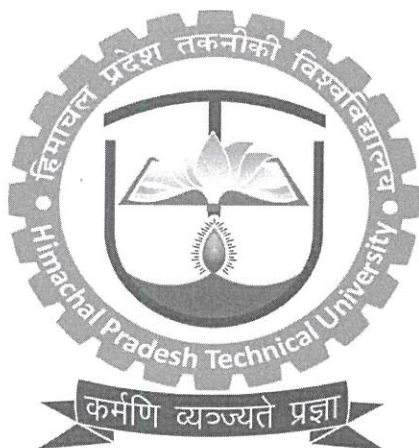


**HIMACHAL PRADESH TECHNICAL UNIVERSITY  
HAMIRPUR**



**Syllabus**

*for*

**M. Sc. (Environmental Sciences)**

*(Two years program spread over four semesters)*

As per National Education Policy (NEP)-2020

(w.e.f. the Academic Year 2023-2024)

  
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M.Sc. Environmental Sciences program is named as Master of Science in Environmental Sciences (M.Sc. Environmental Sciences). The syllabus for this program is framed under National Education Policy-2020 (NEP-2020) with core, elective (discipline specific, skill enhancement and value addition course) and other interdisciplinary courses incorporated as its components following the University Grants Commission (UGC) guidelines. Department of Environmental Sciences also made an attempt to revise the curriculum of M.Sc. Environmental Sciences in alignment with National Education Policy-2020 and UGC Quality Mandate for Higher Education Institutions-2021. With NEP-2020 in background, the revised curricula articulate the spirit of the policy by emphasizing on integrated approach to learning; innovative pedagogies and assessment strategies; multidisciplinary and cross-disciplinary education; creative and critical thinking; ethical and constitutional values through value-based courses. The NEP-2020 also enables the students to select subjects as per their interest. Also, diverse lab experiments as well as field visits/demonstrations allow students to understand the fundamental aspects of the subject. This program is relevant to young students/ professionals who are looking to develop their analytical and research skills regarding important issues in environment. Furthermore, continuous assessment is an integral part of the NEP-2020, which will facilitate systematic and thorough learning towards better understanding of the subject.

Environmental education is concerned with those aspects of human behaviour which are more directly related to man's interaction with bio-physical environment and his ability to understand this interaction. The students will apply the interdisciplinary principles of environmental science. They will apply an understanding of environmental concepts from ecology, chemistry, geology, and physics to real-world problems and analyze the complex interactions within and between environmental systems. Whole course is dedicated for skill development in the fields of biodiversity management, environmental impact assessment, environmental management, life cycle assessment, environmental audits, climate change and mitigation, pollution management and industrial safety etc. Programme has been designed not only to make students, job ready but also dedicated to create an entrepreneurship skills and competency amongst them through the process of innovation. This is accomplished through the following program objectives:

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- To help students to build-up a progressive and successful career in the field of Environmental Sciences.

### 3. Program Learning Outcomes (PLOs)

After completion of the program, the students have acquired fundamental knowledge of different aspects of environment in local, regional and global environmental problems as follows:

- Knowledge about the natural resources, their status, importance and need for conservation.
- Understand different natural and manmade disasters; explore the reason of its origin and the possible antidotes so that it can dwindle to some extent.
- Implement environmentally sound strategies in this concern.
- Knowledge of biodiversity, forest and wildlife ecology for their conservation and management.
- Enhancement of creative and critical thinking, aesthetic sensibility, and analytical skills.
- Understanding of the chemical processes that governs the natural and disturbed environments.
- Waste management practices for the betterment of environment and well beings.
- Understanding of the emerging regional and global environmental issues and their mitigations.
- Understanding the Environmental Impact Assessment and its methodologies for Industries and Regulators.
- Fundamental knowledge of instrumental methods employed in analysis of environmental samples.
- Understandings of natural disasters and their management approaches
- Knowledge of environmental laws, acts, and standard for environmental compliance
- Apply knowledge about existing global frameworks and existing agreements and role of community in successful Disaster Risk Reduction.
- Evaluate Disaster Management study including data search, analysis and presentation as a case study.
- Understanding of environmental biotechnology and its applications in environmental issues and other biotechnology applications.

### 4. Curriculum Structure

M.Sc. Environmental Sciences degree program will have a curriculum with Syllabi consisting of following type of courses:

- **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
- **Discipline Specific Elective (DSE) Course:** Elective courses may be offered by the main discipline/subject of the study is referred to as Discipline Specific Elective.
- **Value addition, Skill Enhancement & Inter Departmental Elective Course:** Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/interdepartmental subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures

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the candidate's values/proficiency/skill is called an Elective Course. These courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills and to improve the employability skills of students.

## 5. SCHEME OF EXAMINATION

The pass percentage in each subject will be 40%.

- **Theory Examination**

Irrespective of credits, each paper will be of 100 marks (60 marks for theory exam and 40 marks for internal assessment) and the duration of paper will be 3 hours.

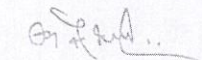
- **Practical Examination**

Each paper will be of 100 marks (60 marks for external practical exam and 40 marks for internal assessment) and the duration of paper will be 3 hours.

