UNIVERSITY OF JAMMU

(NAAC ACCREDITED 'A ++' GRADE' UNIVERSITY)
Baba Sahib Ambedkar Road, Jammu-180006 (J&K)

Academic Section
Email: academicsectionju14@gmail.com

NOTIFICATION
(25/Sep/Adp./64)

It is hereby notified for the information of all concerned that the Vice-Chancellor, in anticipation of the approval of the Academic Council, is pleased to authorize the adoption of the syllabi and courses of studies for **Post Graduate Programme** in **Environmental Science** under **NEP-2020** as per details given below:-

Two Year Post Graduate Programme under NEP-2020

Subject	Semester	For the examinations to be held in the year
Environmental Science	Semester-I	December 2025, 2026 and 2027
	Semester-II	May 2026, 2027 and 2028
	Semester-III	December 2026, 2027 and 2028
	Semester-IV	May 2027, 2028 and 2029

One Year Post Graduate Programme under NEP-2020

Subject	Semester	For the examinations to be held in the year
Environmental Science	Semester-I	December 2026, 2027 and 2028
	Semester-II	May 2027, 2028 and 2029

The Syllabi of the courses are also available on the University website: www.jammuuniversity.ac.in

Sd/-
DEAN ACADEMIC AFFAIRS

No. F. Acd/II/25/ 9085-9112
Dated: 09-09-25

Copy for information and necessary action to:

1. Dean, Faculty of **Life-Science**
2. Director/Convener, Board of Studies in **Environmental Science**
3. Director, Centre for IT Enabled services and Management, University of Jammu for information and for uploading on University Website.
4. All members of the Board of Studies
5. Joint Registrar (Evaluation/P.G. Exam.)
6. Programmer, Computer Section, Examination Wing

9/9/25
Joint Registrar (Academic)

8/9 8/09/25

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

COURSE STRUCTURE
(Programme Code PGFLE005)
Examinations to be held in 2026, 2027 & 2028

DISTRIBUTION OF COURSES AND CREDITS

[SEMESTER-I]

Course Code	Course Name	Credits	Contact Hours / Week L-T-P
P1ESTC101	Disaster Risk Reduction and Management	4	4-1-0
P1ESTC102	Ecotechnologies for Contaminant Remediation	4	4-1-0
P1ESTC103	Research Methodology and Statistics	4	4-1-0
P1ESTE104	Atmospheric Chemistry and Climate Change	4	4-1-0
*P1ESTE105	Environmental Toxicology and Health Hazarads	4	4-1-0
*P1ESTE106	Environmental Microbiology and Biotechnology	4	4-1-0
P1ESPC115	Lab Course-1 (P1ESTC101 and P1ESTC102)	2	0-0-2
P1ESPC116	Lab Course-2 (P1ESTC103 and P1ESTC104)	2	0-0-2

Note: Total credits to be earned in Semester-I= 24 Credits
[Major Core 16 (Theory) +4 (Practicals) = **20**; Major Elective (Any one*) 2 (Theory) = **4**

[SEMESTER-II]

Course Code	Course Name	Credits	Contact Hours / Week L-T-P
P1ESTC201	Environmental Law and Policy	4	4-1-0
*P1ESTE202	Environmental Impact Assessment	2	2-1-0
*P1ESTE203	Environmental Monitoring and Instrumentation	2	2-1-0
*P1ESTE204	Artificial Intelligence for Sustainable Development	2	2-1-0
*P1ESTE205	Energy and Environment	2	2-1-0
P1ESRC230	Research Project/ Dissertation	16	0-0-16

Note: Total credits to be earned in Semester-II= 24 Credits
[Major Core 4 (Theory) + Major Elective (Any Two*) 2 + 2 (Theory) = **8**
Research Project/ Dissertation = **16** (including field visits / industrial training / practicals)]

L- Lectures, T- Tutorials, P- Practical

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

[SEMESTER-I]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P1ESTC101 | **Title: Disaster Risk Reduction and Management**

