# 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: Environmental Impact Assessment and Disaster 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**:

*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.

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**Course No.: P1ESTC101** | **Title: Environmental Impact Assessment and Disaster 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**


3. Bryant, E. A. (1991). *Natural Hazards*. Cambridge University Press, Cambridge, New York.
4. Cantar, L. W. (1977). *Environmental Impact Assessment*. McGraw Hill, Publications, New York.
5. Carter, W. N. (1992). *Disaster Management: A Disaster Manager's Handbook*. ADB Publication, Manila.
6. Cuny, F. (1983). *Disasters and Development*, Oxford University Press, England.
7. Green, S. (1980). *International Disaster Relief towards a Responsive system*. McGraw Hill Book Co., New York.
8. Gupta, H. (2003). *Disaster Management*. University Press, Hyderabad.
9. John, G. R. and Hooten, D. C. (1990). *Environmental Impact Analysis Handbook*, McGraw Hill Book Company.
10. Judith, P. (1999). *Handbook of Environmental Impact Assessment Vol. I & II*. Blackwell Science.
11. Prakash, I. (1995). *Disaster Management.* Rashtra Prahari Prakashan, Ghaziabad.
12. Sapru, R. K. (1987). *Environmental Management in India*. Ashish Publishing House, New Delhi.
13. Shrivastava A.K., Nicola B., Jacob G. (2003). "*Environmental Impact Assessment*", APH Publishers.
14. UNEP (United Nations: Environmental Programme) (1980). Industry and Environment Series, Vol. 1.
15. United Nations (1994). Trends in Environmental Impact Assessment of Energy Projects.
16. 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)** |
|---|---|---|---|
| Minor I (after 30 days) | 20% | 1 hour | 10 (MCQs on LMS)<br>10 (Subjective-type) |
| Minor II (after 60 days) | 21-40% | 1 hour | 10 (MCQs on LMS)<br>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.: P1ESTC102** | **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 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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## ONE-YEAR P.G. IN ENVIRONMENTAL SCIENCES (NEP-2020)

## [SEMESTER-I]

**Examinations to be held in December 2026, 2027 & 2028**

**Course No.: P1ESTC102** **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)<br>10 (Subjective-type) |
| Minor II (after 60 days) | 21-40% | 1 hour | 10 (MCQs on LMS)<br>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.: P1ESTC103** — **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, 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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## [SEMESTER-I]

**Examinations to be held in December 2026, 2027 & 2028**

**Course No.: P1ESTC103** **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)<br>05 (Subjective-type) |
| Minor II (after 60 days) | 21-40% | 1 hour | 05 (MCQs on LMS)<br>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-I]

**Examinations to be held in December 2026, 2027 & 2028**

**Course No.: P1ESTE104** | **Title: Environmental Microbiology**

**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**:

*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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### [SEMESTER-I]

**Examinations to be held in December 2026, 2027 & 2028**

**Course No.: P1ESTE104** **Title: Environmental Microbiology**

**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)** |
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| 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.

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## [SEMESTER-I]

**Examinations to be held in December 2026, 2027 & 2028**

**Course No.: P1ESTE105** | **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-I]

**Examinations to be held in December 2026, 2027 & 2028**

**Course No.: P1ESTE105** **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)<br>05 (Subjective-type) |
| Minor II (after 60 days) | 21-40% | 1 hour | 05 (MCQs on LMS)<br>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-I]

**Examinations to be held in December 2026, 2027 & 2028**

**Course No.: P1ESPC111** | **Title: Lab Course-1 (Based on PSESTC101)**

**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. PSESTC101*

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

## [SEMESTER-I]

**Examinations to be held in December 2026, 2027 & 2028**

**Course No.: P1ESPC112** | **Title: Lab Course-2 (Based on PSESTC102)**

**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. 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** | | | |

# 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.: P1ESPC113** **Title: Lab Course-3 (Based on PSESTC103)**

**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. Procedure for preparation of working standard solutions using serial dilution method.
2. Introduction to various analytical instruments in departmental laboratory.
3. Measure the $PM_{10}$ 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 $SO_2$ concentration in air using gaseous sampler.
7. Measure the ambient $NO_2$ 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** | | | |