- **Project Report / Dissertation**

The project / Dissertation will be evaluated by the internal panel approved by Principal cum Director of the college and external examiner from the panel approved by the university authority/evaluation branch, HPTU, Hamirpur. The Head of the Department will assign a guide/supervisor, to each candidate for his/her project /Dissertation work. The candidate shall be required to maintain his/her project diary (logbook) of work in the organization or under the Guide. Each student will be required to give at least two seminars on his/her project work/ Dissertation work. Each student is required to submit three copies of his/her project reports in the Department after completion of the project work which will be evaluated by external examiner. Most of the students are expected to work on a real-life project / Research preferably in some industry/ Research and Development Laboratories/Educational Institution/Software Company. The student can formulate a project problem / Research problem with the help of her/his Guide and submit the project proposal / Research proposal of the same in the college within 10 days at the starting of Major Project. Approval of the project proposal is mandatory which will be evaluated by internal examiner appointed by respective college Principal or Director or university. If approved, the student can commence working on it and complete it by using the latest versions of the software packages / Research Tools for the development of the project / Dissertation.

- **Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

  
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The question paper for the end semester examination may have any one of the following patterns:

**Section A (UNIT I)**

Two questions of long answer type of which one is to be attempted for 12 Marks.

**Section B (UNIT II)**

Two questions of long answer type of which one is to be attempted for 12 Marks.

**Section C (UNIT III)**

Two questions of long answer type of which one is to be attempted for 12 Marks.

**Section D (UNIT IV)**

Two questions of long answer type of which one is to be attempted for 12 Marks.

**Section E (Compulsory)**

6 to 8 short answer type questions for 2 to 1.5 marks each and total for 12 Marks.

**Total marks (A + B + C + D+ E) 12+ 12 + 12 +12+12) = 60 Marks**

  
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## End Semester Examination (ESE)

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

### Template for End Semester Examination (4,3,2 credits)

Roll No:.....

Total Pages.....

Month-Year (June-2023)

M.Sc. Environmental Sciences Examination

Course Code

Title

Semester-X

Time: 3 Hours

Max. Marks: 60

**Note:** Attempt five questions in all by selecting one question from each section A, B, C and D. Section-E is compulsory.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

#### SECTION – A

(1x12 or 8,4 or 6,6)

- 1.
- 2.

#### SECTION – B

(1x12 or 8,4 or 6,6)

- 3.
- 4.

#### SECTION – C

(1x12 or 8,4 or 6,6)

- 5.
- 6.

#### SECTION – D

(1x12 or 8,4 or 6,6)

- 7.
- 8.

#### SECTION – E (Compulsory)

(6×2=12)

- 9.
- (a-f)

  
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### Periodical Examination (PE)

During one semester, there will be two Periodical Examination-I and Periodical Examination-II (PE-I & PE-II) for theory and only one Periodical Examination for practical subjects. The question paper will consist of three sections A, B and C having total 20 marks. Section A will be compulsory and will have short answer type questions consisting of five parts, each of one mark covering the syllabus mentioned. Sections B and C will contain descriptive type questions of five and ten marks respectively. Sections B and C will have two questions and the candidates will attempt three questions in all, i.e. one question each from the sections B and C. Section-A is compulsory.

#### Template for Periodical Examination (4,3,2 credits)

<b>Roll No:.....</b>	<b>Total Pages.....</b>
<b>Month-Year (June-2023)</b>	
<b>M.Sc. Environment Examination</b>	
<b>Code</b>	
<b>Title</b>	
<b>Semester-X</b>	
<b>Time: 1.5 Hours</b>	<b>Max. Marks: 20</b>
<b>Note:</b> Attempt three questions in all by selecting one question from each section B and C. Section-A is compulsory.	
<b>SECTION – A (Compulsory)</b>	
(8x1=8)	
1. (a-e)	
<b>SECTION – B</b>	
(6)	
2.	
3.	
<b>SECTION – C</b>	
(6)	
4.	
5.	

### 6. Proposed Subject Code System

Each subject code is denoted by alpha-numerals, alphabets before hyphen indicates course name and four numerals after hyphen indicates level, semester, and subject number respectively.

For Example: **ENV-6101**

First three alphabets –ENV is degree indicator.

First number –6 defines the Level. 6 for level 6 subjects and 7 for level 7 subjects.

Second number –1 defines the semester.

Third and fourth numbers –01 defines the subject number.

  
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## 7. Assessment & Evaluation

### Internal Assessment (IA for Theory)

- **Periodical Examination-I (PE-I)** = Weightage of 10 Marks for all courses.
- **Periodical Examination-II (PE-II)** = Weightage of 10 Marks for all courses.

Both the periodical examinations are mandatory. If, in any case, the student is not able to appear in any of the above examinations, then the option of Make-up Examination will be given to the student. For that, he/she has to report before that examination to the concerned teacher/head of the department. Within 3 days, he/she has to submit the documents related to the cause and finally get permission from the concerned Authority. After getting the permission, the student must appear in the examination within 10 days with the weightage of 80% only. For example, if the student scoring 15 marks with the weightage of 100%, then he/she will be given 12 marks (80% weightage).