Credits: 4

Duration of Examination: 3 hrs

Maximum Marks	**: 100**
a) Minor Test-I	**: 20 Marks**
b) Minor Test-II	**: 20 Marks**
c) Major Test	**: 60 Marks**

Objectives:

A course on disaster risk reduction and mitigation is vital for equipping students with the knowledge and skills needed to understand hazards, assess risks, and design effective strategies to reduce the impacts of disasters. It fosters scientific and interdisciplinary thinking by integrating environmental science, engineering, policy, and community-based management approaches. The course aims to enhance the capacity of the students to innovate, engage with vulnerable communities, and address the growing challenges of rising natural and human induced disasters. By linking theory with practical applications, the course empowers future professionals to build resilience and safeguard lives, livelihoods, and ecosystems.

UNIT 1: DISASTERS – CHARACTERISTICS AND ATTRIBUTES (NATURAL DISASTERS)

1.1. Hazards, risks, disasters and vulnerability: concept and their relationship. Classification of disasters
1.2. Natural disasters: causes, consequences and mitigation of geological disasters
1.3. Natural disasters: causes, consequences and mitigation of hydrometeorological disasters
1.4. Climate change and extreme weather events

UNIT 2: DISASTERS – CHARACTERISTICS AND ATTRIBUTES (HUMAN INDUCED DISASTERS)

2.1. Technological and industrial disasters (industrial accidents, mining accidents, structural failures, fires and explosions)
2.2. Transportation disasters (rail, road, aviation, and maritime accidents caused by technical faults or human error)
2.3. Armed conflicts and warfare. Urban heat-island effect
2.4. Socio-economic and public health disasters

UNIT 3: DISASTER RISK IDENTIFICATION AND VULNERABILITY ASSESSMENT

3.1. Disaster risk identification and impact analysis
3.2. Vulnerability: concept and key dimensions
3.3. Vulnerability assessment: steps and indicators
3.4. Hazard mapping and risk analysis

UNIT 4: DISASTER MITIGATION AND PREPAREDNESS

4.1. Disaster management cycle : an overview
4.2. Disaster preparedness: concept and significance
4.3. Disaster response and recovery: early warning systems, response plans, rescue, and relief operations
4.4. Disaster management: concept, principles, mitigation approaches and strategies

UNIT 5: TECHNOLOGY AND LEGAL FRAMEWORK IN DISASTER MANAGEMENT

5.1. Applications of science and technology in disaster management
5.2. Disaster management (amendment) Act, 2025
5.3. National building codes (2016) and dam safety bill (2019)
5.4. Jammu and Kashmir disaster management plan (2023)

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

[SEMESTER-I]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P1ESTC101 | **Title: Disaster Risk Reduction and Management**

Credits: 4
Duration of Examination: 3 hrs

Maximum Marks	**: 100**
a) Minor Test-I	**: 20 Marks**
b) Minor Test-II	**: 20 Marks**
c) Major Test	**: 60 Marks**

LITERATURE RECOMMENDED

1. Alexander, D. (2002). *Principles of Emergency Planning and Management-Comprehensive principles and practical approaches to disaster risk reduction.* Oxford University Press,.
2. Coppola, D. P (2015). Introduction to International Disaster Management. Elsevier, 3rd ed., Global case studies, mitigation frameworks, and policy implications.
3. Sharma, V. K. (1999). *Disaster Management.* National Centre for Disaster Management, IIPA, 1999.– Indian perspective with focus on policy and community-based approaches.
4. Carter, Nick W. (2008). *Disaster Management: A Disaster Manager's Handbook.* Asian Development Bank– Hands-on guide with disaster preparedness and mitigation strategies.
5. Gupta, A. K. and Gupta, N. (2016). *Disaster Management and Risk Reduction: Role of Environmental Knowledge.* PHI Learning, 2016.– Links environmental understanding with disaster mitigation.
6. Gupta, H. (2003). *Disaster Management.* University Press, Hyderabad.
7. Prakash, I. (1995). *Disaster Management.* Rashtra Prahari Prakashan, Ghaziabad.
8. National Disaster Management Authority (NDMA), Government of India – Guidelines on Cyclones, Earthquakes, Floods, Landslides, Urban Flooding, and Heatwaves. – https://ndma.gov.in
9. UNDRR (United Nations Office for Disaster Risk Reduction) – *Sendai Framework for Disaster Risk Reduction (2015–2030).*– https://www.undrr.org
10. Ministry of Home Affairs, GoI – *National Policy on Disaster Management (NPDM), 2009.*

