

Distribution of Courses and Credits
M.Sc. Environmental Sciences (CBCS)
[Semester – I]

Course Code	Title	Credits	Percentage change made as per recommendations of the expert committee	Contact hours per week L – T – P
PSESTC104	Environmental Chemistry	2	30% change in syllabus	2 – 0 – 0
PSESTC105	Basics of Earth Sciences	2	Less than 10%	2 – 0 – 0
PSESTC106	Concepts of Ecology and Ecosystem	2	New Course	2 – 0 – 0
PSESTC107	Community and Population Ecology	2	New Course	2 – 0 – 0
PSESTC108	Remote Sensing and GIS	4	New Course	4 – 0 – 0
PSESTC109	Aquatic Environment (New)	4	New Course	4 – 0 – 0
PSESPC105	Lab Course-I (Based on PSESTC105, 106 and 107)	4	New Course	0 – 0 – 6
PSESPC106	Lab Course-II (Based on PSESTC104 and 109)	2	New Course	0 – 0 – 3
PSESPC107	Lab Course-III (Based on PSESTC108)	2	New Course	0 – 0 – 3

[Semester- II]

Course Code	Title	Credits	Percentage change made as per recommendations of the expert committee	Contact hours per week L – T – P
PSESTC202	Principles of Climatology	4	Less than 10%	
PSESTC206	Environmental Impact Assessment and Management	4	New Course	4 – 0 – 0
PSESTC207	Environmental Pollution	4	New Course	4 – 0 – 0
PSESTC208	Environmental Microbiology	2	New Course	2 – 0 – 0
PSESTC209	Environmental Analysis & Instrumentation	2	New Course	2 – 0 – 0
PSESPC204	Lab Course-I (Based on PSESTC202 and 206)	2	New Course	0 – 0 – 3
PSESPC205	Lab Course-II (Based on PSESTC207)	2	New Course	0 – 0 – 3
PSESPC206	Lab Course-III (Based on PSESTC208)	2	New Course	0 – 0 – 3
PSESPC207	Lab Course-IV (Based on PSESTC209)	2	New Course	0 – 0 – 3

[Semester – III]

Course Code	Title	Credits*	Percentage change made as per recommendations of the expert committee	Contact hours per week L – T – P
PSESTE304	Ecotoxicology	2	30% change in syllabus	2 – 0 – 0
PSESTO305**	Climate Change: Science and Policies	4	Less than 10%	4 – 0 – 0
PSESTE306	Natural Resources: Conservation & Management	2	New Course	2 – 0 – 0
PSESTE307	Ecotechnologies for Contaminant Remediation	2	New Course	2 – 0 – 0
PSESTE308	Basic course in Environmental Economics	2	New Course	2 – 0 – 0
PSESTE309	Biological Statistics	2	New Course	2 – 0 – 0
PSESTE310	Fundamentals of Soil Science	2	New Course	2 – 0 – 0
PSESTE311	Wildlife Conservation and Management	2	New Course	2 – 0 – 0
PSESTE312	Forest Ecology	2	New Course	2 – 0 – 0
PSESTE313	Computer Application	2	New Course	2 – 0 – 0
PSESPE303	Lab Course-I (Based on PSESTE304)	2	New Course	0 – 0 – 3
PSESPE304	Lab Course-II (Based on PSESTE306)	2	New Course	0 – 0 – 3
PSESPE305	Lab Course-III (Based on PSESTE307)	2	New Course	0 – 0 – 3
PSESPE306	Lab Course-IV (Based on PSESTE309)	2	New Course	0 – 0 – 3
PSESPE307	Lab Course-V (Based on PSESTE310)	2	New Course	0 – 0 – 3
PSESPE308	Lab Course-VI (Based on PSESTE311)	2	New Course	0 – 0 – 3
PSESPE309	Lab Course-VII (Based on PSESTE312)	2	New Course	0 – 0 – 3
PSESPE310	Lab Course-VIII (Based on PSESTE313)	2	New Course	0 – 0 – 3
	MOOC Course***	4		

* Students have to opt for 24 Credits from the above courses.

** Optional Course offered to the students from other Departments

***MOOC Course offered to the students of the Department in lieu of Optional course

[Semester- IV]

Course Code	Title	Credits	Percentage change made as per recommendations of the expert committee	Contact hours per week L – T – P
PSESTE401	Environmental Law	4	New Course	4 – 0 – 0
PSESTE404	Environmental Biotechnology	2	New Course	2 – 0 – 0
PSESTO405*	Man and Environment: Issues and policies	4	New Course	4 – 0 – 0
PSESTE406	Atmospheric Processes	2	New Course	2 – 0 – 0
PSESTE407	Energy and Environment	2	New Course	2 – 0 – 0
PSESTE408	Disaster Management	4	New Course	4 – 0 – 0
PSESTE409	Environmental Health Hazards and Sanitation	2	New Course	2 – 0 – 0
PSESDC401	Dissertation	8		0 – 0 – 15

* **Optional Course offered to the students from other Departments**

L – Number of Lectures, T – Number of Tutorials, P – Number of Practical hours.

SCHEME OF EXAMINATIONS

For 4 Credit Courses: Each paper shall carry 100 marks and the distribution of marks in each theory paper shall be as under:

Component	Marks	Remarks
Minor I	20	After 30 days on completion of 25% of syllabus
Minor II	20	After 60 days on completion of 50% of syllabus
Major End of Semester	60	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	100	

For 2 Credit Courses: Each paper shall carry 50 marks and the distribution of marks in each theory paper shall be as under:

Component	Marks	Remarks
Minor I	10	After 30 days on completion of 25% of syllabus
Minor II	10	After 60 days on completion of 50% of syllabus
Major End of Semester	30	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	50	

NOTE FOR PAPER SETTING:

For 2 Credit Courses

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 5 questions (objective/short answer type) of one mark each. Section B will consist of one question with internal choice (Long answer type) of five marks. Each Minor Test would be of 45 minutes duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of ten marks each. Major Test would be of 1½ hrs duration and carry 60% weightage of the total marks.

For 4 Credit Courses

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/Short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of 5 marks each. Each Minor Test would be of 1 hour duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 15 questions (objective/short answer type) of one mark each. Section B will consist of three questions with internal choice (Long answer type) of 15 marks each. Major Test would be of 2½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences(CBCS)

[Semester-I]

For examinations to be held in December 2021, 2022 & 2023

Course No.: PSESTC104

Title: Environmental Chemistry

Credits: 2

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

Objectives:

This course has been designed to acquaint students with various chemical constituents of the environment and the interactions between them with focus on the chemical processes that are central to important environmental problems concerning air, water and soil and the mechanisms of interaction between them.

UNIT-1: ATMOSPHERIC CHEMISTRY

- 1.1 Basic concepts and scope of Environmental Chemistry
- 1.2 Composition and structure of Earth's atmosphere
- 1.3 Cycling of primary gaseous pollutants
- 1.4 Chemical and photochemical reactions in atmosphere and chemistry of methane
- 1.5 Chemistry of ozone and alternatives for CFC's

UNIT-2: CHEMISTRY OF WATER

- 2.1 Water: Structure and bonding of water molecule, Properties of water
- 2.2 Acid-base equilibria, pH of water
- 2.3 Buffer Solutions: Concept of Buffering capacity, Importance of natural buffers, Oxidation –reduction, Redox potential
- 2.4 Concept of DO, BOD and COD, Precipitation Chemistry
- 2.5 Water treatment Process, Principles of coagulation, flocculation, sedimentation and filtration

UNIT-3: CHEMISTRY OF TOXICANTS

- 3.1 Pesticides, their classification and effects
- 3.2 Carcinogens in the air
- 3.3 Sources and biochemical aspects of heavy metals (Hg, Cd, Pb, Cr)
- 3.4 Sources and biochemical aspects of metalloids (As, Se)
- 3.5 Enzyme inhibition

LITERATURE RECOMMENDED:

1. Baird, C. (2000). Environmental Chemistry. W. H. Freeman and Company, USA.
2. Connell, D. W. (2005). Basic Concepts of Environmental Chemistry. 2nd Ed. Published by CRC Press, Taylor and Francis Group.
3. De, A. K. (2017). Environmental Chemistry. New Age International Publishers Ltd., New Delhi.
4. Girard, J. E. (2014). Principals of Environmental Chemistry. Jones and Bartlett Publishers, Inc.
5. Harrison, R. M. and Mora, S. J. De. (1996). Introductory Chemistry for the Environmental Sciences. Cambridge University, Press.
6. Liu, D. H. F. and Liptak, B. G. (1997). Environmental Engineers' Handbook. 2nd Ed. CRC Press. Taylor and Francis Group.

M.Sc. Environmental Sciences (CBCS)

[Semester-I]

For examinations to be held in December 2021, 2022 & 2023

Course No.: PSESTC104

Title: Environmental Chemistry

Credits: 2

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

7. Manahan, S. E. (2009). Environmental Chemistry, 9thEd. CRC Press, Taylor and Francis Group.
8. Masters, G. M. (1997). Introduction to Environmental Engineering and Science: International Edition. 2nd Edition. Published by Pearson.
9. Mido, Y. and Satake, M. (1995). Chemicals in the Environment. Discovery Publishing House, New Delhi.
10. Sharma, B. K. (2001). Environmental Chemistry. Krishna Prakashan Media Pvt. Ltd. Meerut.
11. Sodhi, G. S. (2006). Fundamental concepts of environmental chemistry. Narosa Publishing House, New Delhi.

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	10	After 30 days on completion of 25% of syllabus
Minor II	10	After 60 days on completion of 50% of syllabus
Major End of Semester	30	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	50	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 5 questions (objective/short answer type) of one mark each. Section B will consist of one question with internal choice (Long answer type) of five marks. Each Minor Test would be of 45 minutes duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of ten marks each. Major Test would be of 1½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-I]

For examinations to be held in December 2021, 2022 & 2023

Course No.: PSESTC105

Title: Basics of Earth Sciences

Credits: 2

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

Objectives:

This course is designed to fulfill the needs of students of environmental sciences in understanding the internal structure of Earth and various geomorphological processes as well as systems responsible for the formation and modification of landforms on the Earth. This would also serve as a base for different applied aspects of environmental science e.g. GIS & remote sensing, disaster management and environmental impact assessment and management.

UNIT-1: INTERIOR OF EARTH

- 1.1 Concept of seismology, types of seismic waves and their role in the study of Earth's interior
- 1.2 Different zones in the Earth's interior and their composition
- 1.3 The Earth's Magnetic Field - Magnetic reversal and magnetic anomaly
- 1.4 Continental Drift Theory
- 1.5 Theory of isostasy and global isostatic adjustment

UNIT-2: GEOMORPHOLOGICAL PROCESSES

- 2.1 Types of sedimentary and igneous rocks
- 2.2 Metamorphic rocks and their types; Rock cycle
- 2.3 Folds and faults, major types of folds and faults
- 2.4 Physical weathering, chemical weathering and their types
- 2.5 Volcanism - Components and types of volcanoes, volcanic materials, process and effects of volcanism

UNIT-3: GEOMORPHOLOGICAL SYSTEMS

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

LITERATURE RECOMMENDED:

(A) Books:-

1. Bierman, P. R. and Montgomery, D. (2014). Key Concepts in Geomorphology, Macmillan Higher Education Company, New York.
2. Cooke, R. U. and Doornkamp, J. C. (1990). Geomorphology in Environmental Management- A New Introduction. 2nd Ed. Clarendon Press, Oxford, U.K.
3. Easterbrooke, D. J. (1999). Surface Processes and Landforms. 2nd Ed. Prentice-Hall, Inc., New Jersey.
4. Huggett, R. J. (2016). Fundamentals of Geomorphology. Routledge, London.
5. Keller, E. A. (1999). Introduction to Environmental Geology. Prentice-Hall, New Jersey.

M.Sc. Environmental Sciences (CBCS)

[Semester-I]

For examinations to be held in December 2021, 2022 & 2023

Course No.: PSESTC105

Title: Basics of Earth Sciences

Credits: 2

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

6. Press, F., Siever, R., Grotzinger, J. and Jordan, T. H. (2003). Understanding Earth. 4th Ed. W. H. Freeman & Co. U.S.A.
7. Ritter, D. F.; Kochel, R. C. and Miller, J. R. (2011). Process Geomorphology. 5th Ed. Waveland Press, Inc., Illinois.
8. Singh, S. (2020). Physical Geography. Pravalika Publications, Prayagraj.
9. Smithson, P.; Addison, K. and Atkinson, K. (2008). Fundamentals of the Physical Environment. 4th Ed., Routledge Publishers, London.
10. Strahler, A. H. (2013). Introducing Physical Geography. 6th Ed., John Wiley & Sons, New York.
11. Thornbury, W. D. (2018). Principles of Geomorphology. New Age International Publishers, New Delhi.
12. Wild, R. (1993). The Earth Care Annual. National Wildlife Federation, Rodale Press, Pennsylvania.

(B) Web Sites: -

1. <https://www.nsf.gov/geo/ear/about.jsp>
2. https://www.eaps.purdue.edu/outreach/teacher_resources.html
3. https://ocw.nagoya-u.jp/files/526/humblet_full.pdf

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	10	After 30 days on completion of 25% of syllabus
Minor II	10	After 60 days on completion of 50% of syllabus
Major End of Semester	30	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	50	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 5 questions (objective/short answer type) of one mark each. Section B will consist of one question with internal choice (Long answer type) of five marks. Each Minor Test would be of 45 minutes duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of ten marks each. Major Test would be of 1½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-I]

For examinations to be held in December 2021, 2022 & 2023

Course No.: PSESTC106

Credits: 2

Duration of Examination: 1½ hrs

Title: Concepts of Ecology and Ecosystem

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

Objectives:

The purpose of the course is to make the students understand various ecological principles and factors that determine the size and number of ecosystems that can co-exist within a specific area. This knowledge is crucial for better development and management of natural resources and global environment.

UNIT-1: INTRODUCTION TO ECOLOGY AND ECOSYSTEM

- 1.1 Introduction to Ecology (definition, subdivisions) and ecosystem (concept, component and structure)
- 1.2 Terrestrial ecosystem: Desert (hot and cold), forest, rangeland
- 1.3 Aquatic ecosystem: wetlands, lotic, lentic, estuarine (mangrove), Oceanic
- 1.4 Biomes: Concept, classification, distribution and Characteristics of different biomes: Tundra, Taiga, Grassland, Deciduous Forest biome, Chapparal, Savanna and Tropical Rain Forest
- 1.5 Ecosystem development and concept of climax

UNIT-2: BIOGEOCHEMICAL CYCLE AND PRODUCTIVITY

- 2.1 Biogeochemical cycles –concept and types
- 2.2 Gaseous cycles (nitrogen, carbon)
- 2.3 Sedimentary cycles (phosphorus and sulphur)
- 2.4 Laws of thermodynamics and generalized models of energy flow through ecosystem
- 2.5 Primary productivity and methods of its measurements, Secondary productivity (concept)

UNIT-3: PRINCIPLES OF LIMITING FACTORS

- 3.1 Law of minimum and Law of tolerance
- 3.2 Physical factors as limiting factors (water, light and temperature)
- 3.3 Edaphic factors as limiting factors (soil)
- 3.4 Topographic factors as limiting factors
- 3.5 Ecological Indicators of environmental factors

LITERATURE RECOMMENDED:

1. De, A. K. and De, A. K. (2009). Environment and Ecology, New Age International (P) Ltd. Publisher, New Delhi
2. Benton, A. H. and Werner, W. E. (1976). Field Biology and Ecology. Tata McGraw Hill Publishing Company Ltd. New Delhi
3. Chapman, J. L. and Reiss, M. J. (1999). Ecology-Principles and applications. Cambridge University Press
4. Faure, C.; Ferrer, C.; Medori, P. and Devaux, J. (2001). Ecology. Sciences & Practice. Oxford & IBH Pub. Co. Pvt. Ltd. (N. Delhi)

M.Sc. Environmental Sciences (CBCS)

[Semester-I]

For examinations to be held in December 2021, 2022 & 2023

Course No.: PSESTC106

Credits: 2

Duration of Examination: 1½ hrs

Title: Concepts of Ecology and Ecosystem

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

5. Kormondy, E. J. (1986). Concept of Ecology. Prentice Hall of India, New Delhi
6. Dash, M. C. (1993). Fundamentals of Ecology. Tata McGraw Hill Publishing Company Ltd. New Delhi
7. Odum, E. P. and Barrett, G. W. (2017) (5th Ed.). Fundamentals of Ecology. Cengage Learning (RS); 30.16 Edition Publishers, Dehradun
8. Singh, S. (2008). Physical Geography. Prayag Pustak Bhavan, Allahabad
9. Southwick, H. C. (1976). Ecology & Quality of our Environment. Van Nostrand Reinhold Company, New York

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	10	After 30 days on completion of 25% of syllabus
Minor II	10	After 60 days on completion of 50% of syllabus
Major End of Semester	30	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	50	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 5 questions (objective/short answer type) of one mark each. Section B will consist of one question with internal choice (Long answer type) of five marks. Each Minor Test would be of 45 minutes duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of ten marks each. Major Test would be of 1½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)
[Semester-I]
For examinations to be held in December 2021, 2022 & 2023

Course No.: PSESTC107

Credits: 2

Duration of Examination: 1½ hrs

Title: Community and Population Ecology

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

Objectives:

The purpose of the course is to make the students understand various principles and concepts of community and population and factors that determine the size and number of populations that can co-exist within a specific area. This knowledge is crucial for better development and management of natural resources and the global environment.