- **Teacher's Assessment (Assignment/Quizzes/Seminars/overall behaviour)** = 15 Marks
- **Attendance** = 05 Marks

Sr. No.	Percentage of Lecture Attended	Marks Awarded
1	From 75% to 80%	01
2	Above 80% to 85%	02
3	Above 85% to 90%	03
4	Above 90% to 95%	04
5	Above 95%	05

**Total (IA)** = 10 + 10 + 15 + 05 = 40 for all courses.

- **End Semester Examination (ESE)** = 60 for all courses.  
**Total** = 10 + 10 + 15 + 05 + 60 = 100 for all courses.

### Internal Assessment (IA for Practical)

- Periodical Examination (PE, conducted only one in a semester) (including performance & Internal Viva-Voce) = 20
- Teacher's Assessment (File Work & Lab performance + Attendance) = 15 + 05  
**Total IA for Practical** = 20 + 20 = 40

### External Assessment (EA for Practical)

- End-Semester Examination (ESE) (written script, performance, External viva-voce etc.) = 60

**Total EA for Practical** = 60

**Total IA & EA for Practical** = 40 + 60 = 100

**Research Project/Seminar Assessment/Institutional Training/Internship/Survey/ SWAYAM/MOOC /NPTEL etc. courses**

### For Internal Assessment

- Attendance in Presentation and interaction during the work plan/framework: 10 Marks
- Knowledge/work done of Subject along with Q/A handling during course work: 10 Marks
- Presentation about the outcomes of the study during research: 20 Marks  
**Total** = 10 + 10 + 20 = 40

### For External Assessment

- Overall Project Presentation about the work done/results & viva-voce (In presence of External as well as Internal examiners): 60 Marks.

  
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**Template for- IA-Internal Assessment (Theory)**  
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**Department of Environmental Sciences, School of Environmental Sciences**  
**AWARD SHEET THEORY (INTERNAL ASSESSMENT)**

Name of the Institution:			Distribution of Marks				Total Marks
Programme:			Periodical Examinations		Teacher Assessment (Assignment discussion/ presentation/Quizzes/ Overall behavior)	Attendance	
Subject:	Sub. Code:		1 <sup>st</sup> Periodical Examination	2 <sup>nd</sup> Periodical Examination			
Branch:	Semester:						
MAX. MARKS: MIN. MARKS:							
Sr. No.	University Roll No.	Name of Student	10	10	15	05	40

Name of Internal Examiner  
 Signature.....  
 Date.....

Head of Dept  
 Signature.....  
 Date.....

Head of the Institution  
 Signature .....  
 Date.....

**Template for-IA-Internal Assessment (Practical/Project/Seminar/Viva-Voce)**  
**HIMACHAL PRADESH TECHNICAL UNIVERSITY**  
**Department of Environmental Sciences, School of Environmental Sciences**  
**AWARD SHEET THEORY (Practical/Project/Seminar/Viva-Voce)**  
**(INTERNAL ASSESSMENT)**


Name of the Institution:			Distribution of Marks				Total Marks
Programme:			Periodical Examination		Teachers Assessment (Lab/Work performance/ Report/File work)	Attendance	
Subject:	Sub. Code:		Written/Presentation	Viva-voce			
Branch:	Semester:						
MAX. MARKS: MIN. MARKS:							
Sr. No.	University Roll No.	Name of Student	10	10	15	05	40

Name of Internal Examiner  
 Signature.....  
 Date.....

Head of Dept.  
 Signature.....  
 Date.....

Head of the Institution  
 Signature .....  
 Date.....

*\*Note: The distribution of marks for Institutional training, Internship, Survey, SWAYAM, MOOCs, NPTEL courses (if any) would be same as above.*

  
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**Template for-External Examination  
(Practical/Project/Seminar/Viva-Voce)**

**HIMACHAL PRADESH TECHNICAL UNIVERSITY**  
Department of Environmental Sciences, School of Environmental Sciences  
**(Practical/Project/Seminar/Viva-Voce)**

Name of the Institute: .....				
Programme: .....				
Subject Name:..... Subject Code:.....				
Branch: ..... Semester .....				
Max Marks ..... Min. Marks:.....				
Sr. No.	University Roll No.	Name of Student	Marks in Figure	Marks in Words
Name of Internal Examiner: .....			External Examiner.....	
Signature.....			Signature.....	
Date.....			Date.....	

*\*Note: The distribution of marks would be on the basis of Work done/Task performance (20 marks), Performance (written/presentation) (20 marks) and viva-voce (20 marks), total=60 marks.*

**Guidelines for the Preparation of Report**

- The purpose of the research project in M.Sc. Environmental Sciences (of 2 or 4 credits) is to introduce basic research methodologies to the students. It may consist of review of some research papers, development of a laboratory experiment, field survey, working out Environmental Issues, participation in some on-going research activity, analysis of data, etc. The work can be carried out in any thrust areas of Environmental Sciences under the guidance of faculty members of the department. A small project report or review article submission of any one topic related to the concerned branch of interest will be submitted as per the instructions.
- The students must submit their project work/seminar report in the Department as per the date announced for the submission. Internal assessment of the project work/seminar will be carried out by respective faculty members assigned to them as mentor/supervisor as per evaluation scheme. External assessment of the project work will be carried out by an external examiner (nominated by the Head/Chairperson of the Department) as per evaluation scheme.
- The project report/seminar report will contain a cover page, certificate signed by student and supervisor, table of contents, introduction, methodology, result and discussion conclusion and references etc. The paper size to be used should be A-4 size. The font size should be 12 with Times New Roman Font. The text of the report may be typed in 1.5 (one and a half) space. The print out of the report shall be done on both sides of the paper (instead of single side printing).