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

[SEMESTER-I]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P1ESTC102 | **Title: Ecotechnologies for Contaminant Remediation**

Credits: 4
Duration of Examination: 3 hrs

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 the ecological principles, ecotechnological interventions capitalize on the inherent self-regulating and self-repairing capacities of natural systems to mitigate pollution while contributing to broader environmental restoration. This course offers an in-depth exploration of bioremediation and ecotechnologies, with a focus on their applications in the remediation of contaminated environments. Through the integration of ecological theory and eco-engineering, 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, Biotreatability studies
2.3. Factors affecting bioremediation
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

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

5.1. Land farming- Concept, site requirements, application, and limitations
5.2. White-rot Fungal technology for waste treatment
5.3. Introduction to Green Roofs and Green Walls
5.4. Rain Gardens: Concept and applications

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

[SEMESTER-I]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P1ESTC102 | **Title: Ecotechnologies for Contaminant Remediation**

Credits: 4
Duration of Examination: 3 hrs

Maximum Marks : 100
a) Minor Test-I : 20 Marks
b) Minor Test-II : 20 Marks
c) Major Test : 60 Marks

LITERATURE RECOMMENDED:

1. 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/ (accessed on 26th May 2025)
2. 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.
3. 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): 2575-2647.
4. Mitsch, W. J. and Jorgensen, S. E. (1989). Ecological Engineering: An Introduction to Ecotechnology. John Wiley & Sons, ISBN: 0-471-62559-0.
5. Rai, J. P. N. and Saraswat, S. (2023). Green Technologies for Waste Management: A Wealth from Waste Approach (1st ed.). CRC Press, ISBN: 9781003279136.
6. 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.
7. Singh, A. and Ward, O. P. (2004). Applied Bioremediation and Phytoremediation. Springer-Verlag, ISBN: 3-540-21020-2.
8. Singh, S. N. and Tripathi, R. D. (2007). Environmental Bioremediation Technologies. Springer-Verlag, ISBN: 3-540-34790-9.
9. 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.

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

[SEMESTER-I]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P1ESTC103 | **Title: Research Methodology and Statistics**

Credits: 4
Duration of Examination: 3 hrs

Maximum Marks	**: 100**
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: INFERENTIAL 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's and Spearman's 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.

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

[SEMESTER-I]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P1ESTC103 | **Title: Research Methodology and Statistics**

Credits: 4

Duration of Examination: 3 hrs

Maximum Marks : 100
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.

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

[SEMESTER-I]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P1ESTC104

Title: Atmospheric Chemistry and Climate Change

Credits: 4

Maximum Marks: 100

Duration of Examination: 3 hrs

a) Minor Test-I: 20 Marks

b) Minor Test-I : 20 Marks

c) Major Test : 60 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. It aims to provide students with a comprehensive understanding of the chemical and physical processes occurring in the atmosphere, and how these processes interact with climate change, the science behind climate change, and the policy responses needed to address this global challenge.

UNIT 1: EARTH'S ATMOSPHERE

1.1. Evolution of the Earth's atmosphere: Prebiotic atmosphere and origins of life; rise of oxygen and ozone; oxygen and carbon budgets

1.2. Vertical profiles of temperature and pressure in Earth's atmosphere

1.3. Half-life, residence time, and renewal time of chemicals in the atmosphere; units for chemical abundance

1.4. Interaction of solar and terrestrial radiation with atmospheric components

UNIT 2: ATMOSPHERIC CHEMISTRY-I

2.1. Key atmospheric radicals (OH, HO_2, NO, NO_2, Cl) and their role in atmospheric self-cleansing

2.2. Criteria air pollutants and atmospheric pollution chemistry: primary and secondary pollutants, chemical transformation of SO_2, NO_x, CO, and NH_3 in polluted atmospheres