UNIT-1: BIOTIC COMMUNITY - PRINCIPLES AND CONCEPTS

- 1.1 Concept of biotic community
- 1.2 Intra community - classification and concept of ecological dominance
- 1.3 Aims of Community Analysis
- 1.4 Species diversity –factors and indices
- 1.5 Patterns in communities

UNIT-2: POPULATION CHARACTERISTICS AND DYNAMICS

- 2.1 Group properties –meaningful at level of individual (Intra specific interactions)
- 2.2 Group properties –meaningful at level of community – density and Age distribution
- 2.3 Group properties –meaningful at level of community – natality and mortality survivorship curves and Life tables
- 2.4 Population growth vis-a-vis the concept of carrying capacity
- 2.5 Density as a factor in regulating population – density independent and density dependent factors

UNIT-3: POPULATION REGULATION STRUCTURE AND INTERACTION

- 3.1 Population dispersal
- 3.2 Population structure
 - 3.2. a Internal Distribution Patterns
 - 3.2. b Aggregation and Allee's principle
 - 3.2. c Isolation and territoriality
- 3.3. Interaction within population
 - 3.3. a Negative Interactions - Interspecific competition, Predation, Parasitism, Amensalism.
 - 3.3. b Positive Interactions - Commensalism, Co-operation, Mutualism
- 3.4 Population Behaviour
 - 3.4. a Basic behaviour patterns
 - 3.4. b Regulatory and Compensatory behaviours
 - 3.4. c Social behaviour
- 3.5 Character Displacement - Sympatry and Allopatry

LITERATURE RECOMMENDED:

1. Benton, A. H. and Werner, W. E. (1976). Field Biology and Ecology. Tata McGraw Hill Publishing Company Ltd. New Delhi.

M.Sc. Environmental Sciences (CBCS)
[Semester-I]
For examinations to be held in December 2021, 2022 & 2023

Course No.: PSESTC107

Credits: 2

Duration of Examination: 1½ hrs

Title: Community and Population Ecology

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

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

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	10	After 30 days on completion of 25% of syllabus
Minor II	10	After 60 days on completion of 50% of syllabus
Major End of Semester	30	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	50	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 5 questions (objective/short answer type) of one mark each. Section B will consist of one question with internal choice (Long answer type) of five marks. Each Minor Test would be of 45 minutes duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of ten marks each. Major Test would be of 1½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-I]

For examinations to be held in December 2021, 2022 & 2023

Course No.: PSESTC108

Title: Remote Sensing and GIS

Credits: 4

Duration of Examination: 2½ hrs

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

Objectives:

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

UNIT-1: INTRODUCTION TO REMOTE SENSING AND RS SYSTEMS

- 1.1 Remote sensing basics: definition, concept of Electromagnetic Radiation (EMR); Electromagnetic Spectrum; advantages of Remote Sensing
- 1.2 EMR interaction with Atmosphere & Terrain
- 1.3 Stages in Remote Sensing data acquisition
- 1.4 Platforms and Sensors: Classification of Platforms, Basic Characteristics of Sensors and Spatial, Spectral, Temporal, Radiometric resolutions, Remote sensing systems: Framing and Scanning Systems
- 1.5 Salient features of IRS series, LANDSAT - 5,7,8, SPOT, IKONOS, NOAA, INSAT satellites and sensors

UNIT-2: AERIAL PHOTOGRAPHY AND PHOTOGRAMMETRY

- 2.1 Aerial photography: definition, basic information and specifications for planning and execution of aerial photography.
- 2.2. Aerial Photographs: Types of aerial photographs, information recorded on aerial photographs.
- 2.3 Brief information about Tilt, Swing, Overlap of aerial photographs.
- 2.4 Fundamentals of photogrammetry I: Taking measurements from aerial photographs i.e. Scale of aerial photographs, distance, area.
- 2.5 Fundamentals of photogrammetry II: Stereovision, Stereoscopes, Measurement of height of objects by Parallax method.

UNIT-3: MICROWAVE AND THERMAL REMOTE SENSING

- 3.1 Microwave Remote Sensing: Introduction, advantages, Active and passive microwave remote sensing, SLAR and SAR systems
- 3.2 Radar components, Radar operating principles, imaging systems, spatial resolution concepts
- 3.3 Radar return, Characteristics of Radar images and interpretation of radar images
- 3.4 Introduction to Satellite Radar systems: Seasat, SIR, RISAT –I, Radarsat
- 3.5 Thermal Remote Sensing: Concept, Thermal Infrared Radiation properties, application of Thermal infrared remote sensing

M.Sc. Environmental Sciences (CBCS)

[Semester-I]

For examinations to be held in December 2021, 2022 & 2023

Course No.: PSESTC108

Title: Remote Sensing and GIS

Credits: 4

Duration of Examination: 2½ hrs

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

UNIT-4: IMAGE INTERPRETATION

- 4.1 Visual Interpretation of aerial photographs & Satellite images
- 4.2 Digital Image Processing: Digital Image & image structure, hardware and software requirements for digital image processing.
- 4.3 Image restoration: Radiometric and geometric errors and their corrections
- 4.4 Image enhancement: Contrast, Contrast enhancements- linear and non-linear, edge enhancement.
- 4.5 Information Extraction: Principal component analysis, Image classification-unsupervised and supervised, change detection.

UNIT-5: GEOGRAPHICAL INFORMATION SYSTEM (GIS) AND GLOBAL POSITIONING SYSTEM (GPS)

- 5.1 Geographical Information System (GIS)-I: definition, components, geographical data and database structures.
- 5.2 Basis of GIS Mapping: map projections, datum, coordinate systems Reference maps, topo-sheets, thematic maps
- 5.3 Geographical Information System (GIS)-II: Spatial data models viz. raster and vector, Data input & output in GIS.
- 5.4 Introduction to Global Positioning System (GPS)
- 5.5 Land use / Land cover mapping using GIS

LITERATURE RECOMMENDED:

1. Burrough, P. A. (1986). Principles of Geographical Information System for Land Resource Assessment. Oxford University Press.
2. Curran, P. J. (1988). Principles of Remote Sensing, ELBS, Longman Inc.
3. Jensen, J. R. (1986). Digital Image Processing. Prentice Hall, New York.
4. Jensen, J. R. (2007). Remote Sensing of the Environment, Pearson Education, Singapore.
5. Lillesand, T. M. and Kiefer, R. W. (1987). Remote Sensing & Image Interpretation. 2nd Ed., John Wiley & Sons, NewYork.
6. Rao, U. R. (1996). Space Tech. for Sustainable development, Tata McGraw Hills Co., New Delhi.
7. Tomlin, C. D. (1990). Geographic Information Systems and Cartographic Modeling, Prentice Hall, Englewood Cliffs.

M.Sc. Environmental Sciences (CBCS)

[Semester-I]

For examinations to be held in December 2021, 2022 & 2023

Course No.: PSESTC108

Title: Remote Sensing and GIS

Credits: 4

Duration of Examination: 2½ hrs

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	20	After 30 days on completion of 25% of syllabus
Minor II	20	After 60 days on completion of 50% of syllabus
Major End of Semester	60	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	100	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/Short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of 5 marks each. Each Minor Test would be of 1 hour duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 15 questions (objective/short answer type) of one mark each. Section B will consist of three questions with internal choice (Long answer type) of 15 marks each. Major Test would be of 2½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-I]

For examinations to be held in December 2021, 2022 & 2023

Course No.: PSESTC109

Title: Aquatic Environment(New)

Credits: 4

Duration of Examination: 2½ hrs

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

Objectives:

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

UNIT-1: AQUATIC ENVIRONMENT: BASICS

- 1.1 Hydrology: Definition, terms and concepts used to describe basic physical hydrologic processes including evaporation, transpiration, precipitation, infiltration.
- 1.2 Hydrological cycle: Key components and processes
- 1.3 Global water balance
- 1.4 Distribution of water on Earth
- 1.5 Indian water resources and their status.

UNIT-2: LENTIC ENVIRONMENT- LAKES AND WETLANDS

- 2.1 Lakes: Origin and Classification.
- 2.2 Lake Stratification and mixing
- 2.3 Characteristics of lakes (physical, chemical and biological)
- 2.4 Wetlands: Definition, types and classification
- 2.5 Wetlands: monitoring, assessment and management

UNIT-3: LOTIC ENVIRONMENT-STREAMS AND RIVERS

- 3.1 Types of Streams and rivers, types of flow
- 3.2 Major River Basins of India
- 3.3 Characteristics of lotic waters (physical, chemical and biological)
- 3.4 Conservation of rivers with focus on national river conservation plan
- 3.5 Case studies: Namami Gange and Yamuna Action Plan.

UNIT-4: GROUNDWATER HYDROLOGY

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

UNIT-5: ESTUARINE AND MARINE ENVIRONMENT

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

M.Sc. Environmental Sciences (CBCS)

[Semester-I]

For examinations to be held in December 2021, 2022 & 2023

Course No.: PSESTC109

Title: Aquatic Environment(New)

Credits: 4

Duration of Examination: 2½ 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. (1997). Wetlands of India. Discovery Publishing House. New Delhi.
2. Aggarwal, S. C. (1999). Limnology. APH Publication Corporation, New Delhi.
3. Allan, J. D. (1995). Stream Ecology-Structure and function of running waters. Chapman and Hall Publication, UK.
4. Bal, A. S. (2005). An Introduction to Environment Management. Himalaya Publishing House, Mumbai.
5. Cole, G. A. and Weihe, P. E. (2016). Limnology. 5th Ed., Waveland Press. Inc., Long Grove, IL, 60047-9580(e-book).
6. Dodds, W. and Whiles, M. (2010). Freshwater Ecology. 2nd Ed. Academic Press.
7. Dugan, P. (1993). A Mitchell Beazley World Conservation Atlas. Wetlands in Danger. Mitchell Beazley, London.
8. Garg, S. K. (1998). Hydrology and water resources engineering. Khanna Publishers, Delhi.
9. Goldman, C. R. and Horne, A. J. (1994). Limnology. McGraw Hill Int. Book Co., New Delhi.
10. Hutchinson, G. E. (2004). Treatise on Limnology. Vol. I, part-2, Vol. II. John Wiley and Sons, New York.
11. India's Wetlands Mangroves and Coral Reefs (1992). WWF India.
12. Jhingran, V. G. (1992). Fish and Fishes of India. Hindustan Publishing Corporation, India.
13. Keddy, P. A. (2010). Wetland Ecology- Principles and Conservation. 2nd Ed. Cambridge University Press, Cambridge, UK. ISBN 978-521-51940-3(e-book)
14. Mortimer, C. H. (2003). Lake Michigan in Motion: Responses of an Inland Sea to Weather, Earth-Spin and Human Activities. University of Wisconsin Press.
15. Rushton, K. R. (2003). Groundwater Hydrology- Conceptual and computational Models. John Wiley and Sons, West Sussex, England. ISBN 0-470-85004-3.
16. Schoworbel, J. (1991). Handbook of limnology. Scientific Publication. Jodhpur.
17. Sinha, P. C. and Mohanty, R. (2002). Wetland Management Policy and Law. Kanishka Publishers, Distributors, New Delhi.
18. Speight, M. and Henderon, P. (2010). Marine Ecology- Concepts and applications. Wiley Blackwell. A John Wiley & Sons, Ltd. Publication, UK.
19. Wetzel, R. G. (2001). Limnology: Lakes and River Ecosystem. Academic Press, London.
20. Wetzel, R. G. and Likens, G. E. (2000). Limnological Analyses. 3rd Ed. Springer.

M.Sc. Environmental Sciences (CBCS)

[Semester-I]

For examinations to be held in December 2021, 2022 & 2023

Course No.: PSESTC109

Title: Aquatic Environment(New)

Credits: 4

Duration of Examination: 2½ hrs

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	20	After 30 days on completion of 25% of syllabus
Minor II	20	After 60 days on completion of 50% of syllabus
Major End of Semester	60	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	100	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/Short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of 5 marks each. Each Minor Test would be of 1 hour duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 15 questions (objective/short answer type) of one mark each. Section B will consist of three questions with internal choice (Long answer type) of 15 marks each. Major Test would be of 2½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-I]

For examinations to be held in December 2021, 2022 & 2023

Course No.: PSESPC105

Title: Lab Course-I (Based on PSESTC105; PSESTC106; PSESTC107)

Credits: 4

Duration of Examination: 3 hrs

Maximum Marks : 100

a) Internal : 50 Marks

b) External : 50 Marks

Objectives:

To make students familiar with experimental work based on Course No. PSESTC105; PSESTC106; PSESTC107.

1. To determine minimum size of quadrat to be laid down for study of plant community.
2. To determine minimum number of quadrats to be laid down for study of plant community.
3. Find out abundance of different plant species in given plot of vegetation.
4. Find out density of different plant species in given plot of vegetation.
5. Find out frequency of different plant species in given plot of vegetation.
6. Determine the cover area of different plant species.
7. Determine the Basal area of different plant species.
8. Calculate I.V.I. of different plant species in given plot of vegetation. Arrange different species in descending order of I.V.I. Draw Polygraph of first Five species in order of I.V.I.
9. Determine type of dispersion of different plant species in given plot of vegetation.
10. Cut V.S. of Mesophyte leaf to study ecological adaptation.
11. Cut V.S. of Xerophyte leaf to study ecological adaptation.
12. Cut V.S. of Hydrophyte leaf to study ecological adaptation.
13. Determine the number of seeds in given seed mixture by Capture-Recapture method.
14. Qualitative as well as quantitative count of different phytoplankton in given water sample.
15. Draw Ombrothermic curve from given data of Temperature and Precipitation.
16. Above and below ground biomass in given plot of vegetation.
17. Texture of different types of soils.
18. To determine the Bulk density and porosity of the soil.

SCHEME OF EXAMINATIONS

Component	Marks	Remarks
Internal	50	After 60 days on completion of 50% of syllabus Written Exam: 27 Marks (4 Practicals of 05 Marks each; Viva-voce: 7 Marks) Attendance: 10 Marks Day to Day Performance: 13 Marks
External	50	On completion of entire syllabus Written Exam: 50 Marks (4 Practicals of 10 Marks each; Viva-voce:10 Marks)
Total	100	

M.Sc. Environmental Sciences (CBCS)

[Semester-I]

For examinations to be held in December 2021, 2022 & 2023

Course No.: PSESPC106

Credits: 2

Duration of Examination: 2 hrs

Title: Lab Course-II (Based on PSESTC104; PSESTC109)

Maximum Marks : 50

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with the experimental work based on Course No. PSESTC104; PSESTC109.

1. To find out the amount of Free CO₂ in water sample by Titration method.
2. To find out the amount of DO from water sample by Alsterberg's alkaline sodium azide method.
3. To find out the amount of Cl⁻ in given water sample by Titration method.
4. To find out the amount of CO₃²⁻ and HCO₃⁻ from given water sample by Titration method.
5. To find out the amount of Ca⁺⁺ from given water sample by Titration method.
6. To find out the amount of Ca⁺⁺ and Mg⁺⁺ from given water sample by Titration method.
7. To find out pH of given water sample by potentiometric method.
8. To find out the electrical conductivity of the given water sample.
9. To study the temperature variations in lotic and lentic water bodies at different depths.
10. To find out the transparency of water by Secchi Disc method.
11. To analyze the total dissolved solids (TDS) in the given water sample.
12. To analyze the total suspended solids (TSS) in the given water sample.
13. To analyze the total solids (TS) in the given water sample.
14. To identify the given specimen of macrophytes and write their morphological characteristics.
15. To visit a river/stream/lake/pond/spring and write a field visit report.

SCHEME OF EXAMINATIONS

Component	Marks	Remarks
Internal	25	After 60 days on completion of 50% of syllabus Written Exam: 13 Marks (4 Practicals of 02 Marks each; Viva voce : 5 Marks) Attendance: 5 Marks Day to Day Performance: 7 Marks
External	25	On completion of entire syllabus Written Exam: 25 Marks (4 Practicals of 5 Marks each; Viva-voce: 5 Marks)
Total	50	

M.Sc. Environmental Sciences (CBCS)

[Semester-I]

For examinations to be held in December 2021, 2022 & 2023

Course No.: PSESPC107

Title: Lab Course-III (Based on PSESTC108)

Credits: 2

Duration of Examination: 2 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. PSESTC108.

1. Acquaintance and the study of aerial photos and the information recorded on them.
2. Acquaintance and the study of satellite images and the information recorded on them.
3. Study of topographical sheets and information recorded on them.
4. Measurement of distance, scale from aerial photos/satellite images and area estimation using grids, dotted grid and digital planimeters.
5. View of 3D models using Aerial photos and pocket and mirror stereoscopes.
6. Interpretation of satellite images/aerial photos using photo elements.
7. Acquaintance with Digital satellite data.
8. Acquaintance with Digital image processing software (ERDAS).
9. Acquaintance with GIS software (Arc. GIS) and its working.
10. How to find the height of a tree using Hypsometer?
11. Field visit for ground truth collection and collection of GPS readings.

