, out of which two questions are to be attempted.

Major Examination: Question paper will have two sections, Section-A and Section-B. Section-A will be compulsory, comprising of eight (08) short answer type questions (minimum 01 from each unit) of three (03) marks each. Section B will consist of three (03) long answer type questions from last three units with internal choice of twelve (12) marks each.

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UNIVERSITY OF JAMMU
SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-IV]

Examinations to be held in May 2027, 2028 & 2029

Course No.: P2ESTC403

Credits: 2

Duration of Examination: 2 hrs

Title: Environmental Toxicology

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

Objectives:

This course is designed to equip the students with the knowledge and skills to understand the sources, fate, and effects of environmental pollutants on ecosystems and human health, explore mechanisms of toxicity at molecular, cellular, and organismal levels, analyze risk assessment, bioaccumulation, and regulatory frameworks.

UNIT 1: ENVIRONMENTAL TOXICOLOGY

- 1.1. Toxicology: definition, branches, scope and importance
- 1.2. Principles of toxicology; Toxicants: Classification, routes of entry, duration and frequency of exposure, transport, storage, metabolism, and excretion
- 1.3. Categories of toxic effects -synergistic, antagonistic, and additive; acute and chronic toxic-effects
- 1.4. Dose-effect and dose response relationships

UNIT 2: TOXICITY OF ENVIRONMENTAL POLLUTANTS

- 2.1. Toxicity of Persistent Organic Pollutants (POPs) – pesticides, insecticides, polychlorinated biphenyls
- 2.2. Toxicity of heavy metals – chromium, cadmium, mercury, arsenic, lead; biohazards of radioactive substances
- 2.3. Mode of action of toxicants: biochemical and molecular mechanisms (oxidative stress, enzyme inhibition)
- 2.4. Bioavailability, bioaccumulation, biotransformation, and excretion of xenobiotics

UNIT 3: ANALYTICAL METHODS FOR TOXICITY TESTING

- 3.1. Principles of toxicity testing, measurements of LC₅₀ and LD₅₀ values
- 3.2. Monitoring approaches: indicator populations and indicator species, Model ecosystems – microcosms and mesocosms
- 3.3. Bioassays – *in vitro* and *in-vivo*; biosensors, biomarkers and bioindicators, genotoxicity, mutagenesis and carcinogenesis
- 3.4. Health effects of emerging contaminants

LITERATURE RECOMMENDED

1. Francis B.M. (1994.). *Toxic Substances in the Environment*. New York, John Wiley & Sons.
2. Cockerham L.G., Shane B.S. (1993). *Basic Environmental Toxicology*. USA, CRC Press.
3. Connell, D. W., Lam, P., Richardson, B., & Wu, R. (2009). *Introduction to ecotoxicology*. John Wiley & Sons.
4. Edward A. (2013). *Laws. Environmental Toxicology: Selected entries from the encyclopedia of sustainability science and technology*. New York, Springer-Verlag.
5. Gilbert, S. G. (2005). *A small dose of toxicology: The Health Effects of Common Chemicals of Environmental Health*, 5(2), 82.
6. Hayes, A. W. (2008). *Principles and Methods of Toxicology, 5th Edition*, Boca Raton, FL, Taylor and Francis.
7. I.C. Shaw and J. Chedwick. (2004). *Principles of Environmental Toxicology*, Boca Raton, FL, Taylor and Francis.
8. Levy B.S., Wegman D.H. (1995). *Occupational Health recognizing and preventing work related disease*. Boston, MA: Little Brown & Co.

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UNIVERSITY OF JAMMU
SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-IV]

Examinations to be held in May 2027, 2028 & 2029

Course No.: P2ESTC403

Credits: 2

Duration of Examination: 2 hrs

Title: Environmental Toxicology

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

9. Timbrell, J., & Barile, F. A. (2023). *Introduction to toxicology*. CRC Press.
10. Walker, C. (2014). *Ecotoxicology: effects of pollutants on the natural environment*. CRC Press.
11. Walker C.H., Sibly R.M., Hopkin S.P., Peakall D.B. (2012), *Principles of Ecotoxicology*. Fourth Edition. USA, CRC Press.
12. Zakrzewski S.F. (2002), *Environmental Toxicology*. 3rd Edition. New York, Oxford University Press.
13. Landis W, Sofield R, Yu M.H., (2017), *Introduction to Environmental Toxicology: Molecular Substructures to Ecological Landscapes*, Fifth Edition. Canada, CRC Press.