2.3. Photochemical smog mechanisms (Los Angeles-type vs VOC-limited/NOx-limited regimes); secondary pollutants: peroxyacyl nitrates (PAN), secondary organic aerosols (SOA)

2.4. Cloud and precipitation chemistry: cloud condensation nuclei and nucleation; scavenging; dissolution of gases in cloud droplets; aqueous-phase chemical reactions

UNIT 3: ATMOSPHERIC CHEMISTRY-II

3.1. Atmospheric aerosols: classification (primary vs secondary), sources, size distributions; processes of nucleation, growth, coagulation, and removal

3.2. Chemical composition and hygroscopicity of aerosols; role in Cloud Condensation Nuclei and impacts on radiative forcing and climate

3.3. Stratospheric ozone chemistry, catalytic ozone destruction cycles involving Cl, NO, and Br radicals

3.4. Polar stratospheric clouds (PSCs), ozone depletion events, ozone hole formation; chlorofluorocarbons (CFCs); Montreal Protocol; observed recovery trends

UNIT 4: GREENHOUSE GASES AND CLIMATE INTERACTIONS

4.1. Greenhouse effect and Earth's radiative balance; GHGs and aerosols; radiative forcing and climate sensitivity.

4.2. Evidence for climate change: paleoclimatic data, instrumental records, changes in cryosphere.

4.3. Global carbon cycle and climate feedback; estimation of global warming potential (GWP); national and global emission inventories. Large-scale atmospheric and ocean circulation

4.4. Observed trends and projected climate change: historical temperature and CO_2 trends, IPCC AR6 findings, climate models, emission scenarios.

[SEMESTER-I]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P1ESTC104 | **Title: Atmospheric Chemistry and Climate Change**

Credits: 4 | **Maximum Marks: 100**

Duration of Examination: 3 hrs | **a) Minor Test-I: 20 Marks**

b) Minor Test-I : 20 Marks

c) Major Test : 60 Marks

UNIT 5 : CLIMATE CHANGE IMPACTS, MITIGATION, AND POLICY

5.1. Climate change impacts: Ecological, socio-economic and health
5.2. GHG mitigation strategies, energy transition and sustainable practices
5.3. Climate adaptation strategies and early warning system for weather forecasting
5.4. Climate policies and governance at National and International level

LITERATURE RECOMMENDED

1. Baird, C., and Cann, M. (2005). *Environmental chemistry*. Macmillan.
2. Barry, R. G. and Carleton, A. M. (2001). *Synoptic and Dynamic Climatology*, Routledge, London.
3. Finlayson-Pitts, B. J. and Pitts Jr, J. N. (1986). Atmospheric chemistry. Fundamentals and experimental techniques.
4. Girard, J. (2013). *Principles of environmental chemistry*. Jones & Bartlett Publishers.
5. Hobbs, P. V. (2000). *Introduction to atmospheric chemistry*. Cambridge University Press.
6. Jacob, D. J. (1999). Introduction to atmospheric chemistry. Princeton University Press.
7. Lutgens, F. K.; Tarbuck, E. J. and Tasa, D. (2009). *The Atmosphere: An Introduction to Meteorology*, Prentice-Hall, Englewood Cliffs, New Jersey.
8. Manahan, S. E. (2022). *Environmental chemistry*. CRC press.
9. Masters, G. M. (2014). *Introduction to Environmental Engineering and Science*, 3rd Edn. 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 9 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
ONE-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

[SEMESTER-I]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P1ESTE105 | **Title: Environmental Toxicology and Health Hazards**

Credits: 4

Duration of Examination: 3hrs

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 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. To enable them to analyze risk assessment, bioaccumulation, and regulatory frameworks. Also, 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 is to make students understand importance of health and well-being.