- The candidate shall be required to submit two soft bound copies of the report in the department as per the date announced. Report will be evaluated internally by the supervisor allotted to the student during the semester and the candidate will present his/her work through presentation/viva before the External examiner at the end of semester and will be awarded marks. The candidate is required to submit the final copy of the report in hard bound within two weeks after the viva -voce/presentation as discussed in the presence of internal as well as external examiners.

*For each research project and seminar, each lecture/contact hour per week will be considered as one credit. The duration of written and viva voce examination shall be decided by the internal and external examiners*

- For Seminar/ Institutional Training/ Research Project/ Summer Internship /Survey /SWAYAM /MOOC /NPTEL courses (of 02 or 04 credits), the list of topics will be provided by the Department/University. The students will pick the option, get registered and prepare the report. The evaluation will be done on the basis of presentation/solving assignments.
- Guidelines for the online courses from SWAYAM/MOOC/NPTEL etc. may be taken after the registration through online portal/concerned Department. Each student has to register for online course after the permission/approval from concerned Department/University and has to pass the selected online course within the duration of running semester.
- The students have to complete their Seminar/Industrial Training/Research Project/Summer Internship/Survey/SWAYAM/MOOC/NPTEL under the guidance of the supervisor (taken from the same Department) allotted by Head/Coordinator of the concerned Department. For these courses, the students will prepare presentation. The students may be given option to complete above tasks by choosing co-supervisor from the same Department/University or from any other institutions.
- Value added and Interdepartmental courses offered by the Department for the students of M.Sc. Environmental Sciences may also be taken by the students of other Departments. The students of the Environmental Science Department may also offer such kinds of courses from the other Departments only after the permission of Head/Coordinator of the Department.
- The Department may offer more than one optional/elective courses depending upon the specialization and strength of the faculty members. The final decision will be taken by the Head/Coordinator of the Department.

  
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### 8. Overall General Instructions

- There will be theory papers of 100 (60 % ESE & 40 % IA) marks for all courses of each semester.
- For the 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> semester, there will be 22, 22, 24 and 22 credits. Total marks for the subjects in all the semesters will be 2800 and total credits will be 90.
- Each lecture hour per week will be considered as one credit and two practical hours as one credit.
- For each theory course of 04 credits, there will be 4 lecture hours of teaching per week and for each

- For each practical course of 04 credits, there will be 8 lecture hours of teaching per week.
- Duration of end semester theory examination shall be 3 hours for all courses. Duration for the practical examination shall be 3 hours.
- In each semester, the students are required to perform at least seven experiments for the 04 credits course and five experiments for the 02 credits course.
- For Seminar, Institutional Training, Research Project, Summer Internship, Survey, SWAYAM, MOOC, NPTEL; the internal and external assessment shall be same as that of theory courses i.e. 100 (60 % ESE & 40 % IA) marks for all courses.
- The distribution of internal & external assessment for Project work/Seminar will be same as that of Core course/DSE. Supervisor/Examiner will distribute the marks on the basis of presentations, interaction during the course work, collection resource material, literature survey, setting up of the experiment (if any), theoretical framework, written work of project/Seminar report and viva as well.
- Teaching hours for each 04-credit theory course will be minimum 60 hours and of 02 credit theory course will be minimum 30 hours.
- For Research project, Seminar/SWAYAM/MOOC/NPTEL/Industrial Internship/Survey, the time frame for the duration of classes, examination, format for writing the report and evaluation system will be decided by the Department/University itself or organizing/host/collaborative institutions and the work load will be counted as the theory paper teaching load of the teacher.
- For the attendance from 75% to 80%, 1 mark; above 80% to 85%, 2 marks; above 85% to 90%, 03 marks; above 90% to 95%, 04 marks and above 95%, 5 marks will be awarded.
- Students having the attendance below 75% in each course will not be allowed to appear in the final examination.
- Duration: One year divided into two semesters.
- Medium of instruction: English.
- Passing Standard: As mentioned in the Ordinance.

  
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**SUBJECT COMBINATIONS ALLOWED FOR M.Sc. Environmental Sciences PROGRAM  
THE DETAILS OF CREDIT DISTRIBUTION**