SCHEME OF EXAMINATION

The theory paper will carry 50 marks and the distribution of marks in each theory paper shall be as under:

MCQ on LMS+ Subjective Test	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Minor I (after 30 days)	20%	1 hour	05 (MCQs on LMS) 05 (Subjective-type)
Minor II (after 60 days)	21-40%	1 hour	05 (MCQs on LMS) 05 (Subjective-type)
Major test (after 90 days)	100%	2 hours	30
	Total		50

Minor Examination: Question paper will have two parts viz., Part-I (MCQs on LMS) and Part-II (subjective-type). Part-I is compulsory and will consist of five (05) multiple choice questions of one (01) mark each. Part-II will consist of three (03) short answer type questions of 2.5 marks each, out of which two questions are to be attempted.

Major Examination: Question paper will have two sections, Section-A and Section-B. Section-A will be compulsory, comprising of four (04) short answer type questions (minimum 01 from each unit) of three (03) marks each. Section B will consist of four (04) long answer type questions of nine (09) marks each with internal choice from last two units.

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UNIVERSITY OF JAMMU
SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-IV]

Examinations to be held in May 2027, 2028 & 2029

Course No.: P2ESTE404

Credits: 2

Duration of Examination: 2 hrs

Title: Environmental Health Hazards

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

Objectives:

The purpose of this course is to familiarize the students with various forms of life substances, forces and conditions in the surroundings of man that may exert an influence on man's health and well-being. This would help the students in understanding and assessing the current environmental hazards which are result of man's activities or his modification of environment and have adverse impacts on human health. The main aim of this course is to make students understand importance of health and well-being.

UNIT-1: ENVIRONMENT AND HEALTH

- 1.1. Health: Definition, historical perspective and dimensions of health
- 1.2. Determinants of health
- 1.3. Health indicators and health situation in India
- 1.4. Concept of disease and its prevention, Dynamics of disease transmission

UNIT-2: ENVIRONMENTAL HAZARDS WITH REFERENCE TO OCCUPATIONAL HAZARDS

- 2.1. Environmental hazards: physical, chemical, biological, sociological and psychological
- 2.2. Monitoring and control of environmental hazards
- 2.3. Occupations diseases with particular reference to dust diseases (pneumoconiosis) and occupational cancers
- 2.4. Prevention of occupational hazards

UNIT-3: COMMUNICABLE DISEASES

- 3.1. Water-borne infections: Etiology, pathogenesis and remedial measures of diarrhoea and dysentery
- 3.2. Air borne infections: Etiology, pathogenesis and remedial measures of COVID-19 and Swine influenza
- 3.3. Nosocomial infections and their control
- 3.4. General account, classification and control of zoonotic infections

LITERATURE RECOMMENDED

1. Goel, S. L. (2008). *Environment Health and Value Education*. Deep and Deep Publications.
2. Kumar, H. (2001) *Environmental Health Hazards*. IVY Publishing.
3. Sarkar, A., Panigrahi, S. K. (2007). *Water Borne Diseases in India: Environmental Health and Policy Perspectives*. India Manak Publications.
4. Manak. 2007. Yassi, A. (2001) *Basic Environmental Health*, Volume I. Oxford University Press.
5. Sarkar, A., Panigrahi, S. K. and Anand, M. *Vector Borne diseases in India: Environmental health and policy perspective*.
6. Benjamin O. Alli. (2008) *Fundamental Principles of Occupational Health and Safety*. International Labour Office, Geneva.
7. Park, K. (2005). *Park's Textbook of Preventive and Social Medicine*. Preventive Medicine in Obstet, Paediatrics and Geriatrics.