SCHEME OF EXAMINATIONS

Component	Marks	Remarks
Internal	25	After 60 days on completion of 50% of syllabus Written Exam: 13 Marks (4 Practicals of 02 Marks each; Viva-voce: 5 Marks) Attendance: 5 Marks Day to Day Performance: 7 Marks
External	25	On completion of entire syllabus Written Exam: 25 Marks (4 Practicals of 5 Marks each; Viva-voce: 5 Marks)
Total	50	

M.Sc. Environmental Sciences (CBCS)

[Semester-II]

For examinations to be held in May 2022, 2023 & 2024

Course No.: PSESTC202

Title: Principles of Climatology

Credits: 4

Duration of Examination: 2½ hrs

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

Objectives:

Climatology describes the long-term pattern of weather in a particular area. Climates often undergo cyclic changes over decades, centuries and millennia. As foolproof predictions of environmental futures may be an unattainable goal, but by a better understanding of environmental processes and systems, we shall be better prepared to manage the physical environment and to respond to the changes. The present course describes the basic concepts of climatology and their applications in weather forecasting and immediate human environments.

UNIT-1: CLIMATOLOGY: BASICS AND TEMPERATURE DISTRIBUTION

- 1.1 Definition, sub-divisions and scope of climatology
- 1.2 Composition and structure of the atmosphere
- 1.3 Insolation: Definition, factors governing insolation
- 1.4 Heat budget of the Earth
- 1.5 Factors determining the horizontal distribution of temperature

UNIT-2: ATMOSPHERIC PRESSURE AND WIND SYSTEMS

- 2.1 Factors controlling pressure, horizontal distribution of pressure
- 2.2 Factors controlling wind
- 2.3 Wind system: classification, types of planetary winds
- 2.4 Local winds and types
- 2.5 Measurement of wind, air temperature and insolation

UNIT-3: CLIMATIC CLASSIFICATION AND WEATHER FORECASTING

- 3.1 Air masses and types; Air fronts and their types
- 3.2 Climatic classification: Basis of classification; Koeppen's classification
- 3.3 Thornthwait's classification: 1931 scheme
- 3.4 Thornthwait's classification: 1948 scheme
- 3.5 Tools in weather forecasting, weather forecasting in India

UNIT-4: MAJOR CLIMATES OF THE WORLD

- 4.1 Equatorial
- 4.2 Savanna
- 4.3 Hot Desert
- 4.4 Mediterranean
- 4.5 Steppe

UNIT-5: APPLIED CLIMATOLOGY

- 5.1 Hazards: Fog and thunderstorm
- 5.2 Effect of climate on vegetation
- 5.3 Bioclimatology: Climate and human health
- 5.4 Climate and house types
- 5.5 Climatic change: Indicators of past climate, Carbon dioxide and Volcanic dust theory

M.Sc. Environmental Sciences (CBCS)

[Semester-II]

For examinations to be held in May 2022, 2023 & 2024

Course No.: PSESTC202

Title: Principles of Climatology

Credits: 4

Duration of Examination: 2½ hrs

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

LITERATURE RECOMMENDED:

(A) Books:

1. Barry, R. G. and Carleton, A. M. (2001). Synoptic and Dynamic Climatology, Routledge, London.
2. Critchfield, J. H. (1993). General Climatology. Prentice-Hall, New Delhi, India.
3. Cunningham, W. P. and Saigo, B. W. (1999). Environmental Science - A Global Concern. WCB McGraw Hill, U.S.A.
4. Emiliani, C. (1992). Planet Earth. Cambridge University Press, U.K.
5. Fellmann, J.; Getis, A. and Getis, J. (1996). Human Geography - Landscapes of Human Activities. WCB McGraw Hill, U.S.A.
6. Gilbert, L. (2019). Climatology and Weather forecasting- An Integrated Approach. Syrawood Publishing House, U.S.A.
7. Houghton, J. (1997). Global Warming - The Complete Briefing. Cambridge University Press, U.K.
8. Lunine, J. I. (1999). Earth - Evolution of a Habitable World. Cambridge University Press, U.K.
9. Lutgens, F. K.; Tarbuck, E. J. and Tasa, D. (2009). The Atmosphere: An Introduction to Meteorology, Prentice-Hall, Englewood Cliffs, New Jersey.
10. McKnight, T. L. (1993). Physical Geography - A Landscape Appreciation. Prentice-Hall, New Jersey.
11. Oliver, J. E. and Hidore, J. J. (2002). Climatology: An Atmospheric Science, Pearson Education, New Delhi.
12. Rogers, J. J. W. and Feiss, P. G. (1998). People and the Earth - Basic Issues in the Sustainability of Resources and Environment. Cambridge University. Press, U.K.
13. Shukuya, M. (2019). Bioclimatology for Built Environment. CRC Press, USA.
14. Smithson, P.; Addison, K. and Atkinson, K. (2002). Fundamentals of the Physical Environment. Routledge Publishers, London.
15. Thompson, R. D. and Perry, A. (1997). Applied Climatology- Principles and Practice Routledge, London.
16. Wellburn, A. (1996). Air Pollution and Climate Change - The Biological Impact. Longman Publishers, Singapore.

(B) Web Sites:

1. <https://www.ncdc.noaa.gov/>
2. <https://www.fs.usda.gov/ccrc/topics>
3. https://metnet.imd.gov.in/lecture_notes/course3

M.Sc. Environmental Sciences (CBCS)

[Semester-II]

For examinations to be held in May 2022, 2023 & 2024

Course No.: PSESTC202

Title: Principles of Climatology

Credits: 4

Duration of Examination: 2½ hrs

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	20	After 30 days on completion of 25% of syllabus
Minor II	20	After 60 days on completion of 50% of syllabus
Major End of Semester	60	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	100	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/Short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of 5 marks each. Each Minor Test would be of 1 hour duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 15 questions (objective/short answer type) of one mark each. Section B will consist of three questions with internal choice (Long answer type) of 15 marks each. Major Test would be of 2½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-II]

For examinations to be held in May 2022, 2023 & 2024

Course No.: PSESTC206

Credits: 4

Duration of Examination: 2½ hrs

Title: Environmental Impact
Assessment and Management

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

Objectives:

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

UNIT-1: BASIC CONCEPTS OF ENVIRONMENTAL IMPACT ASSESSMENT

- 1.1 Environmental Impact Assessment (EIA): Concepts, objectives, origin and generalized approach to EIA
- 1.2 Environmental Impacts: various sources of impacts, types of impacts to be considered in EIA, methodologies of EIA
- 1.3 EIA guidelines (GOI Notification of 1994, 2006 and 2010)
- 1.4 Environmental Impact Statement
- 1.5 Environmental Management Plan

UNIT-2: PREDICTION AND ASSESSMENT OF IMPACTS ON

- 2.1 Water Environment
- 2.2 Air Environment
- 2.3 Noise Environment
- 2.4 Socio-Economic & Cultural Environment
- 2.5 Biological Environment

UNIT-3: ENVIRONMENTAL IMPACT ASSESSMENT OF

- 3.1 River valley Projects
- 3.2 Mining Projects.
- 3.3 Oil refinery
- 3.4 Thermal Power Project
- 3.5 Cement Industries

UNIT-4: EIA AND MANAGEMENT - I

- 4.1 Life cycle assessment
- 4.2 Eco labelling
- 4.3 Environmental Auditing: concepts and guidelines.
- 4.4 Environmental priorities in India & sustainable development
- 4.5 Environmental Education: formal & informal education and its role in environmental awareness

M.Sc. Environmental Sciences (CBCS)

[Semester-II]

For examinations to be held in May 2022, 2023 & 2024

Course No.: PSESTC206

Credits: 4

Duration of Examination: 2½ hrs

**Title: Environmental Impact
Assessment and Management**

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

UNIT-5: EIA AND MANAGEMENT - II

- 5.1 Tourism: its impacts on environment and introduction to ecotourism
- 5.2 Introduction to Watershed and its management
- 5.3 Land use changes, land use planning, land use capability and suitability, classification for sustainable land use
- 5.4 Rain Water Harvesting: an overview
- 5.5 Wastelands and their reclamation

LITERATURE RECOMMENDED:

1. Baldwin, J. H. (1985). Environmental Planning & Management. International Book Distributors, Dehradun, India.
2. Bandhu, D.; Bongartz, H.; Ghazuawl, A. C. and Gopal, B. (1994). Environmental Education for Sustainable Development. Indian Environmental Society, New Delhi.
3. Cantar, L. W. (1977). Environmental Impact Assessment. McGraw Hill, Publications, New York.
4. Rajora, R. (2002). Integrated Watershed Management. Rawat Publications, Jaipur & New Delhi.
5. Sapru, R. K. (1987). Environmental Management in India. Ashish Publishing House, New Delhi.
6. Singh, S. S. (1989). Impact of tourism on the mountain environment. Research India Publication, Meerut.
7. Trivedi, P. R. and Raj, C. (1992). Environmental Problems Impact Assessment. Akashdeep Publishing House, New Delhi.
8. Trivedi, P. R. and Raj, C. (1992). Environmental Biology. Akashdeep Publishing House, New Delhi.
9. UNEP (United Nations: Environmental Programme) (1980). Industry and Environment Series, Vol. 1.
10. United Nations (1994). Trends in Environmental Impact Assessment of Energy Projects.
11. Judith, P. (1999). "Handbook of Environmental Impact Assessment Vol. I & II". Blackwell Science.
12. John, G. R. and Hooten, D. C. (1990). "Environmental Impact Analysis Handbook", McGraw Hill Book Company.

M.Sc. Environmental Sciences (CBCS)

[Semester-II]

For examinations to be held in May 2022, 2023 & 2024

Course No.: PSESTC206

Credits: 4

Duration of Examination: 2½ hrs

**Title: Environmental Impact
Assessment and Management**

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	20	After 30 days on completion of 25% of syllabus
Minor II	20	After 60 days on completion of 50% of syllabus
Major End of Semester	60	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	100	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/Short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of 5 marks each. Each Minor Test would be of 1 hour duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 15 questions (objective/short answer type) of one mark each. Section B will consist of three questions with internal choice (Long answer type) of 15 marks each. Major Test would be of 2½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-II]

For examinations to be held in May 2022, 2023 & 2024

Course No.: PSESTC207

Title: Environmental Pollution

Credits: 4

Duration of Examination: 2½ hrs

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

Objectives:

This course has been designed to introduce the students to causes, associated problems and control of different kinds of environmental pollution. The course will address environmental stressors and pollution, their sources, modes of transport and transformation, their ecological and public health effects, and existing methods for prevention and remediation.

UNIT-1: AIR POLLUTION

- 1.1 Sources and kinds of air pollution
- 1.2 Air quality standards
- 1.3 Odour pollution
- 1.4 Indoor air pollution
- 1.5 Vehicular pollution and its control

UNIT-2: AIR AND NOISE POLLUTION

- 2.1 Common effects of air pollution
- 2.2 Gaseous pollutants and their control
- 2.3 Particulate pollutants and their control
- 2.4 Air pollution and climate change
- 2.5 Noise pollution: sources, effects and control

UNIT-3: LAND POLLUTION

- 3.1 Sources and management of Municipal solid waste
- 3.2 Sources and management of Biomedical waste
- 3.3 Sources and management of Hazardous waste
- 3.4 Sources and management of Industrial waste
- 3.5 Sources and management of E-waste

UNIT-4: WATER POLLUTION I

- 4.1 Sources and kinds of water pollution
- 4.2 Water quality standards
- 4.3 Effects of water pollutants on physico-chemical characteristics of water
- 4.4 Effects of water pollutants on plants: phytoplankton and macrophytes
- 4.5 Effects of water pollutants on animals: zooplankton, macrobenthic invertebrates and fish

UNIT-5: WATER POLLUTION II

- 5.1 Sources and kinds of marine pollution
- 5.2 Effects and control of marine pollution
- 5.3 Sources, effects and control of thermal pollution
- 5.4 Eutrophication and restoration of lakes
- 5.5 Groundwater contamination and control

M.Sc. Environmental Sciences (CBCS)

[Semester-II]

For examinations to be held in May 2022, 2023 & 2024

Course No.: PSESTC207

Title: Environmental Pollution

Credits: 4

Duration of Examination: 2½ hrs

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

LITERATURE RECOMMENDED:

1. Bretsehnedder, B. and Kurfurst, J. (1987). Air Pollution. Elsevier Scientific Publication Company Amsterdam, Oxford, New York.
2. Bridgman, H. (1992). Global Air Pollution. CBS Publishers, New Delhi.
3. Bush, M. B. (1997). Ecology of a changing planet. Prentice Hall, USA.
4. Dassber, H. S. and Bortitz, S. (1988). Air pollution and its influence on vegetation. Dr. W. Junk Publication Dordrencht- Bostan Lancaster.
5. Davis, M. L. and Cornwell, D. A. (1991). Introduction to Environmental Engineering. McGraw Hill International Edition.
6. Dhaliwal, G. S.; Sawgha, G. S. and Ralhan, P. K. (1996). Fundamentals of Environmental Science. Kalyani Publications, Ludhiana.
7. Edward, C. A. (1976). Environmental Pollution by Pesticides. Plenum Press, London and New York.
8. Gurjar, B. R.; Molina, L. T. and Ojha, C. S. P. (2010). Air Pollution: Health and Environmental Impacts. CRC Press, Taylor and Francis.
9. Hester, R. E. and Harrison, R. M. (1998). Air Pollution and Health. The Royal Society of Chemistry, U.K.
10. Kudesia, V. P. (1990). Air pollution. Pragati Prakashan, Meerut - 250001.
11. Misra, S. C. and Mani, D. (1994). Agricultural Pollution. (Vol. I). Ashish Publishing House 8/81, Punjabi Bagh, N. Delhi - 110026.
12. Naji, G. K.; Dhillon, M. K. and Dhaliwal, G. S. (1999). Noise Pollution. Commonwealth Publications, New Delhi.
13. Patrick, R. D. (1972). The Water Pollution Problems (Part-I). Plenum Publication Corporation 227, West. 17th Street, New York - 110011.
14. Pepper, I. L.; Gerba, C. P. and Brusseau, M. L. (2006). Environmental and Pollution Science. Elsevier Academic Press.
15. Prasad, O. and Choudhary, M. C. (1992). Environmental Pollution Radiation, Venus Publishing House 11/298 press Colony, Maya Puri, New Delhi.
16. Purohit, S. S. and Ranjan, R. (2007). Ecology, Environment and Pollution. Agrobios Publications.
17. Rana, S. V. S. (2003). Essentials of Ecology and Environmental Sciences. Prentice Hall of India, New Delhi.
18. Rao, M. N. and Rao, H. U. (1998). Air Pollution. Tata McGraw Hill Publication Company, New Delhi.
19. Vesilind, P. J.; Peirce, J. J. and Weiner; R. F. (1990). Environmental Pollution and Control. Butterworth-Heinemann, USA.

M.Sc. Environmental Sciences (CBCS)

[Semester-II]

For examinations to be held in May 2022, 2023 & 2024

Course No.: PSESTC207

Title: Environmental Pollution

Credits: 4

Duration of Examination: 2½ hrs

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	20	After 30 days on completion of 25% of syllabus
Minor II	20	After 60 days on completion of 50% of syllabus
Major End of Semester	60	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	100	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/Short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of 5 marks each. Each Minor Test would be of 1 hour duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 15 questions (objective/short answer type) of one mark each. Section B will consist of three questions with internal choice (Long answer type) of 15 marks each. Major Test would be of 2½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-II]

For examinations to be held in May 2022, 2023 & 2024

Course No.: PSESTC208

Title: Environmental Microbiology

Credits: 2

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

Objectives:

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

UNIT-1: MICROBIAL ENVIRONMENT

- 1.1 History and scope of microbiology
- 1.2 Nature and function of microorganisms in soil
- 1.3 Nature and function of microorganisms in air
- 1.4 Microbes and Biogeochemical cycles - Carbon cycle, Sulphur cycle, Nitrogen Cycle, Phosphorus cycle and iron cycle
- 1.5 Potability of water - Microbial assessment of water quality

UNIT-2: FOOD MICROBIOLOGY

- 2.1 Initial contamination and microbial spoilage of food
- 2.2 Sources and types of microbes in milk
- 2.3 Pasteurization of milk
- 2.4 Preservation and dehydration of food
- 2.5 Fermented foods: Vegetables and dairy products

UNIT-3: INDUSTRIAL MICROBIOLOGY

- 3.1 Types of fermentation process
- 3.2 Alcoholic fermentation
- 3.3 Production of vinegar, lactic acid and citric acid
- 3.4 Production of antibiotics, amino-acids, vitamins, vaccines, steroid transformation
- 3.5 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.

M.Sc. Environmental Sciences (CBCS)

[Semester-II]

For examinations to be held in May 2022, 2023 & 2024

Course No.: PSESTC208

Title: Environmental Microbiology

Credits: 2

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

6. Shukla, S. B. and Shantharam (2000). General Microbiology. Oxford and IBH Publishing Company Ltd. New Delhi.
7. Stainer, R. Y.; Ingraham, J. L.; Wheels, M. L. and Painter, P. R. (1995). General Microbiology. McMillan Press Hong Kong.
8. SubbaRao, N. S. (1986). Soil Microorganisms and Plant growth. Oxford and IBH Publishing Company.