**School:** School of Environmental Sciences

**Program:** Master of Science in Environmental Sciences (M.Sc. Environmental Sciences)

Core Courses (CC) (17 Theory & 03 Practical's)		Discipline Specific Elective Courses (DSE)				Value Added, Skill Enhancement Elective Courses and Minor Elective Courses Seminar/Industrial Training/Summer Internship/Survey/SWA YAM/MOOC/NPTEL			Inter Departmental (ID)			Research Project (RP)-Minor/Major (01 Minor & 01 Major)			
11 Papers (Theory) of 04 credits each & 06 Papers (Theory) of 02 credits each Total = 17 Papers		02 Papers (Theory) of 04 credits each				03 Papers of 02 credits each			01 Paper (Theory) of 02 Credits						
Sem.		Pape rs	Credit	Sem.	Papers	Credit	Sem.	Papers	Credit	Sem.	Papers	Credit	Sem.	Papers	Credit
I		04	14	I	-	-	I	02	04	I	-	-	I	-	-
II		04	14	II	-	-	II	01	02	II	01	02	II	-	-
III		06	18	III	-	-	III	-	-	III	-	-	III	01	02
IV		03	10	IV	02	08	IV	-	-	IV	-	-	IV	01	04
03 Practical Labs of 04 credits each															
Sem.	Papers	Credit													
I	01	04													
II	01	04													
III	01	04													
IV	-	-													
Credits = 68		Credits = 08				Credits = 06			Credits = 02			Credits = 06			
Total Credits = 90									Total Marks = 2800						

  
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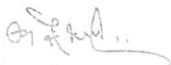
  
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**Scheme of Teaching and Examination**  
**Master of Environmental Sciences (M.Sc. Environmental Sciences)**

**Semester-I**

Subject Code	Course Category	Subject Title/ Subject Name	Periods			Credits	Evaluation Scheme				Total	
			L	T	P		ESE	Internal Assessment				
								PE-I &II	TA	A		Total
ENV-6101	CC	Introduction to Earth Processes	04	0	0	04	60	20	15	05	40	100
ENV-6102	CC	Environmental Chemistry	04	0	0	04	60	20	15	05	40	100
ENV-6103	CC	Ecology and Environment	04	0	0	04	60	20	15	05	40	100
ENV-6104	CC	Waste Management	02	0	0	02	60	20	15	05	40	100
ENV-6105	SEC	Choose any one: (i) Remote Sensing and Geographic Information System (ii) MOOC/NPTL/SWAY AM	02	0	0	02	60	20	15	05	40	100
UHV-6100	VAC	Universal Human Values and Professional Ethics	02	0	0	02	60	20	15	05	40	100
Lab Course												
ENV- 6106P	LAB-1	Environment Science Lab - I	0	0	08	04	60	20	15	05	40	100
Total			18	0	08	22	420	140	105	35	280	700

<b>Legends:</b>	<b>CC - Core Course</b>	<b>PE-Periodical Examination</b>
	<b>SEC - Skill Enhancement Course</b>	<b>ESE - End Semester Examination</b>
	<b>VAC - Value Addition Course</b>	<b>TA - Teacher's Assessment</b>
	<b>DSE - Discipline Specific Electives</b>	<b>A - Attendance</b>
	<b>ID - Inter Departmental Elective Course</b>	<b>L - Lecture</b>
	<b>T - Tutorial</b>	<b>P - Practical</b>

  
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Scheme of Teaching and Examination												
Master of Environmental Sciences (M.Sc. Environmental Sciences)												
Semester-II												
Subject Code	Course Category	Subject Title/ Subject Name	Periods			Credits	Evaluation Scheme					Total
			L	T	P		ESE	Internal Assessment				
								PE-I & II	TA	A	Total	
ENV-6201	CC	Atmospheric Science	04	0	0	04	60	20	15	05	40	100
ENV-6202	CC	Environmental Pollution & Engineering	04	0	0	04	60	20	15	05	40	100
ENV-6203	CC	Hydrology and Water Resources	04	0	0	04	60	20	15	05	40	100
ENV-6204	CC	Climate Change & Global Environmental Issues	02	0	0	02	60	20	15	05	40	100
IKS-6200	VAC	Indian Knowledge System	02	0	0	02	60	20	15	05	40	100
ENV ID-6201	ID		02	0	0	02	60	20	15	05	40	100
Lab Course												
ENV-6205P	LAB-II	Environment Science Lab - II	0	0	08	04	60	20	15	05	40	100
Total			18	0	08	22	420	140	105	35	280	700

<b>Legends:</b>	<b>CC - Core Course</b>	<b>PE-Periodical Examination</b>
	<b>SEC - Skill Enhancement Course</b>	<b>ESE - End Semester Examination</b>
	<b>VAC – Value Addition Course</b>	<b>TA - Teacher's Assessment</b>
	<b>DSE - Discipline Specific Electives</b>	<b>A – Attendance</b>
	<b>ID- Inter Departmental Elective Course</b>	<b>L – Lecture</b>
	<b>T – Tutorial</b>	<b>P – Practical</b>

**List of Inter Departmental Elective Courses (ID) offered by Department of Environmental Sciences:**

(Note: Only for the students of other Departments, e.g., the students of M.Sc. Environmental Sciences will not opt the Inter-Departmental Elective Course offered by the parent department)

Sr. No.	Subject Code	Course Category	Subject Title/ Subject Name	Name of the Faculty
1.	ENV ID-6201 (i)	ID	Basic Concept of Environment Science	
2.	ENV ID-6201 (ii)	ID	Culture and Environment	
3.	ENV ID-6201 (iii)	ID	General Science in daily Life	

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**Scheme of Teaching and Examination**  
**Master of Environmental Sciences (M.Sc. Environmental Sciences)**