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UNIVERSITY OF JAMMU
SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-IV]

Examinations to be held in May 2027, 2028 & 2029

Course No.: P2ESTE404

Credits: 2

Duration of Examination: 2 hrs

Title: Environmental Health Hazards

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

SCHEME OF EXAMINATION

The theory paper will carry 50 marks and the distribution of marks in each theory paper shall be as under:

MCQ on LMS+ Subjective Test	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Minor I (after 30 days)	20%	1 hour	05 (MCQs on LMS) 05 (Subjective-type)
Minor II (after 60 days)	21-40%	1 hour	05 (MCQs on LMS) 05 (Subjective-type)
Major test (after 90 days)	100%	2 hours	30
	Total		50

Minor Examination: Question paper will have two parts viz., Part-I (MCQs on LMS) and Part-II (subjective-type). Part-I is compulsory and will consist of five (05) multiple choice questions of one (01) mark each. Part-II will consist of three (03) short answer type questions of 2.5 marks each, out of which two questions are to be attempted.

Major Examination: Question paper will have two sections, Section-A and Section-B. Section-A will be compulsory, comprising of four (04) short answer type questions (minimum 01 from each unit) of three (03) marks each. Section B will consist of four (04) long answer type questions of nine (09) marks each with internal choice from last two units.

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UNIVERSITY OF JAMMU
SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-IV]

Examinations to be held in May 2027, 2028 & 2029

Course No.: P2ESTE405

Title: Atmospheric Chemistry and Climate Change

Credits: 2

Maximum Marks : 50

Duration of Examination: 2 hrs

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

Objectives:

This course aims to develop an understanding about the chemical composition and processes occurring in the troposphere. To explore the role of reactive gases, radicals, and aerosols in air quality and climate. To analyze pollution formation and transformation at urban, regional, and global scales. To introduce observational techniques and chemical transport modeling for tropospheric chemistry.

UNIT 1: ATMOSPHERIC STRUCTURE AND COMPOSITION

- 1.1. Earth's Atmosphere – history and evolution; CO₂ fluctuations and ice ages
- 1.2. Major and trace constituents; atmospheric circulation; vertical temperature and pressure profile.
- 1.3. Oxidation capacity of the troposphere: key radicals (and their role in atmospheric cleansing. HO_x, SO_x and NO_x chemistry)
- 1.4. Interaction of solar and terrestrial radiation with atmospheric constituents (absorption, scattering, and photolysis)

UNIT 2: OZONE CHEMISTRY AND AIR QUALITY

- 2.1. Ozone formation and loss processes: Chapman mechanism and stratospheric ozone layer chemistry
- 2.2. Catalytic ozone destruction cycles; Implications of halogen chemistry and stratosphere–troposphere exchange
- 2.3. Polar stratospheric clouds (PSCs), ozone depletion events, formation of the ozone hole; chlorofluorocarbons (CFCs), policy interventions, and observed recovery trends
- 2.4. Urban and regional air pollution: photochemical smog and winter smog formation; VOC–NO_x interactions; chemical transformation of SO₂, NO_x, CO, and NH₃ in polluted atmospheres

UNIT 3: GREENHOUSE GASES, AEROSOLS, AND CLIMATE INTERACTIONS

- 3.1. Greenhouse effect and Earth's radiative balance; major greenhouse gases, sources, sinks, atmospheric lifetimes, and temporal trends
- 3.2. The global carbon cycle and climate feedback mechanisms; estimation of global warming potential (GWP); national and global emission inventories.
- 3.3. Atmospheric aerosols: classification (primary vs secondary), sources, size distributions; processes of nucleation, growth, coagulation, and removal.
- 3.4. Chemical composition and hygroscopicity of aerosols; role in cloud condensation nuclei (CCN) formation and impacts on radiative forcing and climate.