UNIT 1: ENVIRONMENTAL TOXICOLOGY

1.1. Toxicology: Basic concepts, scope, and importance
1.2. Principles of toxicology; Toxicants and Toxicity: Factors affecting toxicity
1.3. Toxicity of chemical mixtures; Dose-effect and response; Dose-response relationships
1.4. Toxicokinetics- Absorption, Distribution, Metabolism, and Elimination of toxicants (ADME)

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. Health effects of emerging contaminants
2.4. Bioavailability, bioaccumulation, biotransformation, and excretion of xenobiotics

UNIT 3: ANALYTICAL METHODS FOR TOXICITY TESTING

3.1. Toxicity testing – testing for acute and chronic toxicity, measurements of LC_{50} and LD_{50}
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. Mode of action of toxicants: biochemical and molecular mechanisms (oxidative stress, enzyme inhibition)

UNIT 4: ENVIRONMENT AND HEALTH

4.1. Health: Definition, historical perspective, and dimensions and determinants of health
4.2. Health indicators and health situation in India
4.3. Concept of disease and its prevention, dynamics of disease transmission
4.4. Etiology, pathogenesis and remedial measures of water-borne infections (diarrhoea and dysentery) and Air-borne infections (COVID-19 and Swine influenza)

UNIT 5: ENVIRONMENTAL HAZARDS WITH REFERENCE TO OCCUPATIONAL HAZARDS

5.1. Environmental hazards: physical, chemical, biological, sociological, and psychological
5.2. Occupations hazards with particular-reference to dust diseases and occupational cancers
5.3. Prevention of occupational hazards
5.4. Ecological Risk Assessment and Risk Management

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[SEMESTER-I]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P1ESTE105 | **Title: Environmental Toxicology and Health Hazards**

Credits: 4

Duration of Examination: 3hrs

Maximum Marks : 100
a) Minor Test-I : 20 Marks
b) Minor Test-II : 20 Marks
c) Major Test : 60 Marks

LITERATURE RECOMMENDED

1. Benjamin, O. Alli. (2008). *Fundamental Principles of Occupational Health and Safety*. International Labour Office, Geneva.
2. Connell, D. W., Lam, P., Richardson, B., and Wu, R. (2009). *Introduction to Ecotoxicology*. John Wiley & Sons.
3. Edward, A. (2013). *Laws. Environmental Toxicology: Selected entries from the encyclopedia of Sustainability Science and Technology*. New York, Springer-Verlag.
4. Gilbert, S. G. (2005). *A small dose of toxicology: The Health Effects of Common Chemicals of Environmental Health*, 5(2), 82.
5. Hayes, A. W. (2008). *Principles and Methods of Toxicology, 5th Edition*, Boca Raton, FL, Taylor and Francis.
6. Landis, W., Sofield, R. and Yu, M.H. (2017). Introduction to Environmental Toxicology: Molecular Substructures to Ecological Landscapes, Fifth Edition. Canada, CRC Press.
7. Park, K. (2005). *Park's Textbook of Preventive and Social Medicine*. Preventive Medicine in Obstet, Paediatrics and Geriatrics.
8. Sarkar, A., Panigrah, S. K. and Anand, M. (2012). Vector Borne diseases in India: Environmental health and policy perspective.
9. Timbrell, J. and Barile, F. A. (2023). *Introduction to toxicology*. CRC Press.
10. Walker, C.H., Sibly, R.M., Hopkin S.P. and Peakall, D.B. (2012). Principles of Ecotoxicology. Fourth Edition. USA, CRC Press.
11. Walker, C. (2014). *Ecotoxicology: effects of pollutants on the natural environment*. CRC 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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[SEMESTER-I]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P1ESTE106 | **Title: Environmental Microbiology and Biotechnology**

Credits: 4
Duration of Examination: 3 hrs

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 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. Besides their role in the evolution of life on this planet, microbial activity is linked directly with processing and removal of dead bodies and sewage. This course will help the students to protect the environment from pollution & to conserve natural resources because the rapid industrialization, urbanisation and other developments are constant threat to the clean environment and to the depleting natural resources. Moreover, the threats to the environment are also from release of genetically engineered organisms in the atmosphere and due to release of effluents from biotechnological companies. Thus, the study of course will help to develop cleaner and sustainable environment in future.