**Semester-III**

Subject Code	Course Category	Subject Title/ Subject Name	Periods			Credits	Evaluation Scheme					Total
			L	T	P		ESE	Internal Assessment				
								PE-I & II	TA	A	Total	
ENV-7301	CC	Environmental Analytical Techniques	04	0	0	04	60	20	15	05	40	100
ENV-7302	CC	Natural hazards and disaster management	02	0	0	02	60	20	15	05	40	100
ENV-7303	CC	Toxic and Hazardous Waste Management	04	0	0	04	60	20	15	05	40	100
ENV-7304	CC	Environmental Impact & Risk Analysis	02	0	0	02	60	20	15	05	40	100
ENV-7305	CC	Natural Resource Conservation	02	0	0	02	60	20	15	05	40	100
ENV-7306	CC	Research methodology, Statistics and Computer Applications	04	0	0	04	60	20	15	05	40	100
ENV RP-7307	RP-I	Research Project-I/Seminar-I (Minor)	02 (Contact Hrs 02 per week group wise)			02	60	20	15	05	40	100
Lab Course												
ENV-7308P	LAB-III	Environment Science Lab - III	0	0	08	04	60	20	15	05	40	100
Total			20	0	08	24	480	160	120	40	320	800

<b>Legends:</b>	CC - Core Course	PE-Periodical Examination
	SEC - Skill Enhancement Course	ESE - End Semester Examination
	VAC - Value Addition Course	TA - Teacher's Assessment
	DSE - Discipline Specific Electives	A - Attendance
	ID - Inter Departmental Elective Course	L - Lecture
	P - Practical	T - Tutorial
	RP- Research Project	

  
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**Scheme of Teaching and Examination**  
**Master of Environmental Sciences (M.Sc. Environmental Sciences)**

**Semester-IV**

Subject Code	Course Category	Subject Title/ Subject Name	Periods			Credits	Evaluation Scheme					Total
			L	T	P		ESE	Internal Assessment				
								PE-I & II	TA	A	Total	
ENV-7401	CC	Meteorology and Climatology	04	0	0	04	60	20	15	05	40	100
ENV-7402	CC	Energy and Environment	04	0	0	04	60	20	15	05	40	100
ENV-7403	CC	Environmental Legislation	02	0	0	02	60	20	15	05	40	100
ENV-7404	DSE	Any one of the following: (i) Green Technology (ii)Toxicology and Occupational Safety	04	0	0	04	60	20	15	05	40	100
ENV-7405	DSE	Any one of the following: (i) Soil Biology (ii) Glaciology (iii) Occupational Hazards	04	0	0	04	60	20	15	05	40	100
ENV RP-7406	RP-II	Research Project-II/Seminar-II (Major)	04 (Contact Hrs 04 per week group wise)			04	60	20	15	05	40	100
Total			22	0	00	22	360	120	90	30	240	600

<b>Legends:</b>	<b>CC</b> - Core Course	<b>PE</b> -Periodical Examination
	<b>SEC</b> - Skill Enhancement Course	<b>ESE</b> - End Semester Examination
	<b>VAC</b> – Value Addition Course	<b>TA</b> - Teacher's Assessment
	<b>DSE</b> - Discipline Specific Electives	<b>A</b> – Attendance
	<b>ID</b> - Inter Departmental Elective Course	<b>L</b> – Lecture
	<b>P</b> – Practical	<b>T</b> – Tutorial
	<b>RP</b> - Research Project	

  
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**HIMACHAL PRADESH TECHNICAL UNIVERSITY  
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**Syllabus**

*for*

**M.Sc. Environmental Sciences**

**(Semester - I)**

*(Two years program spread over four semesters)*

As per National Education Policy (NEP)-2020


(w.e.f. the Academic Year 2023-2024)

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Scheme of Teaching and Examination												
Master of Environmental Sciences (M.Sc. Environmental Sciences)												
Semester-I												
Subject Code	Course Category	Subject Title/ Subject Name	Periods			Credits	Evaluation Scheme					Total
			L	T	P		ESE	Internal Assessment				
								PE-I & II	TA	A	Total	
ENV-6101	CC	Introduction to Earth Processes	04	0	0	04	60	20	15	05	40	100
ENV-6102	CC	Environmental Chemistry	04	0	0	04	60	20	15	05	40	100
ENV-6103	CC	Ecology and Environment	04	0	0	04	60	20	15	05	40	100
ENV-6104	CC	Waste Management	02	0	0	02	60	20	15	05	40	100
ENV-6105	SEC	Choose any one: (i) Remote Sensing and Geographic Information System (ii) MOOC/NPTL/SWAY AM	02	0	0	02	60	20	15	05	40	100
UHV-6100	VAC	Universal Human Values and Professional Ethics	02	0	0	02	60	20	15	05	40	100
Lab Course												
ENV- 6106P	LAB-1	Environment Science Lab - I	0	0	08	04	60	20	15	05	40	100
Total			18	0	08	22	420	140	105	35	280	700

<b>Legends:</b>	<b>CC - Core Course</b>	<b>PE-Periodical Examination</b>
	<b>SEC - Skill Enhancement Course</b>	<b>ESE - End Semester Examination</b>
	<b>VAC – Value Addition Course</b>	<b>TA - Teacher's Assessment</b>
	<b>DSE - Discipline Specific Electives</b>	<b>A – Attendance</b>
	<b>ID - Inter Departmental Elective Course</b>	<b>L – Lecture</b>
	<b>T – Tutorial</b>	<b>P – Practical</b>

  
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ENV-6101 Introduction to Earth Processes							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
4	0	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

### Course Objectives (COs)

- To introduce students to the basic concepts and principles of physical and environmental geology, focusing on Earth materials and processes.
- To provide students with an understanding of questions like how geologic processes and hazards influence human activities (and sometimes the reverse), the geologic aspects of pollution and waste-disposal problems, and several other environmental processes.