LITERATURE RECOMMENDED

- 1 Hobbs, P. V. (2000). *Introduction to Atmospheric Chemistry*. Cambridge University Press.
- 2 Holloway, A. M., & Wayne, R. P. (2015). *Atmospheric Chemistry*. Royal Society of Chemistry.
- 3 Seinfeld, J. H., & Pandis, S. N. (2016). *Atmospheric Chemistry and Physics: From Air Pollution to Climate Change*. John Wiley & Sons.
- 4 Baird, C., & Cann, M. (2005). *Environmental Chemistry*. Macmillan.
- 5 VanLoon, G. W., & Duffy, S. J. (2017). *Environmental Chemistry: A Global Perspective*. Oxford University Press.

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UNIVERSITY OF JAMMU
SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-IV]

Examinations to be held in May 2027, 2028 & 2029

Course No.: P2ESTE405

Title: Atmospheric Chemistry
and Climate Change

Credits: 2

Duration of Examination: 2 hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

SCHEME OF EXAMINATION

The theory paper will carry 50 marks and the distribution of marks in each theory paper shall be as under:

MCQ on LMS + Subjective Test	Syllabus to be covered in the examination	Time allotted for the examination	% Weightage (Marks)
Minor I (after 30 days)	20%	1 hour	05 (MCQs on LMS) 05 (Subjective-type)
Minor II (after 60 days)	21-40%	1 hour	05 (MCQs on LMS) 05 (Subjective-type)
Major test (after 90 days)	100%	2 hours	30
	Total		50

Minor Examination: Question paper will have two parts viz., Part-I (MCQs on LMS) and Part-II (subjective-type). Part-I is compulsory and will consist of five (05) multiple choice questions of one (01) mark each. Part-II will consist of three (03) short answer type questions of 2.5 marks each, out of which two questions are to be attempted.

Major Examination: Question paper will have two sections, Section-A and Section-B. Section-A will be compulsory, comprising of four (04) short answer type questions (minimum 01 from each unit) of three (03) marks each. Section B will consist of four (04) long answer type questions of nine (09) marks each with internal choice from last two units.

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UNIVERSITY OF JAMMU
SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-IV]

Examinations to be held in May 2027, 2028 & 2029

Course No.: P2ESRC411

**Title: Field Visits / Industrial training /
Practicals**

Credits: 4

Maximum Marks : 100

Evaluation / Examination :

The reports based on the following to be submitted upon the completion of the respective visits at the end of semester.

Tours / Trips / Others	Marks
Educational tour	50
Short field trips / Industrial visit / Experiential learning	50
Total Marks	100

Dathia

Piguel

Pakeeshat

Van

Andi Sarker

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Raz



UNIVERSITY OF JAMMU
SYLLABUS FOR
TWO-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-IV]

Examinations to be held in May 2027, 2028 & 2029

Course No.: P2ESRC425
Credits: 8

Title: Research Project / Dissertation
Maximum Marks : 200

Research Project / Dissertation Examination

External examination shall be conducted for Research Project / Dissertation by the Board of Examiners consisting of :

1. Head of the Department
2. Faculty members of the department
3. Concerned Supervisor
4. External Expert (to be appointed by the Vice Chancellor out of the panel provided by the Convener / Head of the Department who shall evaluate final Research Project / Dissertation of the student).

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Piguel

Pakeeshat

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EXIT POINT (AFTER ONE YEAR)

Students enrolled in the Two-Year PG Programme will have a single exit option at the end of first year (after semester – I). Students opting to exit at this stage shall be awarded a **POSTGRADUATE DIPLOMA**.

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VOCATIONAL COURSE

Credits: 4

8 Weeks

The students intending to exit after first year ((after semester – II) of the two-Year PG Programme and desirous of getting a Postgraduate Diploma must earn an additional 4 credits through vocational course during the summer term.

The following Vocational Courses are being offered by the Department of Environmental Sciences:

Course Code	Course Name
P2ESVC251	Environmental quality monitoring and analysis
P2ZOVC252	Parataxonomy with special focus on plants, birds, and butterflies
P2ZOVC253	Vermitechnology and solid waste management
P2ZOVC254	Tools and techniques in wildlife monitoring

Dathia

Piguel

Pakeeshat

Van

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Raz