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

UNIT 4 : INTRODUCTION TO BIOTECHNOLOGY & POLLUTION CONTROL

4.1. Definition, historical background, scope & importance of biotechnology
4.2. Biosorption - use of bacteria, fungi and algae in biosorption
4.3. Biotechniques for air pollution abatement & odour control-bioscrubbers, biobeds, biotrickling filters
4.4. Biodegradation of pesticides, microbial treatment of oil pollution

UNIT 5 : RECYCLING AND RECLAMATION

5.1. Conventional waste water treatment strategies using biosystem, activated sludge process, Trickling filter, Rotating Biological contactor (RBC) and Fluidized Beds
5.2. Role of Biotechnology in energy production from biomass, fuel alcohol and hydrogen production
5.3. Reforestation of degraded land through micro-propagation, use of mycorrhizae and microbes
5.4. Use of microbes as bioinsecticide, biofungicide and bioherbicides

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

[SEMESTER-I]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P1ESTE106 | **Title: Environmental Microbiology and Biotechnology**

Credits: 4

Duration of Examination: 3 hrs

Maximum Marks : 100
a) Minor Test-I : 20 Marks
b) Minor Test-II : 20 Marks
c) Major Test : 60 Marks

LITERATURE RECOMMENDED

1. Abbasi, S.A. and Ramasami, E. (1999). Biotechnological Methods of Pollution Control.
2. Alemander, M. (1983). *Soil Microbiology*, Wiley Eastern Limited.
3. Chaterjii, A. K. (2002). Introduction to Environmental Biotechnology. Prentice Hall of India. Co. New Delhi.
4. Frazier, W. C. and Westheff, D. C. (1978). *Food Microbiology*, TATA McGraw Hill Publishing Company Ltd.
5. 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.
6. Gupta, P.K. (1994). Elements of Biotechnology. Rastogi & Co. Meerut
7. Pelczar, M. J. Reid, R. D. and Chan, E. C. S. (1977). *Microbiology*. McGraw Hill, New York.
8. Purohit, S. S. & Mathur, S. K. (1996). Biotechnology Fundamentals &Applications. Agro botanical Publication, New Delhi.
9. Schlegel, H. G. (1985). *General Microbiology*, Cambridge University Press.
10. Sohal, H.S. & Srviastava, A.K. (1994). Environment & Biotechnology. Ashish Pub. House, Unviersities Press (India) Ltd., Hyderabad.

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-I]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P1ESPC115 | **Title: Lab Course-1 (Based on P1ESTC101 and P1ESTC102)**

Credits: 2
Duration of Examination: 4 hrs

Maximum Marks : 50
a) Internal : 25 Marks
b) External : 25 Marks

Objectives:

To make students familiar with the experimental work based on Course No. P1ESTC101 and Course No. P1ESTC102

1. To equip students with the knowledge and skills for designing and setting up a bioremediation laboratory.
2. To engage students in assessing site conditions and applying selection criteria to identify suitable bioremediation technologies for field-scale applications.
3. To acquaint students with designing rain gardens and evaluating their applications for stormwater management and landscape sustainability.
4. To apprise students in designing green walls and evaluating their applications for environmental improvement and urban sustainability.
5. To familiarize students with designing green roofs and evaluating their applications for stormwater management, energy efficiency, and enhancing urban sustainability.
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**			

[SEMESTER-I]

Examinations to be held in December 2026, 2027 & 2028

Course No.: P1ESPC116 | **Title: Lab Course-2 (Based on P1ESTC103 and P1ESTC104)**

Credits: 2
Duration of Examination: 4 hrs

Maximum Marks : 50
a) Internal : 25 Marks
b) External : 25 Marks

Objectives:

Objectives:

To make students familiar with the experimental work based on Course No. P1ESTC103 and P1ESTC104