<b>Unit I: Introduction to Earth Science</b>	<b>15 Lectures</b>
The role of earth science, Importance of minerals in everyday life, Evolution of various branches of Earth Science, Earth as a dynamic system, Earth, Man and Environment. Introduction to the planetary system, Different theories of origin and evolution of earth, Origin of atmosphere, water and life, Geological time scale, Primary differentiation and multilayer structure of Earth.	
<b>Unit II: Rock-Minerals, Internal and Surficial Geosystems</b>	<b>15 Lectures</b>
An overview on different Rock types: Igneous Rocks, Sedimentary Rocks, metamorphism & Metamorphic Rocks, Different mineral groups: Silicate and Non Silicate, Physical properties of mineral, Moh's hardness scale. Volcanoes, earthquakes, weathering: Chemical and Mechanical weathering, erosion, and mass wasting; stream transport, winds and deserts.	
<b>Unit III: Plate Tectonics</b>	<b>15 Lectures</b>
The concept of Hypothesis and Theory, Continental Drift hypothesis, Theory of Plate tectonics, Mountain building, Himalayas Formation and sea floor spreading processes, Distribution of earthquake and volcanic activity across the globe.	
<b>Unit IV: Oceanography</b>	<b>15 Lectures</b>
Hypsography of the continents and ocean floor –continental shelf, slope, rise and abyssal plains. chemical properties of sea water and their spatial variations, Ocean currents, ocean circulation Concept of El-nino, La-nina: ENSO.	



### Course Learning Outcomes (CLOs)


- The students would be able to understand the spectrum of interactions between people and the physical environment.
- The students would develop an understanding of how geology interacts with major environmental problems facing people and society.
- The knowledge shared with the students will provide a useful foundation for discussing and evaluating specific environmental issues, as well as for developing ideas about how the problems should be solved.

### Suggested Readings:

- Tarbuck E. J. and Lutgens F. K. (1996). An introduction to Physical Geology. Prentice Hall, New Jersey; ISBN 0-13-371584-1
- Kumar K. (1998). Course Material of -Foundation Course in Disaster Management of School of Social Sciences - Indira Gandhi National Open University; ISBN 81-7605-236-X to ISBN 81-7605-248-X
- Valdiya K. S. (1987). Environmental Geology (Indian Context). Tata-McGraw-Hill, New Delhi

### Further References:

- Coates Donald R. (1985). Geology and Society. Chapman and Hall, NY
- Keller Edward A. (1996). Environmental Geology. Prentice-Hall, NJ
- Keller Edward A. (2007). Environmental Geology. 4th ed. Prentice-Hall, NJ
- Valdiya K. S. (2001). Geology, Environment and Society. University Press, Hyderabad Eby, N. Principles of Environmental Geochemistry. Brooks Cole, USA. 2003.
- Bennett, M.R. and Doyle, P. (1997). Environmental geology: - Geology and the Human Environment. John Wiley and Sons.
- Botkin, Daniel B. and Keller, Edward A. (2007). Environmental Science: Earth as a Living Planet. 6th ed. John Wiley & Sons, USA.
- Grotzinger J., Jordan Thomas H. (2014). Press Frank, Siever Raymond: Understanding Earth; Freeman and Company.
- Garrison Tom S. (2009). Essentials of Oceanography 5 th ed. Belmont, Brooks/Cole, Cengage Learning.
- Paul R. Pinet. (2011). Introduction to Oceanography: Jones & Bartlett Learning.
- Alan P. Trujillo and Harold V Thurman. (2013). Essentials of Oceanography, Prentice Hall.
- Lalli M.C. and Parsons T.R. (2012). Biological Oceanography: An Introduction, Elsevier.
- Frank J. Millero. (2014). Chemical Oceanography, CRC Press.



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**Sample Question Paper for End Semester Examination for 04.03 and 02 Credits**

Roll No:.....

Total Pages.....