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	10	After 30 days on completion of 25% of syllabus
Minor II	10	After 60 days on completion of 50% of syllabus
Major End of Semester	30	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	50	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 5 questions (objective/short answer type) of one mark each. Section B will consist of one question with internal choice (Long answer type) of five marks. Each Minor Test would be of 45 minutes duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of ten marks each. Major Test would be of 1½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-II]

For examinations to be held in May 2022, 2023 & 2024

Course No.: PSESTC209

Credits: 2

Duration of Examination: 1½ hrs

Title: Environmental Analysis & Instrumentation

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 BASICS OF ENVIRONMENTAL ANALYSIS

- 1.1 Quantitative and qualitative analysis; Common analytical methods used in environmental analysis
- 1.2 Quality control in analysis, Environmental quality standards
- 1.3 Sampling and analytical techniques used in monitoring of indoor and outdoor air quality
- 1.4 Sampling and analysis techniques used for determination of physico-chemical parameters of water
- 1.5 Collection, processing and analysis of soil samples for environmental analysis

UNIT-2 ANALYTICAL METHODS: SPECTROPHOTOMETRY

- 2.1. Introduction to Spectrophotometry; UV-VIS Spectrophotometer: Principle, working and applications
- 2.2. Infrared Spectrophotometer; Principle, working and applications of FTIR
- 2.3. Emission spectrometry: Flame Photometer; ICP-OES, ICP-MS
- 2.4. Absorption Spectrometry: Atomic Absorption Spectrophotometer.
- 2.5. Introduction to X-Ray Diffractometer, X-ray fluorescence techniques

UNIT-3 ANALYTICAL METHODS: CHROMATOGRAPHIC AND MICROSCOPY

- 3.1. Chromatographic techniques: Planer Chromatographic Techniques (Paper and Thin Layer chromatography)
- 3.2. High Pressure liquid Chromatography - Principle, instrumentation and applications
- 3.3. Ion Chromatography – Principle, applications and experimental procedures
- 3.4. Gas Chromatography – Principle, Components and applications
- 3.5. Microscopic techniques: Compound Microscope, SEM, TEM

LITERATURE RECOMMENDED:

1. Rajvaidya, N. and Markenday, D. K. (2005). Environmental Analysis and Instrumentation (Vol. 2) APH Publishing Corporation.
2. Skoog, D. A.; Holler, F. J. and Crouch, S. R. (2017). Principles of instrumental analysis. Cengage learning.
3. A.P.H.A. (2005). Standard Methods for the examination of water & Wastewater, 20th Ed. Am. Pub. Hlth. Asso., Washington.

M.Sc. Environmental Sciences (CBCS)

[Semester-II]

For examinations to be held in May 2022, 2023 & 2024

Course No.: PSESTC209

Credits: 2

Duration of Examination: 1½ hrs

Title: Environmental Analysis & Instrumentation

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

4. Khandpur, R. S. (2007). Handbook of analytical instruments. Tata McGraw Hill Education.
5. Christian, G. D. (2007). Analytical Chemistry. John Wiley & Sons; 6th Ed.
6. Harvey, D. (2000). Modern analytical chemistry. McGraw Hill. 1st Ed.

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	10	After 30 days on completion of 25% of syllabus
Minor II	10	After 60 days on completion of 50% of syllabus
Major End of Semester	30	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	50	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 5 questions (objective/short answer type) of one mark each. Section B will consist of one question with internal choice (Long answer type) of five marks. Each Minor Test would be of 45 minutes duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of ten marks each. Major Test would be of 1½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-II]

For examinations to be held in May 2022, 2023 & 2024

Course No.: PSESPC204

Credits: 2

Duration of Examination: 2 hrs

Title: Lab Course-I (Based on

PSESTC202; PSESTC206)

Maximum Marks : 50

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with the experimental work based on Course No. PSESTC202; PSESTC206.

1. To study types and coding of meteorological laboratories.
2. Selection of site and layout for instruments in an agro meteorological laboratory.
3. To calibrate the thermometer at the ice-point of water, the boiling point of water and air temperature
4. To find data correlation between body temperature and air temperature recorded at different sites.
5. To understand the concept of air masses and air front and their representation on weather map.
6. Measurement of wind speed and direction.
7. To draw wind roses with given data.
8. To measure atmospheric pressure with the help of a barometer.
9. To measure insolation with the help of a pyranometer.
10. Visit to a meteorological observatory at SKUAST-Jammu.
11. Visit to a Doppler Weather Radar (DWR) system at IMD, Jammu.
12. To calculate heat indices for crops.
13. To draw a climograph based on given data.
14. To draw a hythergraph based on given data.
15. To draw a comfort zone with given data.
16. Identification of various symbols used in the weather map.
17. Decoding of synoptic elements plotted on a weather map.
18. A field visit for the preliminary assessment of environmental impact of different developmental project.
19. Prepare a questionnaire to study the social impacts of developmental projects.
20. Adhoc method to assess the Environmental impacts of industries.
21. To prepare a checklist of Environmental impacts caused due to widening of roads.
22. Prepare a matrix of impacts caused due to construction of roads.

SCHEME OF EXAMINATIONS

Component	Marks	Remarks
Internal	25	After 60 days on completion of 50% of syllabus Written Exam: 13 Marks (4 Practicals of 02 Marks each; Viva-voce: 5 Marks) Attendance: 5 Marks Day to Day Performance: 7 Marks
External	25	On completion of entire syllabus Written Exam: 25 Marks (4 Practicals of 5 Marks each; Viva-voce: 5 Marks)
Total	50	

M.Sc. Environmental Sciences (CBCS)

[Semester-II]

For examinations to be held in May 2022, 2023 & 2024

Course No.: PSESPC205

Title: Lab Course-II (Based on PSESTC207)

Credits: 2

Duration of Examination: 2 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. PSESTC207.

1. Calculate the stomatal index on the upper and lower surface of given leaf material.
2. Determination of Chemical Oxygen Demand in Water Sample.
3. Determination of Biological Oxygen Demand in Water Sample.
4. Determination of Sound Level by using Sound Level Meter.
5. Give a detailed structure of air pollution control devices for control of particulate and gaseous pollutants.
6. To determine the indoor particulate matter using a handy air sampler.
7. To visit a polluted waterbody. Write observations and suggest remedial measures.
8. To visit an industrial area and write about the wastewater/various treatment methods followed by a particular industry.
9. To determine the composition, collection, transportation and management of solid waste of a particular area.
10. To visit a dumping site and write a note on the environmental pollution problems resulting from disposal of solid waste.
11. To visit sewage treatment plant and write about the treatment methods.
12. To visit a drinking water treatment plant and write about the treatment methods.

SCHEME OF EXAMINATIONS

Component	Marks	Remarks
Internal	25	After 60 days on completion of 50% of syllabus Written Exam: 13 Marks (4 Practicals of 02 Marks each; Viva-voce: 5 Marks) Attendance: 5 Marks Day to Day Performance: 7 Marks
External	25	On completion of entire syllabus Written Exam: 25 Marks (4 Practicals of 5 Marks each; Viva-voce: 5 Marks)
Total	50	

M.Sc. Environmental Sciences (CBCS)

[Semester-II]

For examinations to be held in May 2022, 2023 & 2024

Course No.: PSESPC206

Title: Lab Course-III (Based on PSESTC208)

Credits: 2

Duration of Examination: 2 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. PSESTC208.

1. To study the principle, construction and working of Autoclave.
2. To study the principle, construction and working of electric oven.
3. To study the principle, construction and working of Incubator.
4. To study the principle, construction and working of Laminar Air Flow.
5. To prepare Gram stain for the study of bacteria.
6. To study the type of bacteria in curd by Gram staining technique.
7. To calculate the number of bacteria in a given sample of milk by DMC method.
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 measure the size of bacteria in a given sample.
11. To study the bacteria of the throat using sterile swab by Gram staining technique.
12. To find out the drinking water quality by MPN method.

SCHEME OF EXAMINATIONS

Component	Marks	Remarks
Internal	25	After 60 days on completion of 50% of syllabus Written Exam: 13 Marks (4 Practicals of 02 Marks each; Viva-voce: 5 Marks) Attendance: 5 Marks Day to Day Performance: 7 Marks
External	25	On completion of entire syllabus Written Exam: 25 Marks (4 Practicals of 5 Marks each; Viva-voce: 5 Marks)
Total	50	

M.Sc. Environmental Sciences (CBCS)

[Semester-II]

For examinations to be held in May 2022, 2023 & 2024

Course No.: PSESPC207

Title: Lab Course-IV (Based on PSESTC209)

Credits: 2

Duration of Examination: 2 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. PSESTC209.

1. To study the principle, construction and working of HPLC.
2. To study the principle, construction and working of Ion Chromatograph.
3. To study the principle, construction and working of AAS.
4. To study the principle, construction and working of a Flame Photometer.
5. To study the principle, construction and working of Single Beam Spectrophotometer.
6. To study the principle, construction and working of the Double Beam Spectrophotometer.
7. To study the principle, construction and working of high volume air samplers.
8. To measure the SO₂ concentration in air.
9. To measure the NO₂ concentration in air.
10. To analyse the amount of phosphate from a given water sample.
11. To analyse the amount of nitrate from a given water sample.
12. To determine turbidity of water sample by Turbidity meter.
13. Preparation of analytical standard solutions using serial dilution method.
14. To determine major ion concentration in a given water sample using Ion Chromatograph.
15. To determine the total organic carbon in a given water sample using TOC analyzer.

SCHEME OF EXAMINATIONS

Component	Marks	Remarks
Internal	25	After 60 days on completion of 50% of syllabus Written Exam: 13 Marks (4 Practicals of 02 Marks each; Viva-voce: 5 Marks) Attendance: 5 Marks Day to Day Performance: 7 Marks
External	25	On completion of entire syllabus Written Exam: 25 Marks (4 Practicals of 5 Marks each; Viva-voce: 5 Marks)
Total	50	

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESTE304

Title: Ecotoxicology

Credits: 2

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

Objectives:

The aim of the present course is to acquaint the students with various aspects of environmental toxicology from molecular to ecosystem level to equip students to evolve the best ways of dealing with chemical pollution.

UNIT-1: CONCEPT, HISTORICAL BACKGROUND AND DEFINITIONS

- 1.1 Basic concepts of Toxicology
- 1.2 Development of environmental toxicology - Historical and evolutionary perspective
- 1.3 Toxicants and Toxicity - factors that affect toxicity
- 1.4 Toxicity of chemical mixtures
- 1.5 Dose effect and response; Dose-response relationships

UNIT-2: ROUTES AND KINETICS OF TOXICANT UPTAKE

- 2.1 Toxicity testing - Testing for acute toxicity and chronic toxicity
- 2.2 Toxicokinetics - Absorption, Distribution and elimination of toxicants
- 2.3 Route of toxicant uptake - skin, lungs, GIT, gills, toxicant uptake in plants
- 2.4 Biochemical effects of Mercury, Lead, Chromium, Cadmium, Arsenic and their relation to toxicity
- 2.5 Biotransformation and bioaccumulation

UNIT-3: COMPLEX ISSUES

- 3.1 Antidotal procedure in toxicology
- 3.2 Environmental Toxicology of metal mining and smelting
- 3.3 Biological indicator of toxicants
- 3.4 Methodology of ecological reassessment and risk management
- 3.5 Environmental toxicology of fertilizers

LITERATURE RECOMMENDED:

1. Wright, D. A. and Welbown, P. (2002). Environmental Toxicology. Cambridge Univ. Press, U.K.
2. Banerjee, S. K. (2001). Environmental Chemistry. Prentice Hall of India Pvt. Ltd., New Delhi.
3. Satake, M.; Mido, Y.; Ysuhisa, H.; Taguchi, S.; Sethi, M. S. and Iqbal, S. A. (1997). Environmental Toxicology. Discovery Pub. House, New Delhi.
4. De, A. K. (2003). Environmental Chemistry. New Age Int. Ltd., New Delhi.
5. Sood, A. (1999). Toxicology. Sampand Songs, New Delhi.
6. Walker, C. H.; Sibly, R. M.; Hopkin, S. P. and Peakall, D. B. (2012). Principles of Ecotoxicology. CRC Press, USA
7. Newman, M. C. (2020). Fundamentals of Ecotoxicology. CRC Press, USA.

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESTE304

Title: Ecotoxicology

Credits: 2

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	10	After 30 days on completion of 25% of syllabus
Minor II	10	After 60 days on completion of 50% of syllabus
Major End of Semester	30	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	50	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 5 questions (objective/short answer type) of one mark each. Section B will consist of one question with internal choice (Long answer type) of five marks. Each Minor Test would be of 45 minutes duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of ten marks each. Major Test would be of 1½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESTO305*

Title: Climate Change: Science & Policies

Credits: 4

Duration of Examination: 2½ hrs

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

Objectives:

Climate change from anthropogenic greenhouse gases is a major environmental challenge of present times. This course will help students to understand the scientific basis of climate change. Students will also learn about various national and international policy frameworks to combat the climate change.

UNIT-1: UNDERSTANDING CLIMATE CHANGE

- 1.1 Introduction to the Climate System
- 1.2 Energy Balance of the Planet Earth, Introduction to Radiative Forcing
- 1.3 Drivers of Climate system (Natural and Anthropogenic)
- 1.4 Learning from the Past
- 1.5 Recent Climate Change

UNIT-2: CLIMATE CHANGE: VULNERABILITIES AND IMPACTS

- 2.1 Climate change impacts – reasons for concern
- 2.2 Climate change effects on Freshwater Systems
- 2.3 Climate change and Agriculture
- 2.4 Impacts on Human settlements and Infrastructure, Climate Refugees
- 2.5 Impacts on Human Health

UNIT-3: LIMITING CLIMATE CHANGE: ADAPTATION AND MITIGATION

- 3.1 Mitigation: Reducing the impacts
- 3.2 Adaptation: Living with the climate change
- 3.3 Renewable Energy Sources and Climate Change Mitigation
- 3.4 Assessment of adaptation practices, options, constraints and capacity
- 3.5 Policies, measures, and instruments to mitigate climate change

UNIT-4: POLICY FRAMEWORK ON CLIMATE CHANGE:

- 4.1 Governmental and Intergovernmental Actions to Combat Climate Change
- 4.2 The Role of the IPCC on Climate Change
- 4.3 United Nations Framework Convention on Climate Change
- 4.4 The Kyoto Protocol to the Framework Convention
- 4.5 Paris Convention

UNIT-5: CLIMATE CHANGE AND INDIA'S CONCERNS

- 5.1 Vulnerability of Coastal Belt in India towards climate Change
- 5.2 Climate Change, Rural Livelihoods and Food Security in India
- 5.3 India's Climate and Energy Policies
- 5.4 India's Position on International Climate Negotiations
- 5.5 India's National Action Plan on Climate Change

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESTO305*

Title: Climate Change: Science & Policies

Credits: 4

Duration of Examination: 2½ hrs

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

LITERATURE RECOMMENDED:

1. Bidwai, P. (2012). The Politics of Climate Change and the Global Crisis: Mortgaging Our Future. Orient BlackSwan.
2. Cowie, J. (2012). Climate Change: Biological and Human Aspects. 2ndEd., Cambridge University Press.
3. Tanaka, S. (2006). Climate Change. Toronto [Ont.].Groundwood Books publishers.
4. Gupta, K. R. (2010).Climate Change: Meeting the Challenge. Latest Ed. Atlantic publishers.
5. Palanisami, K.; Ranganathan, C. R.; Nagothu, U. S. and Kakumanu, K. R. (2016). Climate Change and Agriculture in India. Published by Routledge, India.
6. Sarkar, A. N. and Bhushan, A. (2009). Global Climate Change and Sustainable Energy Development. Pentagon Press.
7. Newbolt, B. (2009). Climate Change. Oxford University Press, USA.
8. Halder, N. K. and Sven, W. (2012). Climate Change Effect in the Sundarbans: A case study on Cyclone SIDR (2007). Lap Lambert Academic Publishing.
9. Pittock, A. B. (2013). Climate change: The science, impacts and solutions. CSIRO Publishing.

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	20	After 30 days on completion of 25% of syllabus
Minor II	20	After 60 days on completion of 50% of syllabus
Major End of Semester	60	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	100	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/Short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of 5 marks each. Each Minor Test would be of 1 hour duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 15 questions (objective/short answer type) of one mark each. Section B will consist of three questions with internal choice (Long answer type) of 15 marks each. Major Test would be of 2½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESTE306

Credits: 2

Duration of Examination: 1½ hrs

Title: Natural Resources:

Conservation & Management

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

Objectives:

The future of this planet to a larger extent would depend how wisely humans consume the limited natural resources. This course would help student to understand the status of various natural resources of this planet, the rate of their depletion and various conservation and management strategies of their optimal use.