# 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.: P1ESPC114** | **Title: Lab Course-4 (Based on PSESTE104)**

**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. P2ESTE104*

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** | | | |

# 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.: P1ESPC115** — **Title: Lab Course-5 (Based on PSESTE105)**

**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. P2ESTE105*

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** | | | |

## [SEMESTER-I]

**Examinations to be held in December 2026, 2027 & 2028**

**Course No.: P1ESRC125** **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** |

## [SEMESTER-II]

**Examinations to be held in May 2027, 2028 & 2029**

**Course No.: P2ESTC201** **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.: P2ESTC201** **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)<br>10 (Subjective-type) |
| Minor II (after 60 days) | 21-40% | 1 hour | 10 (MCQs on LMS)<br>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.

## [SEMESTER-II]

**Examinations to be held in May 2027, 2028 & 2029**

**Course No.: P2ESTC202** **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 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

## [SEMESTER-II]

**Examinations to be held in May 2027, 2028 & 2029**

**Course No.: P2ESTC202** — **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/
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): 2575-264
4. Rai, J. P. N. and Saraswat, S. (2023). Green Technologies for Waste Management: A Wealth from Waste Approach (1st ed.). CRC Press, ISBN: 9781003279136.
5. 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.
6. Tomasini, A. and Leon-Santiesteban, H. H. (2019). Fungal Bioremediation. CRC Press, ISBN: 978-1-138-63640-8.
7. 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.
8. 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)<br>10 (Subjective-type) |
| Minor II (after 60 days) | 21-40% | 1 hour | 10 (MCQs on LMS)<br>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.

## [SEMESTER-II]

**Examinations to be held in May 2027, 2028 & 2029**

**Course No.: P2ESTC203** **Title: Environmental Toxicology**
**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 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 $LC_{50}$ and $LD_{50}$ 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.

## [SEMESTER-II]

**Examinations to be held in May 2027, 2028 & 2029**

**Course No.: P2ESTC203** **Title: Environmental Toxicology**
**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**

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 Univeristy 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)<br>05 (Subjective-type) |
| Minor II (after 60 days) | 21-40% | 1 hour | 05 (MCQs on LMS)<br>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.

## [SEMESTER-II]

**Examinations to be held in May 2027, 2028 & 2029**

**Course No.: P2ESTE204** **Title: Environmental Health Hazards**
**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:**

*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 environmentand 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., Panigrah, 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.

## [SEMESTER-II]

**Examinations to be held in May 2027, 2028 & 2029**

**Course No.: P2ESTE204** **Title: Environmental Health Hazards**
**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)<br>05 (Subjective-type) |
| Minor II (after 60 days) | 21-40% | 1 hour | 05 (MCQs on LMS)<br>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.

## [SEMESTER-II]

**Examinations to be held in May 2027, 2028 & 2029**

**Course No.: P2ESTE205** | **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; $CO_2$ 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. HOx, SOx and NOx 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 $SO_2$, $NO_x$, CO, and $NH_3$ 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.

## [SEMESTER-II]

**Examinations to be held in May 2027, 2028 & 2029**

**Course No.: P2ESTE205** **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**

### 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)<br>05 (Subjective-type) |
| Minor II (after 60 days) | 21-40% | 1 hour | 05 (MCQs on LMS)<br>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.

## [SEMESTER-II]

**Examinations to be held in May 2027, 2028 & 2029**

**Course No.: P1ESRC211** | **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.

| **Theme of the visit** | **Marks** |
|---|---|
| Educational tour | 50 |
| Short field trips / Industrial visit / Experiential learning | 50 |
| **Total Marks** | **100** |

## [SEMESTER-II]

**Examinations to be held in May 2027, 2028 & 2029**

**Course No.: P1ESRC225** **Title: Research Project / Dissertation**
**Credits: 8** **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).