1. To formulate hypotheses and research questions based on real-world environmental issues.
2. To perform hands-on simulations of random, stratified, systematic, and cluster sampling designs and analyses the data using appropriate statistics.
3. To carry out a systematic literature review using academic library and summarize key trends.
4. To prepare visualizations like histograms and boxplots using Excel or R programming language on a given dataset.
5. To conduct inferential statistics such as t-tests, chi-square tests, ANOVA, correlation and regression on a given dataset.
6. To measure the Particulate Matter (PM2.5 & PM10) concentration using gravimetric method and/or real-time monitors.
7. To determine the mass concentration and chemical composition (ions/metals) of PM.
8. To measure the Nitrogen Oxides (NO_2) in air using sodium arsenite method (also known as the modified Jacobs and Hochheiser method).
9. To determine the Sulfur Dioxide in Ambient Air using Improved West–Gaeke method.
10. To quantify recent warming trends by downloading historical surface temperature datasets (e.g., NOAA/GISTEMP), compute anomalies, plot time series and linear/LOESS trend.
11. To conduct survey-based studies to assess the perception of climate change and its impacts.

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 2027, 2028 & 2029

Course No.: P1ESTC201 | **Title: Environmental Law and Policy**

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 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.

[SEMESTER-II]

Examinations to be held in May 2027, 2028 & 2029

Course No.: P1ESTC201 | **Title: Environmental Law and Policy**
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

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. VardhichandAIR1980 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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[SEMESTER-II]

Examinations to be held in May 2027, 2028 & 2029

Course No.: P1ESTE202 | **Title: Environmental Impact Assessment**

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**

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

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.
   Bryant, E. A. (1991). *Natural Hazards*. Cambridge University Press, Cambridge, New York.
4. John, G. R. and Hooten, D. C. (1990). *Environmental Impact Analysis Handbook*, McGraw Hill Book Company.
5. Judith, P. (1999). *Handbook of Environmental Impact Assessment Vol. I & II*. Blackwell Science.
6. Prakash, I. (1995). *Disaster Management*. Rashtra Prahari Prakashan, Ghaziabad.
7. Sapru, R. K. (1987). *Environmental Management in India*. Ashish Publishing House, New Delhi.
8. Shrivastava A.K., Baxter Nicola, Grimm Jacob (2003). "*Environmental Impact Assessment*", APH Publishers.

[SEMESTER-II]

Examinations to be held in May 2027, 2028 & 2029

Course No.: P1ESTE202 **Title: Environmental Impact Assessment**

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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[SEMESTER-II]

Examinations to be held in May 2027, 2028 & 2029

Course No.: P1ESTE203 | **Title: Environmental Monitoring and Instrumentation**

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**

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, components, working, and environmental applications of Atomic Absorption Spectroscopy (AAS) and UV-Visible Spectrophotometry (UV-VIS)
2.2. Principle, components, working, and environmental applications of Fourier Transform Infrared (FTIR) spectroscopy
2.3. Principle, components, working, and environmental applications of Flame Photometry
2.4. Principle, components, working, and environmental applications 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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[SEMESTER-II]

Examinations to be held in May 2027, 2028 & 2029

Course No.: P1ESTE203 | **Title: Environmental Monitoring and Instrumentation**

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.

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

[SEMESTER-II]

Examinations to be held in May 2027, 2028 & 2029

Course No.: P1ESTE204 | **Title: Artificial Intelligence for Sustainable Development**

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

Objectives

This course introduces students to the transformative potential of Artificial Intelligence (AI) in addressing critical environmental challenges and advancing the United Nations Sustainable Development Goals (SDGs). As the world grapples with climate change, biodiversity loss, and resource scarcity, AI offers powerful tools for monitoring, modelling, and managing complex environmental systems. The primary objectives of this course are to provide a foundational understanding of AI, Machine Learning (ML), Internet of Things (IoT) and Deep Learning (DL) concepts relevant to environmental science. The students will explore the direct applications of AI across various domains such as climate action, conservation, and resource management.