UNIT-1: FOREST AND WILDLIFE RESOURCES

- 1.1 Concept of resources, classification of natural resources. Factors influencing resource availability, distribution and uses
- 1.2 Forest resources, status, distribution and ecosystem services
- 1.3 Forest products: a general account with reference to timber, food and medicines. Priorities for Conservation of plant resources: wild relatives of crop plants, land races, advanced cultivars, medicinal plants and wild plants of potential utility
- 1.4 Wildlife importance; Concept of endemic, extinct and threatened species (endangered, rare, vulnerable and indeterminate species)
- 1.5 Fish and other marine resources: distribution, production and challenges for resource supply

UNIT-2: SOIL AND MINERALS

- 2.1 Soil as a natural resource: a general account with reference to nutrients and soil biota
- 2.2 Land as a resource; land use classification; land use planning; land degradation and desertification
- 2.3 Origin and classification of minerals; Economic Minerals (Iron, steel and the ferroalloy metals): Distribution and Exploitation
- 2.4 Economic mineral resources from land and oceans. Energy Minerals (coal, oil, natural gas and thorium, uranium)
- 2.5 Impact of exploitation of economic minerals on environment

UNIT-3: CONSERVATION STRATEGIES AND MANAGEMENT

- 3.1 Conservation and management strategies for wild flora and fauna; Sustainable Ecotourism
- 3.2 Strategies for soil conservation; sustainable land-use; and improvement of carbon stocks
- 3.3 Policies, strategies, and activities made to manage water as a sustainable resource
- 3.4 Sustainable use policies; strategies and activities made to manage the conventional energy resources
- 3.5 Sustainable resource management to strengthen the climate resilience

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESTE306

Credits: 2

Duration of Examination: 1½ hrs

Title: Natural Resources:

Conservation & Management

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

LITERATURE RECOMMENDED:

1. Kesler, S. E.; Simon, A. C. and Simon, A. F. (2015). Mineral resources, economics and the environment. Cambridge University Press.
2. Krausman, P. R.; Cain III, J. W. and Cain, J. W. (Eds.). (2013). Wildlife management and conservation: contemporary principles and practices. JHU Press.
3. Hosetti, B. B. (2014). Concepts in Wildlife Management. 3rdEd., Daya Publishing House.
4. Bebarta, K. C. (2004). Forest resources and sustainable development: Principles, perspectives and practices. Concept Publishing Company.
5. Grebner, D. L.; Bettinger, P.; Siry, J. P. and Boston, K. (2021). Introduction to forestry and natural resources. Academic Press.
6. Kant, S. and Alavalapati, J. (Eds.) (2014). Handbook of forest resource economics. Routledge.
7. Wright, G. and Czelusta, J. (2003). Mineral resources and economic development: In Conference on Sector Reform in Latin America, Stanford Center for International Development Nov: 13-15.
8. Dubinski, J. (2013). Sustainable development of mining mineral resources. Journal of Sustainable Mining, 12(1): 1-6.
9. Aswathanarayana, U. (2003). Mineral resources management and the environment. CRC Press.
10. Calas, G. (2017). Mineral resources and sustainable development. Elements: An International Magazine of Mineralogy, Geochemistry and Petrology, 13(5): 301-306.
11. Hodges, C. A. (1995). Mineral resources, environmental issues and land use. Science, 268(5215): 1305-1312.
12. Meinert, L. D.; Robinson, G. R. and Nassar, N. T. (2016). Mineral resources: Reserves, peak production and the future. Resources, 5(1): 14.
13. Young, A. (2000). Land resources: now and for the future. Cambridge University Press.
14. McKenzie, N. J.; Grundy, M. J.; Webster, R. and Ringrose-Voase, A. J. (Eds.). (2008). Guidelines for surveying soil and land resources. CSIRO Publishing.

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESTE306

Credits: 2

Duration of Examination: 1½ hrs

Title: Natural Resources:

Conservation & Management

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	10	After 30 days on completion of 25% of syllabus
Minor II	10	After 60 days on completion of 50% of syllabus
Major End of Semester	30	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	50	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 5 questions (objective/short answer type) of one mark each. Section B will consist of one question with internal choice (Long answer type) of five marks. Each Minor Test would be of 45 minutes duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of ten marks each. Major Test would be of 1½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESTE307

Credits: 2

**Title: Ecotechnologies for
contaminant remediation**

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

Objectives:

Biological treatment technologies are finding widespread recognition as an “organic” approach to contaminated site remediation. Ecotechnological interventions can help conserve and restore the environment through the integration of various ecological components and principles. To support such an approach, it is important to acquire knowledge and understanding about the dynamics of ecosystems and their vulnerabilities. The present course has been designed to make the students well versed with the concept of bioremediation, the applicability of various ecotechnologies for contaminant remediation, the processes and factors affecting remediation capabilities of various ecotechnologies, and the creation of green infrastructures for contaminant remediation with pertinent case studies. After the completion of the course, students will be able to utilize the self-designing and self-healing capabilities of various ecosystems in devising contaminant-/site-specific ecotechnologies.

UNIT-1: BIOREMEDIATION- OVERVIEW AND PROCESSES INVOLVED

- 1.1 Concept, types, advantages and disadvantages of bioremediation
- 1.2 Applied bioremediation- An overview, the bioremediation laboratory, biotreatability studies
- 1.3 Factors affecting bioremediation and selection of appropriate bioremediation technology
- 1.4 Microbial processes for remediation of environmental pollutants
- 1.5 WRF technology for hazardous waste treatment

UNIT-2: BIOREMEDIATION TECHNOLOGIES

- 2.1 Natural attenuation and *In-situ* bioremediation
- 2.2 Bioventing- Concept, site characteristics, design, application and limitations
- 2.3 Air sparging- Principle, design, application, advantages and limitations
- 2.4 Bioaugmentation, Alternate electron acceptors technology
- 2.5 Land farming- Concept, site requirements, applicability, limitations

UNIT-3: PHYTOTECHNOLOGIES FOR CONTAMINANT REMEDIATION

- 3.1 Overview of phytotechnologies, types of phytoremediation
- 3.2 Rhizoremediation
- 3.3 Green Infrastructures for contaminant remediation
- 3.4 Constructed wetlands- Concept, types and application
- 3.5 Phytotechnological interventions for contaminant remediation in India

LITERATURE RECOMMENDED:

1. Gadd, G. M. (2001). Fungi in Bioremediation. Cambridge University Press, ISBN: 0-521-78119-1.
2. <https://clu-in.org/techfocus/default.focus/sec/Bioremediation/cat/Overview/>

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESTE307

Credits: 2

**Title: Ecotechnologies for
contaminant remediation**

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

3. 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.
4. Mitsch, W. J. and Jorgensen, S. E. (1989). *Ecological Engineering: An introduction to Ecotechnology*. John Wiley & Sons, ISBN: 0-471-62559-0.
5. Singh, A. and Ward, O. P. (2004). *Applied Bioremediation and Phytoremediation*. Springer-Verlag, ISBN: 3-540-21020-2.
6. Singh, S. N. and Tripathi, R. D. (2007). *Environmental Bioremediation Technologies*. Springer-Verlag, ISBN: 3-540-34790-9.
7. Tomasini, A. and Leon-Santiesteban, H. H. (2019). *Fungal Bioremediation*. CRC Press, ISBN: 978-1-138-63640-8.
8. Varjani, S. J.; Agarwal, A. K.; Gnansounou, E. and Gurunathan, B. (2018). *Bioremediation: Applications for Environmental Protection and Management*. Springer Singapore, ISBN: 978-981-10-7484-4.

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	10	After 30 days on completion of 25% of syllabus
Minor II	10	After 60 days on completion of 50% of syllabus
Major End of Semester	30	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	50	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 5 questions (objective/short answer type) of one mark each. Section B will consist of one question with internal choice (Long answer type) of five marks. Each Minor Test would be of 45 minutes duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of ten marks each. Major Test would be of 1½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESTE308

Credits:2

Duration of Examination: 1½ hrs

Title: Basic course in

Environmental Economics

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

Objectives:

The importance of Environmental Economics lies on the fact that the economic development and economic activities performed by human are linked with environment as it provides raw material for industries and resources for the people and most importantly a sink for our waste. Environmental economics combines the study of environmental science with its interactions with human economic markets and enhancing the understanding of environmental and natural resource economics. This course has been designed with an objective to make the students, with Environmental Sciences background, aware about the causes and consequences of economic growth, role of natural resources and environmental control in the growth process and better understanding about how choices are made in economic and political systems and how these choices affect, and are affected by the natural environment. It encompasses the understanding of the capacities and vulnerabilities of the planet, to adapt and respond to different challenges; considering natural resources as fundamental assets for the global economy, it explores the common interaction of economic analysis with market failure, externalities, property rights, and valuing the environment.

UNIT-1: ENVIRONMENTAL ECONOMICS AND ENVIRONMENTAL VALUATION

- 1.1 Basics of economics: definition, concept, basic economic principles, economic welfare, etc.
- 1.2 Environmental economics: concept, linkages between environment, growth and economics
- 1.3 Sustainable Development: Development of concept and indicators
- 1.4 Market failure: concept and various reasons for market failure
- 1.5 Externalities: concept and an overview

UNIT-2: ENVIRONMENTAL VALUATION METHODS

- 2.1 Environmental valuation: introduction and concept, Types of Values, need for environmental valuation
- 2.2 Environmental valuation I: Travel cost method
- 2.3 Environmental valuation II: Hedonic Production Function, Household Production Function
- 2.4 Environmental valuation III: Contingent valuation and Household production function
- 2.5 Integrated Environmental accounting and environmentally corrected GDP

UNIT-3: ECONOMIC MEASURES FOR ENVIRONMENTAL MANAGEMENT

- 3.1 Common property resources: tragedy of commons and role of people in their management
- 3.2 Economic instruments for sustainable environmental management
- 3.3 Ecological footprint concept, carbon trading, climate change
- 3.4 ISO - 14001 an outline
- 3.5 Cost- Benefit Analysis for Environmental Assessment: An overview

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESTE308

Credits:2

Duration of Examination: 1½ hrs

Title: Basic course in

Environmental Economics

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

LITERATURE RECOMMENDED:

1. Gilpin, A. (1999). Environmental Economics: A Critical Overview. John Wiley and Sons Ltd., New York.
2. Bromely, D. W. (Ed) (1995). Handbook of Environmental Economics. Blackwell, London.
3. Crones, R. and Sandler, T. (1989). The Theory of Externalities and Public Goods. Cambridge Univ. Press, Cambridge.
4. ESCAP (1997). Accounting and Valuation of Environment - A Primer for Developing Countries. Vol. 1. United Nations, New York.
5. Fisher, A. C. (1981). Resource and Environmental Economics, Cambridge.
6. Hanley, N. and Colin, J. R. (2002). Issues in Environmental Economics. Blackwell Pub. Ltd.
7. Hussen, A. N. (1999). Principles of Environmental Economics. Rutledge, London.
8. Jeroen, C. J. M. (1999). Handbook of Environmental and Resource Economics. Edward, Elgar Pub. Ltd., U.K.
9. Joshi, M. V. (2001). Theories and Approach of Environmental Economics. Atlantic Pub. & Distributors, New Delhi.
10. Kerr, J. M. (1997). Natural Resource Economics: Theory and Applications in India. Oxford and IBH Publications.
11. Kolstad, C. D. (1999). Environmental Economics. Oxford University Press, New Delhi.
12. Mitchell, R. C. and Carson, R. T. (1993). Using Surveys to Value Public Goods: Resource for the Future, Washington, D.C.
13. Sankar, U. (Ed.) (2001). Environmental Economics. Oxford University Press, New Delhi.
14. Sengupta, R. P. (2001). Ecology and Economics- An Approach to Sustainable Development. Oxford University Press, New Delhi.
15. Smith, V. K. (1996). Estimating Economic Values for Nature: Methods for Non-market Valuation. Edward Elgar, U.K.

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESTE308

Credits:2

Duration of Examination: 1½ hrs

Title: Basic course in

Environmental Economics

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	10	After 30 days on completion of 25% of syllabus
Minor II	10	After 60 days on completion of 50% of syllabus
Major End of Semester	30	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	50	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 5 questions (objective/short answer type) of one mark each. Section B will consist of one question with internal choice (Long answer type) of five marks. Each Minor Test would be of 45 minutes duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of ten marks each. Major Test would be of 1½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESTE309

Title: Biological Statistics

Credits: 2

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

Objectives:

Biometrics helps the biologists to understand the nature of variability and to assess and represent it quantitatively. The course is designed to help the students to make statistical calculations to present the result in more meaningful manner.

UNIT-1: INTRODUCTION TO BIOSTATISTICS

- 1.1 Importance and scope of biometry
- 1.2 Sampling of data - random and non-random sampling
- 1.3 Diagrammatic (Line, bar, pie diagram) and Graphic (Histogram, frequency polygon, frequency curve, cumulative frequency curve) representation of data
- 1.4 Measures of central tendency – Mean (AM, GM and HM), Mode and Median
- 1.5 Measures of dispersion; skewness and kurtosis

UNIT-2: DISTRIBUTION AND HYPOTHESIS

- 2.1 Probability distribution - Binomial distribution
- 2.2 Poisson distribution
- 2.3 Normal distribution
- 2.4 Test of hypothesis, two types of errors
- 2.5 T-Test for assumed population mean and comparison of two samples

UNIT-3: ANALYSIS OF VARIANCE

- 3.1 Chi square test and its application
- 3.2 Co-relation and regression
- 3.3 Principles of design of experiments. Examples of CRD and RBD
- 3.4 One-way analysis of variance
- 3.5 Two-way analysis of variance

LITERATURE RECOMMENDED:

1. Gupta, S. C. (1999). Fundamentals of Statistics. Himalayan Pub. House, Delhi.
2. Hoshmand, A. R. (1988). Statistical methods for Env. and Agr. Science. CRS Press, New York
3. Khan, I. A. and Khanum, A. (1994). Biostatistics. Ukaaz Publications, Hyderabad.
4. Rao, P. S. S. and Richard, J. (1996). An Introduction to Biostatistics. Prentice Hall, New Delhi.
5. Sukhatme, P. V. and Amble, V. N. (1976). Statistical methods for Agricultural workers: ICAR, New Delhi.

M.Sc. Environmental Sciences (CBCS)
[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESTE309

Title: Biological Statistics

Credits: 2

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	10	After 30 days on completion of 25% of syllabus
Minor II	10	After 60 days on completion of 50% of syllabus
Major End of Semester	30	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	50	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 5 questions (objective/short answer type) of one mark each. Section B will consist of one question with internal choice (Long answer type) of five marks. Each Minor Test would be of 45 minutes duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of ten marks each. Major Test would be of 1½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESTE310

**Title: Fundamentals of Soil
Science**

Credits: 2

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

Objectives:

The course has been designed to acquaint students with the basic of soil science. The course will be relevant in providing knowledge on genesis and evolution of soils, their physical and chemical properties and the plant-soil relations with respect to the availability of macro- and micro-nutrients.

UNIT-1: SOIL: GENESIS AND CLASSIFICATION

- 1.1 Concepts of Soil, the parent material of soil
- 1.2 Soil physical properties: texture, colour, pore space, particle density
- 1.3 Soil profile, weathering and soil development
- 1.4 Soil water: Characteristics and behavior
- 1.5 Soil survey, RS and GIS applications

UNIT-2: SOIL CHEMISTRY

- 2.1 Chemical composition of Soil, Inorganic and organic constituents
- 2.2 The soil solution, pH and Eh, Oxidation-reduction
- 2.3 Cation exchange capacity of the soil and its importance
- 2.4 Soil acidity: Saline and Sodic soils. Soil Buffer Capacity
- 2.5 Inorganic and organic soil contaminants

UNIT-3: SOIL: A NATURAL RESOURCE

- 3.1 Soil macro and micronutrients
- 3.2 Soil Fertilizers and fertility evaluation; Nutrients recycling
- 3.3 Soil degradation from anthropogenic and natural factors
- 3.4 Reclamation of degraded land, desertification and its control
- 3.5 Origin, distribution and use of economic minerals

LITERATURE RECOMMENDED:

1. Horton, R. E. (1941). An approach toward a physical interpretation of infiltration capacity. Soil Science Society of America Journal, 5(C): 399-417.
2. Millar, C. E. and Turk, L. M. (2002). Fundamentals of soil science. Daya Books.
3. Foth, H. D. (1978). Fundamentals of Soil Science. Soil Science, 125(4), 272.
4. Essington, M. E. (2015). Soil and water chemistry: an integrative approach. CRC press.
5. Evangelou, V. P. (1998). Environmental soil and water chemistry: principles and applications (No. 631.455 E6).
6. Carter, M. R. (Ed.). (1993). Soil sampling and methods of analysis. CRC Press.
7. Sparks, D. L. (2003). Environmental soil chemistry. Academic Press.
8. Conklin, A. R. (2013). Introduction to soil chemistry: Analysis and instrumentation. John Wiley and Sons.
9. White, R. E. (2013). Principles and practice of soil science: the soil as a natural resource. John Wiley and Sons.

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESTE310

Title: Fundamentals of Soil

Credits: 2

Science

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	10	After 30 days on completion of 25% of syllabus
Minor II	10	After 60 days on completion of 50% of syllabus
Major End of Semester	30	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	50	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 5 questions (objective/short answer type) of one mark each. Section B will consist of one question with internal choice (Long answer type) of five marks. Each Minor Test would be of 45 minutes duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of ten marks each. Major Test would be of 1½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESTE311

Title: Wildlife Conservation and Management

Credits:2

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

Objectives:

Wildlife helps in maintaining the ecological balance of nature and provides immense resources to various stakeholders. There is a growing concern of wildlife depletion across the globe. The course is intended to teach students regarding the status of wildlife, identification of factors responsible for its depletion & efforts taken at national and international level for its protection.