UNIT 1: INTRODUCTION TO ARTIFICIAL INTELLIGENCE

1.1. Introduction to AI and ML: definitions, history, AI vs. traditional computing, relevance to sustainability
1.2. Data Science for Environment: types and sources of environmental data; big data; remote sensing data; IoT sensors
1.3. AI techniques overview: machine learning, deep learning, natural language processing, computer vision
1.4. Global and National Initiatives: AI for Earth (Microsoft), climate change AI, India's AI for all, and related SDG frameworks

UNIT 2: AI APPLICATIONS FOR SUSTAINABLE DEVELOPMENT

2.1. Climate Change and Disaster Management: AI in climate modelling, extreme event prediction, early warning systems
2.2. Biodiversity and Ecosystem Conservation: Species identification, population modelling, habitat suitability mapping
2.3. Sustainable Agriculture and Water Management: Precision farming, irrigation optimization, water quality monitoring
2.4. Energy and Resource Efficiency: AI in renewable energy forecasting, smart grids, circular economy

UNIT 3: TOOLS, ETHICS, AND CASE GOVERNANCE

3.1. AI tools and platforms for environmental applications: Google Earth Engine, TensorFlow, PyTorch, QGIS with ML plugins
3.2. Case Studies: air quality monitoring in cities, glacier melt prediction, plastic waste tracking
3.3. Ethics, bias, and equity in AI: Algorithmic bias, data privacy, inclusivity, sustainable AI practices
3.4. Policy, governance, and future directions: AI policy frameworks, environmental governance, responsible innovation

LITERATURE RECOMMENDED

1. Haldorai, A., R, B. L., Murugan, S., and Balakrishnan, M. (2024). *Artificial Intelligence for Sustainable Development. Springer Nature Switzerland.*
2. Ghai, D., Rawal, K., Dhir, K., and Tripathi, S. L. (Eds.). (2025). *Artificial Intelligence Techniques for Sustainable Development.* CRC Press, Taylor & Francis Group.
3. Mondal, S. R., Vartiak, L., and Das, S. (Eds.). (2025). *Generative AI for a Net-Zero Economy: Managing Climate Change and Business Innovation in the Digital Era.* Springer Nature Singapore.

[SEMESTER-II]

Examinations to be held in May 2027, 2028 & 2029

Course No.: P1ESTE204 — **Title: Artificial Intelligence for Sustainable Development**

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

4. Reichstein, M. et al. (2019). Deep learning and process understanding for data-driven Earth system science. *Nature*, 566, 195–204.
5. UNEP (2022). *Artificial Intelligence in Environmental Science.*
6. Climate Change AI. *https://www.climatechange.ai/*

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.

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

[SEMESTER-II]

Examinations to be held in May 2027, 2028 & 2029

Course No.: P1ESTE205 | **Title: Energy and Environment**

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 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.

[SEMESTER-II]

Examinations to be held in May 2027, 2028 & 2029

Course No.: P1ESTE205 | **Title: Energy and Environment**

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

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.

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

[SEMESTER-II]
Examinations to be held in May 2027, 2028 & 2029

Course No.: P1ESRC230 | **Title: Research Project / Dissertation**
Credits: 16 | **Maximum Marks : 400**

Research Project / Dissertation Examination

The course shall comprise of the following :

A) Educational tour / Short field trips / Industrial visit / Experiential learning (100 marks)

The evaluation shall be as per the break-up below :

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

* The overall evaluation shall be based upon the field visit reports submitted by the students

B) Research Project / Dissertation

The Research Project / Dissertation shall be based on the research problem given to each student during the commencement of Semester - I. The Research Project / Dissertation shall comprise of the following chapters :

Chapter – 1	**Introduction**
Chapter – 2	**Review of Literature**
Chapter – 3	**Material and Methods**
Chapter – 4	**Results and Discussion**
Chapter – 5	**Summary and Conclusions**
--	**References / Bibliography**

Examination / Evaluation for Research Project / Dissertation

a) The Mid-term Evaluation shall be based on the report submitted on following chapters :

Chapter – 1	**Introduction**
Chapter – 2	**Review of Literature**
Chapter – 3	**Material and Methods**

b) The End-term Evaluation of Research Project / Dissertation shall be based on the external examination conducted 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).