UNIT-1: WILDLIFE AND WILDLIFE HABITAT

- 1.1 Wildlife: Definition, concepts and importance
- 1.2 Wildlife as a Natural Resource
- 1.3 Wildlife Census methods
- 1.4 Wildlife Habitat: Forest, Desert and Grassland with their characteristic wildlife
- 1.5 Wildlife distribution pattern in India

UNIT-2: ENVIRONMENT DEGRADATION AND WILDLIFE

- 2.1 Impact of Environment pollutants on wildlife
- 2.2 Changed landuse pattern and its effect on wildlife
- 2.3 Wildlife diseases (Viral, Bacterial, Protozoan, Helminthes and Ticks)
- 2.4 Man and Wildlife conflict
- 2.5 Wildlife management principle

UNIT-3: STATUS AND DISTRIBUTION OF WILDLIFE IN INDIA

- 3.1 Zoo-geographic subdivisions of India based on important mammalian fauna
- 3.2 Endangered Wildlife species (Birds & Mammals) of India
- 3.3 Protected area network: National Parks, Wildlife Sanctuaries and Biosphere Reserves
- 3.4 Important conservation areas in India and their characteristic wildlife
- 3.5 Important conservation areas and wildlife species of J&K

LITERATURE RECOMMENDED:

1. Krausman, P. R.; Cain III, J. W. and Cain, J. W. (Eds.) (2013). Wildlife management and conservation: contemporary principles and practices. JHU Press.
2. Hosetti, B. B. (2014). Concepts in Wildlife Management. 3rdEd., Daya Publishing House.
3. Kant, S. and Alavalapati, J. (Eds.) (2014). Handbook of forest resource economics. Routledge.
4. Decker, D. J.; Riley, S. J. and Siemer, W. F. (Eds.) (2012). Human dimensions of wildlife management. JHU Press.
5. Koprowski, J. L. and Krausman, P. R. (Eds.) (2019). International wildlife management: Conservation challenges in a changing world. JHU Press.
6. McComb, B. C. (2015). Wildlife habitat management: Concepts and applications in forestry. CRC Press.
7. Gopal, R. (2021). Fundamentals of Wildlife Management. Natraj Publishers

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESTE311

**Title: Wildlife Conservation and
Management**

Credits: 2

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	10	After 30 days on completion of 25% of syllabus
Minor II	10	After 60 days on completion of 50% of syllabus
Major End of Semester	30	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	50	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 5 questions (objective/short answer type) of one mark each. Section B will consist of one question with internal choice (Long answer type) of five marks. Each Minor Test would be of 45 minutes duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of ten marks each. Major Test would be of 1½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESTE312

Title: Forest Ecology

Credits: 2

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

Objectives:

The course has been designed to acquaint the students with different aspects related to ecology and management of the forest as these are very important for the survival and sustainable exploitation of the forests.

UNIT-1: INTRODUCTION TO FOREST ECOLOGY AND FORESTS

- 1.1 Concept of forest ecology and its applicability
- 1.2 Factors affecting establishment, growth, development, and distribution of forests
- 1.3 Forests in India: Types, classification, composition, area, distribution, and density
- 1.4 Features of forest trees: canopy, forest density; stages of tree development, phenology, even-aged and uneven-aged forests, pure and mixed forests, natural/artificial regeneration
- 1.5 Tree form, Taper, Age-gradation and normal diameter distribution of forest trees, measurement of tree height, forest inventory, kinds of enumeration, sampling types, designs and major errors, estimation of crop volume

UNIT-2: FOREST COMMUNITIES, ECOSYSTEM FUNCTIONS AND DYNAMICS

- 2.1 Forest community- concept and life forms
- 2.2 Forest succession and changes in forest ecosystems, characteristics & competition in overstory and under-story trees, transition of trees from understory to overstory.
- 2.3 Primary productivity of forest ecosystem and its measurement: determination of tree growth and measurement, Tree age and growth, age and Diameter relation, CAI / MAI, increment percent
- 2.4 Estimation of forest growing stock/ biomass, concept of sustained yield and yield regulation
- 2.5 Factors responsible for forest degradation - Grazing, lopping, cutting, forest fire, forest diseases (fungal dieback, root/stem rots, sal borer), diversion of forest land for non-forestry purposes / infra-structure development, forest fragmentation, etc.)

UNIT-3: FOREST ECOSYSTEM MANAGEMENT

- 3.1 Ecological and economic considerations in 'Management of forests'
- 3.2 Forest management systems: guiding principles, management interventions and their applicability to different forest types
- 3.3 Concept of Joint forest management, Case study: Choukoni Vanpanchayat, Ranikhet; Bohal village and Palampur Municipal Council spring recharge zone management agreement
- 3.4 Social forestry: concept and contribution, Arabari and Sukhomajri model of people's participation, Chipko and Appiko moments
- 3.5 Role of Remote Sensing and LiDAR technique in preparation of working plans and forest management

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESTE312

Title: Forest Ecology

Credits: 2

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

LITERATURE RECOMMENDED:

1. Assmann, E. (1970). The principles of forest yield. Pergamon Press.
2. Barnes, B. V.; Zak, D. R.; Denton, S. R. and Spurr, S. R. (1998). Forest ecology (4th Ed.). John Wiley and Sons.
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5. Chaturvedi, A. N. and Khanna, L. S. (2015). Forest Mensuration and Biometry, Khanna Bandhu, Dehradun.
6. Dwivedi, A. P. (1993). Forests-the ecological ramifications. Natraj Pub., Dehradun.
7. Dwivedi, A. P. (1993). Forestry in India. Surya Publications, Dehradun.
8. FSI (2019). State of forest report 2019. Forest Survey of India, Dehradun.
9. Kimmins, J. P. (2004). Forest ecology (2ndEd.). Pearson Education.
10. Lal, J. B. (2011). Forest Management: Classical Approach and Current Imperatives. Natraj Publishers.
11. Parkash, R. (2006). Forest management. International Book Distributors, Dehradun.
12. Ravindranath, N. H. (2004). Joint forest management in India. Oxford Univ. Press.
13. Stebbins, E. P. (1977). Indian forest Insects. L. K. Jain and Sons, India.

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	10	After 30 days on completion of 25% of syllabus
Minor II	10	After 60 days on completion of 50% of syllabus
Major End of Semester	30	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	50	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 5 questions (objective/short answer type) of one mark each. Section B will consist of one question with internal choice (Long answer type) of five marks. Each Minor Test would be of 45 minutes duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of ten marks each. Major Test would be of 1½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESTE313

Title: Computer Applications

Credits: 2

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

Objectives:

The course has been designed with the objective to provide the basic knowledge about the computer and to develop basic skills on computer programming tools such as HTML and to create awareness on how static web page development is done.

UNIT-1: BASICS OF COMPUTER FUNDAMENTALS

- 1.1 Computers and its Components
- 1.2 Computer Memory and its types
- 1.3 Conversion Binary to Decimal and Vice-versa, Binary Arithmetic
- 1.4 Operating system, its functions and types
- 1.5 Software and its types

UNIT-2: CONCEPTS OF COMPUTER NETWORK

- 2.1 Internet, intranet and its uses
- 2.2 Data Communication and transmission methods
- 2.3 Types of networks and topologies, Network Protocol and its types
- 2.4 World Wide Web, Search engines, Web browsers
- 2.5 Internet security and cyber laws

UNIT-3: HTML BASICS

- 3.1 Introduction to HTML. Creating and loading HTML pages and tags
- 3.2 Structure of HTML, basics, elements, attributes, headings
- 3.3 Formatting text, paragraph, styles, marquee
- 3.4 Images, hyper Links, color effects
- 3.5 Creation of Tables and lists and HTML forms

LITERATURE RECOMMENDED:

1. Sinha, P. K. (2003). Computer Fundamentals. 6th Ed., BPB Pub., New Delhi.
2. Rajaraman (1989). Fundamentals of Computers. PHI Pub., New Delhi.
3. Jain, P. K. (1995). Fundamentals of Computers. BPB Pub., New Delhi.
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6. Larsen, R. (2013). Beginning HTML and CSS, John Wiley Pub.
7. HTML–Basics. www.W3schools.com

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESTE313

Title: Computer Applications

Credits: 2

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	10	After 30 days on completion of 25% of syllabus
Minor II	10	After 60 days on completion of 50% of syllabus
Major End of Semester	30	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	50	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 5 questions (objective/short answer type) of one mark each. Section B will consist of one question with internal choice (Long answer type) of five marks. Each Minor Test would be of 45 minutes duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of ten marks each. Major Test would be of 1½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESPE303

Title: Lab Course-I (Based on
PSESTE304)

Credits: 2

Duration of Examination: 2 hrs

Maximum Marks : 50

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with experimental work based on Course No. PSESTE304.

1. Calculate the unknown concentration of Antibiotic by bioassay method.
2. Calculate the unknown concentration of Niacin by bioassay method.
3. Calculate the unknown concentration of Pantothenic acid by bioassay method.
4. Calculate the unknown concentration of Biotin by bioassay method.
5. From given data of %age mortality at different concentrations of toxicant, calculate LC_{50} .
6. Study the effect of different concentrations of salt solution on osmotic stress in onion cell.
7. From given toxicity data of chemical A & B calculate the LC_{50} of mixture to conclude additive effect.
8. From given toxicity data of chemical A & B calculate the LC_{50} of mixture to conclude antagonistic effect.
9. From given toxicity data of chemical A & B calculate the LC_{50} of mixture to conclude simple additive effect.
10. Demonstrate practically Dose-response relationship in same and different size entities.

SCHEME OF EXAMINATIONS

Component	Marks	Remarks
Internal	25	After 60 days on completion of 50% of syllabus Written Exam: 13 Marks (4 Practicals of 02 Marks each; Viva-voce: 5 Marks) Attendance: 5 Marks Day to Day Performance: 7 Marks
External	25	On completion of entire syllabus Written Exam: 25 Marks (4 Practicals of 5 Marks each; Viva-voce: 5 Marks)
Total	50	

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESPE304

Title: Lab Course-II (Based on PSESTE306)

Credits: 2

Duration of Examination: 2 hrs

Maximum Marks : 50

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with experimental work based on Course No. PSESTE306.

1. Visit a forest and write a detailed account on various ecosystems services provided by the forests.
2. Make a field visit to a forest and identify the important species that provides timber, food and medicines.
3. Enlist the important endemic, extinct and threatened species (endangered, rare, vulnerable and indeterminate species) of Jammu and Kashmir.
4. Make an inventory of important minerals in Jammu and Kashmir.
5. Make a field visit to a hilly village and identify the traditional practices used for soil conservation
6. Calculate the carbon stock in above ground biomass in Jammu University campus.
7. Enlist the potential energy minerals and their distribution in Jammu and Kashmir.
8. Enlist the economic minerals and their distribution in Jammu and Kashmir.
9. Identify common mineral types.

SCHEME OF EXAMINATIONS

Component	Marks	Remarks
Internal	25	After 60 days on completion of 50% of syllabus Written Exam: 13 Marks (4 Practicals of 02 Marks each; Viva-voce: 5 Marks) Attendance: 5 Marks Day to Day Performance: 7 Marks
External	25	On completion of entire syllabus Written Exam: 25 Marks (4 Practicals of 5 Marks each; Viva-voce: 5 Marks)
Total	50	

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESPE305

Title: Lab Course-III (Based on PSESTE 307)

Credits: 2

Duration of Examination: 2 hrs

Maximum Marks : 50

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with experimental work based on Course No. PSESTE307.

1. Selection of suitable bioremediation technology for field-scale bioremediation
2. Design and application of rain gardens.
3. Phytoremediation for textile dye decolorization.
4. Study of anatomical changes in plants employed for phytoremediation.
5. Design and application of green walls.
6. Design and application of Horizontal flow wetlands
7. Design and application of Vertical flow wetlands
8. Working and application of Decentralized Wastewater Treatment Systems
9. Design and application of green roofs.

SCHEME OF EXAMINATIONS

Component	Marks	Remarks
Internal	25	After 60 days on completion of 50% of syllabus Written Exam: 13 Marks (4 Practicals of 02 Marks each; Viva-voce: 5 Marks) Attendance: 5 Marks Day to Day Performance: 7 Marks
External	25	On completion of entire syllabus Written Exam: 25 Marks (4 Practicals of 5 Marks each; Viva-voce: 5 Marks)
Total	50	

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESPE306

Title: Lab Course-IV (Based on PSESTE309)

Credits: 2

Duration of Examination: 2 hrs

Maximum Marks : 50

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with experimental work based on Course No. PSESTE309.

1. Classification of the provided data and preparation of frequency distribution table.
2. Diagrammatic (Line, bar, pie diagram) and graphic (Histogram, frequency polygon, frequency curve) representation of the data.
3. Determination of Mean, Mode and Median in different data (individual, discrete and continuous data).
4. Determination of Standard Deviation, CV in different data (individual, discrete and continuous data).
5. Exercise based on addition and multiplication rule of Probability.
6. Exercise based on Binomial, Poisson and Normal distribution.
7. Testing the significance of the Mean of an assumed population, Mean of two samples (independent and dependent).
8. To test the goodness of fit of the data (Chi Square test).
9. Exercise based on Correlation and Regression analysis.
10. Exercise based on One-way and Two-way ANOVA.

SCHEME OF EXAMINATIONS

Component	Marks	Remarks
Internal	25	After 60 days on completion of 50% of syllabus Written Exam: 13 Marks (4 Practicals of 02 Marks each; Viva-voce: 5 Marks) Attendance: 5 Marks Day to Day Performance: 7 Marks
External	25	On completion of entire syllabus Written Exam: 25 Marks (4 Practicals of 5 Marks each; Viva-voce: 5 Marks)
Total	50	

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESPE307

Title: Lab Course-V (Based on PSESTE310)

Credits: 2

Duration of Examination: 2 hrs

Maximum Marks : 50

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with experimental work based on Course No. PSESTE310.

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

SCHEME OF EXAMINATIONS

Component	Marks	Remarks
Internal	25	After 60 days on completion of 50% of syllabus Written Exam: 13 Marks (4 Practicals of 02 Marks each; Viva-voce: 5 Marks) Attendance: 5 Marks Day to Day Performance: 7 Marks
External	25	On completion of entire syllabus Written Exam: 25 Marks (4 Practicals of 5 Marks each; Viva-voce: 5 Marks)
Total	50	

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESPE308

Title: Lab Course-VI (Based on PSESTE311)

Credits: 2

Duration of Examination: 2 hrs

Maximum Marks : 50

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with experimental work based on Course No. PSESTE311.

1. Make a rapid assessment of terrestrial faunal species within and nearby areas of the University campus.
2. List the national parks, wildlife sanctuaries and biosphere reserves on the Map of India.
3. Using photographs/paintings/coloured drawings identify and enlist the important mammalian species of India.
4. Using photographs/paintings/coloured drawings identify and enlist the important bird species of Himalayas.
5. Using photographs/paintings/coloured drawings identify and enlist the important reptiles of Himalayas.
6. Identify some economic important plant species of J&K and their silvicultural importance.
7. Field visits to nearby wildlife sanctuaries and national parks.
8. Preparation of information procedure about important wildlife tourist spots and ecotourism sites in J&K.
9. Using photographs/paintings/coloured drawings identify and study ecological role of characteristic animal species (major representative species only) of various Biomes.
10. Using photographs/paintings/coloured drawings identify and study distribution and ecological role of endangered species of Himalayan region.
11. Prepare a geological map of J&K.

SCHEME OF EXAMINATIONS

Component	Marks	Remarks
Internal	25	After 60 days on completion of 50% of syllabus Written Exam: 13 Marks (4 Practicals of 02 Marks each; Viva-voce: 5 Marks) Attendance: 5 Marks Day to Day Performance: 7 Marks
External	25	On completion of entire syllabus Written Exam: 25 Marks (4 Practicals of 5 Marks each; Viva-voce: 5 Marks)
Total	50	

M.Sc. Environmental Sciences (CBCS)

[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESPE309

Title: Lab Course-VII (Based on PSESTE312)

Credits: 2

Duration of Examination: 2 hrs

Maximum Marks : 50

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with experimental work based on Course No. PSESTE312.

1. Vegetation analysis (frequency, density, abundance and IVI of different tree species by quadrat method).
2. Stratification/profile of forest vegetation.
3. Tree form, Taper, Age-gradation and normal diameter distribution of forest trees, measurement of tree height/ volume, forest inventory, kinds of enumeration.
4. Measurement of tree, Tree age and growth, Age and Diameter relation, CAI / MAI, increment percent.
5. Estimation of forest growing stock/ biomass and productivity.
6. Quantification of litter production and decomposition.
7. Trip to different regions of the state to study forest types /vegetation.
8. Visit to national parks, wildlife sanctuaries, botanical gardens and arboreta.
9. To measure status of regeneration.

SCHEME OF EXAMINATIONS

Component	Marks	Remarks
Internal	25	After 60 days on completion of 50% of syllabus Written Exam: 13 Marks (4 Practicals of 02 Marks each; Viva-voce: 5 Marks) Attendance: 5 Marks Day to Day Performance: 7 Marks
External	25	On completion of entire syllabus Written Exam: 25 Marks (4 Practicals of 5 Marks each; Viva-voce: 5 Marks)
Total	50	

M.Sc. Environmental Sciences (CBCS)
[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESPE310

Title: Lab Course-VIII (Based on PSESTE313)

Credits: 2

Duration of Examination: 2 hrs

Maximum Marks : 50

a) Internal : 25 Marks

b) External : 25 Marks

Objectives:

To make students familiar with experimental work based on Course No. PSESTE313.

1. Create simple Web pages formatting of text with all the different text styles (bold, italic and Underline show effects on separate lines). Include the following specifications
 - a. Title of the page should be about my dept
 - b. Put the image in the background
 - c. Place your department name at the top of the page in large text followed by address in smaller size
 - d. Add names of courses offered each in a different colour, style and typeface
 - e. Add scrolling text with a message of your choice.
2. Write a HTML program to design a simple form which should allow to enter your personal data. Hint: make use of text field, password field, e-mail, lists, radio buttons, checkboxes, submit button
3. Write a html code to generate following output.
 - Coffee
 - Tea
 - o Black Tea
 - o Green Tea
 - Milk
4. Write a HTML code to generate following output

Registration Form

Username	<input type="text"/>
Password	<input type="password"/>
Confirm Password	<input type="password"/>
FirstName	<input type="text"/>
LastName	<input type="text"/>
Email	<input type="text"/>
Phone No	<input type="text"/>
Location	<input type="text"/>

5. Write a HTML code to generate the following output: -



M.Sc. Environmental Sciences (CBCS)
[Semester-III]

Examinations to be held in Dec. 2022, Dec. 2023 and Dec. 2024

Course No.: PSESPE310

Title: Lab Course-VIII (Based on PSESTE313)

Credits: 2

Duration of Examination: 2 hrs

Maximum Marks : 50

a) Internal : 25 Marks

b) External : 25 Marks

6. Create an html page with red background with a message “warning” in large size blinking. Add scrolling text “read the message” below it.
7. Create an html page with 7 separate lines in different colors. State color of each line in its text.
8. Write a HTML code to generate following output.

2. Write the HTML code which generates the following output.

Country	Population (In Crores)	
INDIA	1998	85
	1999	90
	2000	100
USA	1998	30
	1999	35
	2000	40
UK	1998	25
	1999	30
	2000	35

9. Write a HTML code to generate following output.

Enter Name of your friend

Choose the file you want to post to your friend

What does the file contain?

Image Source code Binary code

You have Completed the Form .

10. Write code to create a static web page containing your department information include as much as possible html features studied such text size, colours, scrolling, image, table, list and forms, etc.

SCHEME OF EXAMINATIONS

Component	Marks	Remarks
Internal	25	After 60 days on completion of 50% of syllabus Written Exam: 13 Marks (4 Practicals of 02 Marks each; Viva-voce: 5 Marks) Attendance: 5 Marks Day to Day Performance: 7 Marks
External	25	On completion of entire syllabus Written Exam: 25 Marks (4 Practicals of 5 Marks each; Viva-voce: 5 Marks)
Total	50	

M.Sc. Environmental Sciences (CBCS)

[Semester-IV]

Examinations to be held in May 2023, May 2024 and May 2025

Course No.: PSESTE401

Title: Environmental Law

Credits:4

Duration of Examination: 2½ 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 acquaint the students with elementary principles of environmental Laws to enable them to make proper and effective use of their professional abilities. Because the scientific gains can be put into use within the parameters of a legal system and the science and law must be subservient to the needs of the society. Through this course the students shall learn about the legislative measures for protection of environment 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 LAWS

- 1.1 Environmental Protection in India: Origin of environmental laws and protection policy post-Independence
- 1.2 General Principles of Environmental Law
- 1.3 Indian Constitution and Environmental Protection
- 1.4 History and development of Environmental Protection under International Law and key international efforts
- 1.5 Millennium Development Goals (MDGs) vs. Sustainable Development Goals (SDGs)

UNIT-2: POLLUTION ABATEMENT AND LAW

- 2.1 Water (Prevention & Control of Pollution) Act, 1974: Salient Features
- 2.2 Prevention, Control & abatement of water pollution under WPA
- 2.3 Air (Prevention & Control of Pollution) Act, 1981: Salient Features
- 2.4 Prevention, Control & abatement of air pollution under APA
- 2.5 Power and functions of SPCB and CPCB under WPA & APA
(Note: Only relevant provisions of the above Acts supported by cases)

UNIT-3: ENVIRONMENT PROTECTION AND LAW

- 3.1 Environment (Protection) Act, 1986: Salient Features
- 3.2 Prevention, Control & abatement of environmental pollution under EPA
- 3.3 Motor Vehicle Act, 1988 with latest amendments: Salient Features
- 3.4 Public Liability Insurance Act, 1991.
- 3.5 National Green Tribunal Act, 2010
(Note: Only relevant provisions of the above Acts supported by cases)

UNIT-4: NATURAL RESOURCE CONSERVATION AND THE LAW

- 4.1 Wildlife (Protection) Act, 1972 amended 1991, 2002
- 4.2 Forest Conservation Act, 1980
- 4.3 Biological Diversity Act, 2002
- 4.4 National Forest Policy, 1988
- 4.5 National Environment Policy, 2006
(Note: Only relevant provisions of the Acts supported by cases)

M.Sc. Environmental Sciences (CBCS)

[Semester-IV]

Examinations to be held in May 2023, May 2024 and May 2025

Course No.: PSESTE401

Title: Environmental Law

Credits: 4

Duration of Examination: 2½ hrs

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

UNIT-5: ENVIRONMENTAL PROTECTION RULES AND JUDICIAL ACTIVISM

- 5.1 Noise pollution (Regulation and Control) Rules, 2000
- 5.2 Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016
- 5.3 Role of Indian Judiciary in Environmental Protection
- 5.4 Indian Penal Code (IPC 1860) and offences affecting public health, safety and convenience (Sections 268, 277, 278, 279, 284, 290, 291)
- 5.5 Sections 133-143 of Criminal Procedure Code, 1973

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.
3. Jaswal, P. S. and Jaswal, N. (2014). Environmental Law. Allahabad Law Agency, Allahabad.
4. Khan, I. A. (2002). Environmental Law (2ndEd.), Central Law Agency, Allahabad.
5. Krishnamoorthy, B. (2017). Environmental Management: Text and Cases (3rdEd.), PHI learning Private Ltd, New Delhi.
6. Lal, S. (1990). Commentaries on Water, Air pollution & Environment (protection) Law. Law Pub. Pvt. Ltd. India.
7. Leelakrishnan, P. (1999). Environmental Law in India. Butterworths Publications, New Delhi.
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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 Public Interest Litigation in India: Determining the Key Variables. Fordham Environmental Law Review. 21(2) Art.3: 239-292.
3. Jariwala, C. M. (2000). Complex Enviro-Techno-science Issues. Journal of Indian Law Institute 42(1): 29.
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M.Sc. Environmental Sciences (CBCS)

[Semester-IV]

Examinations to be held in May 2023, May 2024 and May 2025

Course No.: PSESTE401

Title: Environmental Law

Credits:4

Duration of Examination: 2½ hrs

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

5. Jasrotia, A. (2003). Global Environmental Law: Emerging concepts & dimensions. Kashmir Univ. Law Review. X: 171-190.
6. 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.
7. Jena, K. C. (2005). Ecological and environmental protection movements: A Brief Conspectus, AIR Journal. 288.
8. Mahajan, N. (2015). Judicial Activism for Environment Protection in India. International Research Journal of Social Sciences, 4(4): 7-14.
9. Rubagotti, G. (2006). The Clean Development Mechanism: Establishing a Regulatory Framework to favour Climate- Friendly investments in developing Countries. Indian Journal of International Law, 46(2).
10. Sahu, G. (2008). Implications of Indian Supreme Court's Innovations for Environmental Jurisprudence, 4/1 Law, Environment and Development Journal, 1 available at <http://www.lead-journal.org/content/08001.pdf>
11. Sarkar, M. D. (2005). Contribution of Indian Judiciary towards the development of environmental jurisprudence. AIR Journal. 298.
12. Sen, A. (2001). Environmental concerns and judicial intervention in India. AIR Journal. 16.
13. Tiwari, G. S. (2001). Conservation of Biodiversity & Techniques of people's activism. Journal of Indian Law Institute. 43(2): 191.

WEB REFERENCE:

1. <http://envfor.nic.in/>
2. edugreen.teri.res.in/explore/laws.htm
3. <https://sustainabledevelopment.un.org/>
4. https://devgan.in/ipc/chapter_14.php#s279

SUGGESTED CASES:

1. Sachidanand Pandey vs. State of West Bengal AIR 1987 SC 1109
2. Municipal Council, Ratlam vs. Vardhichand AIR 1980 SC 1622
3. Rural Litigation and Entitlement Kendra, Dehradun vs. State of Uttar Pradesh AIR 1988 SC 2187.
4. T. Damodar Rao vs. Municipal Corporation of Hyderabad AIR 1987 AP 171.
5. State of Uttar Pradesh vs. Raj Narain AIR 1975 SC 865.
6. S. P. Gupta vs. Union of India, AIR 1982 SC 149.
7. M. C. Mehta vs. Kamal Nath AIR 2000 SC 1997.
8. Indian Council for Enviro-Legal Action vs. Union of India, 1996 (3) SCC 212.
9. S. Jagannath vs. Union of India (Shrimp Culture Case) AIR 1997 SC 811.

M.Sc. Environmental Sciences (CBCS)

[Semester-IV]

Examinations to be held in May 2023, May 2024 and May 2025

Course No.: PSESTE 401

Title: Environmental Law

Credits:4

Duration of Examination: 2½ hrs

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

10. Vellore Citizens Welfare Forum vs. Union of India AIR 1996 SC 2715.
11. Narula Dyeing and Printing vs. Union of India AIR 1995 Guj. 185.
12. M. C. Mehta vs. Union of India (Shriram Food and Fertilizer Case) 1986 (2) SCC 176.
13. M. C. Mehta vs. Union of India 1987 (4) SCC 463
14. M. C. Mehta vs. Union of India 1988 (1) SCC 471
15. M. C. Mehta vs. Union of India AIR 1988 SCR (2) 538
16. M. C. Mehta vs. Union of India (Taj Trapezium Case) AIR 1987
17. T. N. Godavarman Thirumulpad vs. Union of India 2001 (10) SCC 645
18. Animal and Environmental Legal Defence Fund vs. Union of India AIR 1997 SC 1070
19. Animal Welfare Board of India vs. A. Nagaraj and Ors. 2014 (7) SCC 547
20. Centre for Environmental Law WWF-1 vs. Union of India AIR 1999 SC 354
21. Narmada Bachao vs. Union of India Air 2000 SC 3751

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	20	After 30 days on completion of 25% of syllabus
Minor II	20	After 60 days on completion of 50% of syllabus
Major End of Semester	60	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	100	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/Short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of 5 marks each. Each Minor Test would be of 1 hour duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 15 questions (objective/short answer type) of one mark each. Section B will consist of three questions with internal choice (Long answer type) of 15 marks each. Major Test would be of 2½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-IV]

Examinations to be held in May 2023, May 2024 and May 2025

Course No.: PSESTE404

Title: Environmental Biotechnology

Credits: 2

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

Objectives:

The study of this course will help the students to protect the environment from pollution & to conserve natural resources because the rapid industrialization, urbanization & other developments are constant threat to the clean environment & to the depleting natural resources. Moreover, the threats to the environment are also from release of genetically engineered organisms in the atmosphere & due to release of effluents from biotechnological companies. Thus, the study of course will help to develop cleaner & sustainable environment in future.

UNIT-1: INTRODUCTION AND POLLUTION CONTROL

- 1.1 Definition, Historical background, scope and importance of biotechnology
- 1.2 Biosorption - use of bacteria, fungi and algae in biosorption
- 1.3 Bioabatement of metal pollution using higher and lower plants
- 1.4 Biodegradation of Pesticides
- 1.5 Microbial treatment of oil pollution

UNIT-2: RECYCLING AND RECLAMATION

- 2.1 Conventional wastewater treatment strategies using biosystem, Activated sludge process, Trickling filter, Rotating Biological contactor (RBC) and Fluidized Beds
- 2.2 Role of Biotechnology in:
 - 2.2.1 Energy production from Biomass
 - 2.2.2 Fuel Alcohol production
 - 2.2.3 Hydrogen production
- 2.3 Biotechnology for restoration of degraded land
 - 2.3.1 Reforestation through micropropagation
 - 2.3.2 Use of mycorrhizae in reforestation
 - 2.3.3 Use of microbes in improving soil fertility
- 2.4 Use of microbes as bio insecticide
- 2.5 Use of microbes as bio fungicide and bio herbicides

UNIT-3: NOVEL METHODS FOR POLLUTION CONTROL

- 3.1 Biotechniques for Air pollution Abatement and odour control- Bioscrubbers, Biobeds, Biotrickling filters
- 3.2 Production of bio- fertilizers
- 3.3 Vermitechnology
- 3.4 Wastewater treatment using aquatic plants
- 3.5 Biodegradable plastics - Bioplastics

LITERATURE RECOMMENDED:

1. Abbasi, S. A. and Ramasami, E. (1999). Biotechnological Methods of Pollution Control. Universities Press (India) Ltd., Hyderabad.

M.Sc. Environmental Sciences (CBCS)

[Semester-IV]

Examinations to be held in May 2023, May 2024 and May 2025

Course No.: PSESTE404

Title: Environmental Biotechnology

Credits: 2

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

2. Chaterjii, A. K. (2002). Introduction to Environmental Biotechnology. Prentice Hall of India Pvt. Ltd., New Delhi.
3. Gupta, P. K. (1994). Elements of Biotechnology. Rastogi & Co., Meerut.
4. Higgins *et al.* (1984). Biotechnology- Fundamentals and Principles. Blackwell Publishers, London.
5. Jogdand, S. N. (1995). Environmental Biotechnology. Himalayan Publishing House, New Delhi.
6. Mukherjee, R. N. (1992). Downstream processing in Biotechnology. Tata McGraw Hill Pub. Co., New Delhi.
7. Purohit, S. S. and Mathur, S. K. (1996). Biotechnology Fundamentals and Applications. Agrobotanical Publication, New Delhi.
8. Sohal, H. S. and Srviastava, A. K. (1994). Environment & Biotechnology. Ashish Pub. House, New Delhi.
9. Rittmann, B. E. and McCarty, P. L. (2020). Environmental Biotechnology: Principles and Applications, 2ndEd. McGraw Hill Education.
10. Gothandam, K. and Ranjan, S. (2020). Environmental Biotechnology. I, Springer Nature, Switzerland.

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	10	After 30 days on completion of 25% of syllabus
Minor II	10	After 60 days on completion of 50% of syllabus
Major End of Semester	30	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	50	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 5 questions (objective/short answer type) of one mark each. Section B will consist of one question with internal choice (Long answer type) of five marks. Each Minor Test would be of 45 minutes duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of ten marks each. Major Test would be of 1½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-IV]

Examinations to be held in May 2023, May 2024 and May 2025

Course No.: PSESTO405*

Credits: 4

Duration of Examination: 2½ hrs

Title: Man and Environment:
Issues & Policies

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

Objectives:

Humans need to interact with the environment to obtain our food, water, fuel, medicines, building materials and many other things. However, massive extraction of natural resources has seriously damaged the environmental resources, but also have threatened the existence of humans on this planet. This course will provide students with an up-to-date account of various environmental challenges and various policy measures at national and international level taken for environmental conservation. Besides, this course will also help students to understand the importance of public participation and activism in the conservation of environment.

UNIT-1: ENVIRONMENT: CONCEPT, COMPONENTS AND MANAGEMENT

- 1.1 Environment: concepts, components and evolution
- 1.2 Population growth - biological growth curves and carrying capacity
- 1.3 Sustainable development and Common future goals
- 1.4 Role of UNEP, UNFCCC and IPCC in environmental Protection
- 1.5 Environmental Laws in India

UNIT-2: ALTERNATIVE ENERGY

- 2.1 Energy scenario in India
- 2.2 Coal, oil and natural gas
- 2.3 Hydro energy, wind energy, tidal energy
- 2.4 Solar energy, Nuclear energy
- 2.5 Biogas, fire wood, Petro plants, Dendro thermal energy

UNIT-3: WILDLIFE: IMPORTANCE, CONSERVATION AND MANAGEMENT

- 3.1 Wildlife: Importance and Conservation
- 3.2 Depletion of wildlife: Causes & Consequences. Man and wildlife conflict.
- 3.3 Important National Parks, Wildlife Sanctuaries and Biosphere Reserves in India
- 3.4 Endangered wildlife species (Birds and Mammals) of India.
- 3.5 Important Wildlife species of J&K.

UNIT-4: HUMAN IMPACTS ON ENVIRONMENT

- 4.1 Impact on the Land Resources
- 4.2 Eutrophication - causes and control measures.
- 4.3 Atmospheric Pollution: Ozone Depletion, Criteria Pollutants
- 4.4 E-waste pollution
- 4.5 Radiation pollution, Thermal Pollution, Noise Pollution

UNIT-5: ENVIRONMENTAL ETHICS AND ACTIVISM

- 5.1 History of Environmental Movements
- 5.2 Movements related to environment sacred groves, Bishnoi tradition, Chipko movement
- 5.3 Tehri dam, Sardar Sarovar, Narmada dam, Almatti dam, Silent Valley movement
- 5.4 Supreme Court Cases – Ratlam Municipality, Ganga Action Plan, Taj Trapezium, Delhi CNG, Tamil Nadu Tanneries, Oleum gas case
- 5.5 National Green Tribunal

M.Sc. Environmental Sciences (CBCS)

[Semester-IV]

Examinations to be held in May 2023, May 2024 and May 2025

Course No.: PSESTO405*

Credits: 4

Duration of Examination: 2½ hrs

Title: Man and Environment:
Issues & Policies

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

LITERATURE RECOMMENDED:

1. Byrne, J. and Rich, D. (Eds.). (2021). Energy and environment: The policy challenge. Routledge.
2. Elliott, D. (2004). Energy, society and environment. Routledge.
3. Hinrichs, R. A. and Kleinbach, M. H. (2012). Energy: Its use and the environment. Cengage Learning.
4. Goldemberg, J. and Lucon, O. (2010). Energy, environment and development. Earthscan.
5. Kaltschmitt, M.; Streicher, W. and Wiese, A. (Eds.). (2007). Renewable energy: technology, economics and environment. Springer Science & Business Media.
6. Foster, R.; Ghassemi, M. and Cota, A. (2009). Solar energy: renewable energy and the environment. CRC press.
7. Nelson, V. (2009). Wind energy: renewable energy and the environment. CRC press.
8. Wilson, R. (2012). Energy, ecology, and the environment. Elsevier.
9. Michaelides, E. E. S. (2012). Alternative energy sources. Springer Science & Business Media.
10. Schlager, N. and Weisblatt, J. (2006). Alternative energy. Thomson Gale.
11. Farret, F. A. and Simoes, M. G. (2006). Integration of alternative sources of energy. John Wiley & Sons.
12. Efstathios, E. (2012). Alternative energy sources. Springer.
13. Kruger, P. (2006). Alternative energy resources: the quest for sustainable energy. Hoboken: Wiley.
14. Hodge, B. K. (2017). Alternative energy systems and applications. John Wiley & Sons.

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	20	After 30 days on completion of 25% of syllabus
Minor II	20	After 60 days on completion of 50% of syllabus
Major End of Semester	60	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	100	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/Short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of 5 marks each. Each Minor Test would be of 1 hour duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 15 questions (objective/short answer type) of one mark each. Section B will consist of three questions with internal choice (Long answer type) of 15 marks each. Major Test would be of 2½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-IV]

Examinations to be held in May 2023, May 2024 and May 2025

Course No.: PSESTE406

Title: Atmospheric Processes

Credits: 2

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

Objectives:

This course has been designed to provide students a broad and up-to-date account of our understanding of the processes that occur in the atmosphere, how these are changing as Man's relentless use of natural resources continues and what effects these changes are having on the Earth's climate and the quality of the air we breathe.

UNIT-1: ATMOSPHERIC THERMODYNAMICS

- 1.1 Gas Laws: Virtual Temperature
- 1.2 The Hydrostatic Equation: Geopotential, Scale Height and the Hypsometric Equation
- 1.3 The First Law of Thermodynamics: Joule's Law, Specific Heats, Enthalpy
- 1.4 Adiabatic Processes: Concept of an Air Parcel, Lapse Rate, Potential Temperature. Water Vapor in Air: Moisture Parameters, Latent Heats, The Saturated Adiabatic Lapse Rate, Normand's Rule
- 1.5 Static Stability: Unsaturated Air, Saturated Air, Conditional and Convective Instability

UNIT-2: ATMOSPHERIC RADIATIVE TRANSFER

- 2.1 Blackbody Radiation: The Planck Function, Wien's Displacement Law, The Stefan-Boltzmann Law, Kirchhoff's Law, The Greenhouse Effect
- 2.2 Scattering and Absorption and Emission: Scattering by Air Molecules and Particles, Absorption by Particles, Absorption and Emission by Gas Molecules
- 2.3 Radiative Transfer in Planetary Atmospheres: Beer's Law, Reflection and Absorption by a Layer of the Atmosphere.
- 2.4 Absorption and Emission of Infrared Radiation in Cloud-Free Air
- 2.5 Radiation Balance at the Top of the Atmosphere

UNIT-3: ATMOSPHERIC DYNAMICS

- 3.1 Dynamics of Horizontal Flow: Apparent Forces, Real Forces
- 3.2 The Geostrophic Wind, The Effect of Friction, The Gradient Wind, The Thermal Wind
- 3.3 The Atmospheric General Circulation. Atmosphere as a Heat Engine
- 3.4 Cloud Formation: Condensation Nuclei, Growth of Cloud Drops and Ice-Crystals, Cloud Classification
- 3.5 Precipitation mechanisms: artificial precipitation, hail suppression, fog and cloud – dissipation

LITERATURE RECOMMENDED:

1. Chandrasekar, A. (2010). Basics of atmospheric science. PHI Learning Pvt. Ltd.
2. Wallace, J. M. and Hobbs, P. V. (2006). Atmospheric science: an introductory survey. (Vol. 92). Elsevier.

M.Sc. Environmental Sciences (CBCS)

[Semester-IV]

Examinations to be held in May 2023, May 2024 and May 2025

Course No.: PSESTE406

Title: Atmospheric Processes

Credits: 2

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

3. Frederick, J. E. (2011). Principles of atmospheric science. Jones & Bartlett Publishers.
4. Seinfeld, J. H. and Pandis, S. N. (2016). Atmospheric chemistry and physics: from air pollution to climate change. John Wiley & Sons.
5. Hewitt, C. N. and Jackson, A. V. (2009). Atmospheric science for environmental scientists. John Wiley & Sons.

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	10	After 30 days on completion of 25% of syllabus
Minor II	10	After 60 days on completion of 50% of syllabus
Major End of Semester	30	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	50	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 5 questions (objective/short answer type) of one mark each. Section B will consist of one question with internal choice (Long answer type) of five marks. Each Minor Test would be of 45 minutes duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of ten marks each. Major Test would be of 1½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-IV]

Examinations to be held in May 2023, May 2024 and May 2025

Course No.: PSESTE407

Title: Energy and Environment

Credits: 2

Duration of Examination: 1½ 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 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 in India. Trends in energy use of oil, coal and gas
- 1.5 Environmental consequences and energy use.

UNIT-2: ENERGY AND CLIMATE

- 2.1 Energy and carbon emissions, Environmental problems associated with fossil fuels
- 2.2 Global climate change: Greenhouse effect, greenhouse gases: sources, trends, radiative forcing, warming potential of gases
- 2.3 Impacts of global warming: Polar ice caps and melting of glaciers, sea level increase, weather extreme, ecosystems, human health, coral reef bleaching, surface ocean chemistry, biogenic calcification in oceans.
- 2.4 Climate Impacts on Society (Displacement and migration, Human settlement and Health)
- 2.5 Adaptation and mitigation towards climate crisis: Concept and Strategies.

UNIT-3: ALTERNATIVE RESOURCES AND GREEN TECHNOLOGIES

- 3.1 Solar energy - collection and storage - present scenario in India, Indirect and direct solar energy conversion
- 3.2 Wind energy and management, Wind energy: Conversion to wind flow, wind energy converters, commercial wind power development, wind energy storage and transfer
- 3.3 Nuclear energy and environment, Energy production, Fission and fusion
- 3.4 Tidal energy and management, Geothermal energy, Bio-gas plants and energy management
- 3.5 Geoengineering and green technologies.

M.Sc. Environmental Sciences (CBCS)

[Semester-IV]

Examinations to be held in May 2023, May 2024 and May 2025

Course No.: PSESTE407

Title: Energy and Environment

Credits: 2

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

LITERATURE RECOMMENDED:

1. Byrne, J. and Rich, D. (Eds.). (2021). Energy and environment: The policy challenge. Routledge.
2. Elliott, D. (2004). Energy, society and environment. Routledge.
3. Hinrichs, R. A. and Kleinbach, M. H. (2012). Energy: Its use and the environment. Cengage Learning.
4. Goldemberg, J. and Lucon, O. (2010). Energy, environment and development. Earthscan.
5. Kaltschmitt, M.; Streicher, W. and Wiese, A. (Eds.). (2007). Renewable energy: technology, economics and environment. Springer Science & Business Media.
6. Foster, R.; Ghassemi, M. and Cota, A. (2009). Solar energy: renewable energy and the environment. CRC press.
7. Nelson, V. (2009). Wind energy: renewable energy and the environment. CRC press.
8. Wilson, R. (2012). Energy, ecology and the environment. Elsevier.
9. Michaelides, E. E. S. (2012). Alternative energy sources. Springer Science & Business Media.
10. Schlager, N. and Weisblatt, J. (2006). Alternative energy. Thomson Gale.
11. Farret, F. A. and Simoes, M. G. (2006). Integration of alternative sources of energy. John Wiley & Sons.
12. Efstathios, E. (2012). Alternative energy sources. Springer.
13. Kruger, P. (2006). Alternative energy resources: the quest for sustainable energy. Hoboken: Wiley.
14. Hodge, B. K. (2017). Alternative energy systems and applications. John Wiley & Sons.

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	10	After 30 days on completion of 25% of syllabus
Minor II	10	After 60 days on completion of 50% of syllabus
Major End of Semester	30	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	50	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 5 questions (objective/short answer type) of one mark each. Section B will consist of one question with internal choice (Long answer type) of five marks. Each Minor Test would be of 45 minutes duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of ten marks each. Major Test would be of 1½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-IV]

Examinations to be held in May 2023, May 2024 and May 2025

Course No.: PSESTE408

Title: Disaster Management

Credits: 4

Duration of Examination: 2½ hrs

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

Objectives:

Disasters are all pervading phenomena in human affairs. These disasters strike sudden, unexpected and are widespread. Environmental degradation which is often a result of economic development and associated human settlement patterns that ignore appropriate resource management can increase a country's vulnerability to natural hazards and aggravate the impacts. This course is designed to familiarize the students with various concepts of disasters and their management which include causes and effects of disaster, types, predictability, preparedness, nature of damage caused and also disaster mitigation, pre-and post-disaster management. The course will upgrade the information, knowledge and skill of the students which in turn will enable them to act with confidence in pre-and post-disaster situations.

UNIT-1: DISASTER INTRODUCTION AND MAN-MADE DISASTERS - I

- 1.1 Disasters: Meaning, difference between disaster and hazard, causal factors
- 1.2. Disaster management cycle
- 1.3 Man-Made Disasters, types, nature of man-made disasters, general effects, concerns for manmade disasters
- 1.4 Biological disasters: meaning, types, vulnerability, effects, preparedness and mitigation
- 1.5 Chemical Disasters: Causes and impacts, chemical disaster management, mitigation, preparedness and response

UNIT-2: MAN-MADE DISASTERS - II

- 2.1 Nuclear disaster: causes, effects, management
- 2.2 Fires I: Characteristics of fires; Building, coal and chemical fires; causes, safety and prevention, safety norms and disaster management
- 2.3 Fires II: Forest fires, their types, causes, impacts, mitigation and control
- 2.4 Desertification: Causes, general characteristics and effects and mitigation measures
- 2.5 Transportation Accidents: types, causes, impacts and disaster management

UNIT-3: NATURAL DISASTERS - I

- 3.1 Natural disasters: introduction, meaning and nature, types of natural disasters, general effects
- 3.2 Earthquake: General characteristics, vulnerability, causes, impacts related to earthquakes, prediction, warning and mitigation measures
- 3.3 Volcanic eruptions: Nature and causes, volcanic hazard monitoring, mitigation
- 3.4 Landslides: General characteristics, Causes, vulnerability, effects, prediction and warning, risk reduction mitigation measures
- 3.5 Snow Avalanches: Avalanches formation and classification, hazard mitigation and management

M.Sc. Environmental Sciences (CBCS)

[Semester-IV]

Examinations to be held in May 2023, May 2024 and May 2025

Course No.: PSESTE 408

Title: Disaster Management

Credits: 4

Duration of Examination: 2½ hrs

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

UNIT-4: NATURAL DISASTERS - II

- 4.1 Cyclone: Formation, General characteristics, vulnerability, effects, Forecasting and warning, mitigation measures
- 4.2 Floods: General characteristics, vulnerability Causes and impacts, forecasts and warning, Flood Plain zonation, mitigation measures
- 4.3 Drought: Meaning, types, General characteristics, Causes and impacts, vulnerability, prediction and warning and mitigation measures
- 4.4 Heat and Cold Waves: introduction, causes and impacts, prevention and preparedness, Response
- 4.5 Tsunami: General characteristics, causes, impacts and mitigation

UNIT-5: DISASTER MITIGATION AND MANAGEMENT

- 5.1 Disaster Response: Disaster response plans, Search, Rescue and evacuation, Community Health and Casualty, Management and damage assessment
- 5.2. Risk and Vulnerability assessment: Risk, Vulnerability, their concepts, elements at risk, Risk analysis techniques, vulnerability identification and factors associated with vulnerability
- 5.3 Disaster preparedness: Concept and nature, Disaster preparedness plans, Role of Information, education, communication and awareness
- 5.4 Disaster mitigation: Concept, principles, mitigation approaches and strategies
- 5.5 Recovery: Rehabilitation, its social and economic aspects, Housing to resist disasters, relocation, retrofitting, repairing and strengthening of houses

LITERATURE RECOMMENDED:

- 1. Bryant, E. A. (1991). Natural Hazards. Cambridge University Press, Cambridge, New York.
- 2. Carter, W. N. (1992). Disaster Management: A Disaster manager's handbook. ADB Publication, Manila.
- 3. Cuny, F. (1983). Disasters and Development, Oxford University Press, England.
- 4. Cutter, S. L. (1999). Environmental Risks and Hazards. Prentice Hall of India Pvt. Ltd., New Delhi
- 5. Green, S. (1980). International Disaster Relief towards a Responsive system. McGraw Hill Book Co., New York.
- 6. Gupta, H. (2003). Disaster Management. University Press, Hyderabad.
- 7. Prakash, I. (1995). Disaster Management. Rashtra Prahari Prakashan, Ghaziabad.
- 8. Sahini, P. and Ariabandu, M. N. (2003). Disaster Risk Reduction in South Asia. Prentice Hall of India. Pvt. Ltd., New Delhi.
- 9. Sahni, P. and Malalgoda, M. (2003). Disaster Risk Reduction in South Asia. Prentice-Hall of India, New Delhi.

M.Sc. Environmental Sciences (CBCS)

[Semester-IV]

Examinations to be held in May 2023, May 2024 and May 2025

Course No.: PSESTE408

Title: Disaster Management

Credits: 4

Duration of Examination: 2½ hrs

Maximum Marks : 100

a) Minor Test-I : 20 Marks

b) Minor Test-II : 20 Marks

c) Major Test : 60 Marks

10. Sinha, P. C. (1998). Encyclopedia of Disaster Management series. Anmol Pub., New Delhi.
11. Smith, K. (1996). Environmental Hazards, Assessing risk and Reducing disaster, London.

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	20	After 30 days on completion of 25% of syllabus
Minor II	20	After 60 days on completion of 50% of syllabus
Major End of Semester	60	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	100	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/Short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of 5 marks each. Each Minor Test would be of 1 hour duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 15 questions (objective/short answer type) of one mark each. Section B will consist of three questions with internal choice (Long answer type) of 15 marks each. Major Test would be of 2½ hrs duration and carry 60% weightage of the total marks.

M.Sc. Environmental Sciences (CBCS)

[Semester-IV]

Examinations to be held in May 2023, May 2024 and May 2025

Course No.: PSESTE409 (New Course)

Title: Environmental Health

Credits: 2

Hazards & Sanitation

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

Objectives:

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

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
- 1.5 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)
- 2.4 Occupations diseases with particular reference to occupational cancers
- 2.5 Prevention of occupational hazards

UNIT-3: COMMUNICABLE DISEASES

- 3.1 Water-borne infections I: Etiology, Pathogenesis and remedial measures of Diarrhoea and Dysentery
- 3.2 Water-borne infections II: Etiology, Pathogenesis and remedial measures of Cholera and Typhoid
- 3.3 Air borne infections: Etiology, Pathogenesis and remedial measures of Tuberculosis and Influenza
- 3.4 Nosocomial infections and their control
- 3.5 General account, classification and control of zoonotic infections.

LITERATURE RECOMMENDED:

1. Alcamo, I. E. (1994). Fundamentals of Microbiology. The Benjamin / Cummings Pub. Co., USA.
2. Kumar, R. (1987). Environmental Pollution and Health Hazards in India. Ashish Pub. House, New Delhi.
3. Park, K. (2021). Textbook of preventive and social medicine. M/s Banarsi Das Bhanot, Jabalpur. (26thEd.).

M.Sc. Environmental Sciences (CBCS)

[Semester-IV]

Examinations to be held in May 2023, May 2024 and May 2025

Course No.: PSESTE409 (New Course)

Title: Environmental Health

Credits: 2

Hazards & Sanitation

Duration of Examination: 1½ hrs

Maximum Marks : 50

a) Minor Test-I : 10 Marks

b) Minor Test-II : 10 Marks

c) Major Test : 30 Marks

4. Prescott, L. M.; Harley, J. P. and Klein, D. A. (1993). Microbiology. WCB Pub., USA.
5. Shukla, S. K. and Srivastava, P. R. (1992). Characterization of Health hazards in man and Environment. Commonwealth Pub., New Delhi.
6. Shukla, S. K. and Srivastava, P. R. (1992). Environmental Pollution and chronic diseases. Commonwealth Pub., New Delhi.
7. Tortora, G. J.; Funke, B. R. and Case, C. L. (1995). Microbiology - An Introduction. The Benjamin / Cummings Pub. Co., USA.
8. Upton, A. C. and Graber, E. (1993). Staying Healthy in a risky Environment. Simon and Schuster Pub., USA.

SCHEME OF EXAMINATIONS

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

Component	Marks	Remarks
Minor I	10	After 30 days on completion of 25% of syllabus
Minor II	10	After 60 days on completion of 50% of syllabus
Major End of Semester	30	On completion of syllabus (51%-100%) (Question Paper would cover 20% of the syllabus covered in Minor I and Minor II and 80% of syllabus not covered in Minors)
Total	50	

NOTE FOR PAPER SETTING:

Minor Examinations: Question paper will have two sections A and B. Section-A is compulsory and will consist of 5 questions (objective/short answer type) of one mark each. Section B will consist of one question with internal choice (Long answer type) of five marks. Each Minor Test would be of 45 minutes duration and carry 20% weightage of the total marks.

Major Examination: Question paper will have two sections A and B. Section-A is compulsory and will consist of 10 questions (objective/short answer type) of one mark each. Section B will consist of two questions with internal choice (Long answer type) of ten marks each. Major Test would be of 1½ hrs duration and carry 60% weightage of the total marks.