(June- 2023)

**M.Sc. Environmental Sciences Examination**

**ENV-6101**

**Introduction to Earth Processes**

**Semester-I**

**Time: 3 Hours**

**Max. Marks: 60**

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**

1. What is the importance of studying Earth science? Describe the evolution of its various branches. (12)
2. Write note on the following:
  - (a) Geological time scale (8)
  - (b) Origin of life (4)

**SECTION-B**

3. What are the various types of mineral groups? Write down the characteristic features of non-silicate minerals. (12)
4. Illustrate the physical properties of minerals with examples. (12)

**SECTION – C**

5. Describe the distribution of earthquake activities across the globe. (12)
6. Elaborate the theory of Plate Tectonics in formation of landforms. (12)

**SECTION – D**

7. Write in detail the hypsography of the continents and ocean floor.
  - (a) Ocean Currents (6)
  - (b) Abyssal plains (6)
8. Describe the concept of El-nino, La-nina and ENSO. (12)

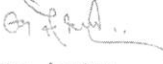


### SECTION-E (Compulsory)

9. Attempt all the questions.

Write short notes on the following:

- (a) Formation of igneous rocks (2)
- (b) Scale of mineral hardness (2)
- (c) Bathymetry (2)
- (d) Asteroids (2)
- (e) Layers of earth (2)
- (f) Continental shelf (2)

  
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ENV-6102 Environmental Chemistry							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
4	0	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

### Course Objectives (COs)

- To impart the knowledge about the basics of chemistry in relation to environment.
- To impart knowledge to become part of professional organizations working in the field of conservation and environmental protection.
- To impart the knowledge of important terminology for nuclear chemistry and brief description of heavy metals chemistry and toxic components.

<b>Unit-I: Fundamentals of Environmental Chemistry</b>	<b>15 Lectures</b>
Stoichiometry, Gibbs' energy, chemical Potential, Chemical equilibrium acid base reactions, Solubility product, Solubility of gases in water, Henry's Law, Carbonate system, Saturated and unsaturated hydrocarbons, Laws of thermodynamics, Carnot's cycle, Radionuclides.	
<b>Unit-II: Composition of Air</b>	<b>15 Lectures</b>
Chemical compositions of Air: Classification of elements, chemical speciation, Particles, Ions and radicals in atmosphere, chemical processes for formation of inorganic and organic particulate matter, thermo chemical and photochemical reaction in atmosphere Oxygen and Ozone chemistry, chemistry of air pollutants, photochemical smog.	
<b>Unit-III: Water and Soil Chemistry</b>	<b>15 Lectures</b>
Water Chemistry: Chemistry of water, Concept of DO, BOD, COD, Major aquatic chemical reactions - Carbonate system, Alkalinity and acidity, Metal ions in water, Significance of Oxidation-reduction reactions: Electron and redox reactions, Nernst Equation. Calcium and other metals in water. Soil Chemistry: Inorganic and organic components of soil, Nitrogen pathway and NPK in soil.	
<b>Unit-IV: Main and Transition Metals Chemistry</b>	<b>15 Lectures</b>
Metal- Ligand concept: Complexation and chelation, Bonding and structure of metal complexes, Complexation by deprotonated and protonated ligands, Solubilization of Lead ion from solids by NTA. Biochemical aspects of heavy metals (Hg, Cd, Pb, Cr) and metalloids (As, Se).	

  
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### Course Learning Outcomes (CLOs)

- Students will be able to apply basic chemical concepts to analyse chemical processes involved in different environmental problems (air, water & soil).
- Students will be able to describe causes and effects of environmental pollution by energy industry and discuss some mitigation strategies.
- They will be able to explain energy crisis and different aspects of sustainability.

### Suggested Readings:

- Manahan, Stanley E. (2000). "FRONTMATTER" Environmental Chemistry Boca Raton: CRC Press LLC.
- A K De Environmental Chemistry, 4th Edition, New Age International (P) Ltd., New Delhi 110 002.
- J. E. Girard, Principles of Environmental Chemistry (II Edition) Jones and Bartlett Learning, Delhi 110 002; ISBN 978-93-80108-12-4.
- Siegfried Hubener, Encyclopedia of Inorganic Chemistry (3ed, AP) Forschungszentrum Rossendorf; ISBN 128-53-80108-11-0.

### Further References:

- Jayaraman, J., Laboratory Manual in Biochemistry, New Age International (P) Limited.
- Puri Sharma and Kalia, Principles of Inorganic Chemistry, S. Chand and company, N Delhi.
- Keith Bucher, Global Climate, Wiley, New York 1976.
- J. Heichlen, Atmospheric Chemistry, Academic Press, New York 1976.
- Levin, Aerosol pollution impact on precipitation. New York Springer, 2009.
- Rao, M N Air pollution, New Delhi: TMH, 2010.
- Bali, J.S Bioindustrial watershed management. New Delhi: JCS, 2005.
- Marcos, Ronand Biological waste water treatment in warm climate regions. London: IWA, 2006.
- Rogers, J. Environment and water resources. USA: ASCE, 2007.
- Manahan, Stanley Environmental chemistry. Boca Raton: CRC, 2010.
- O'Neill, Environmental chemistry.-- London: Blackie, 2009.
- Srivastava, Manish Environmental chemistry.-- Delhi: Sree, 2009.
- Vanloon, Gary Environmental chemistry.-- New York: Oxford, 2009.
- Vanloon, Gary W, Environmental chemistry.-- New York: Oxford, 2010.
- Handbook of HPLC. Danilo Corradini, Elena Eksteen (Katz), Roy Eksteen, Peter Schoenmakers, Neil Miller. CRC Press. [[http://books.google.co.in/books/about/Handbook\\_of\\_HPLC.html?id=4mj\\_DArD5n0C](http://books.google.co.in/books/about/Handbook_of_HPLC.html?id=4mj_DArD5n0C)]
- Introduction to Modern Liquid Chromatography, 3rd Ed. Lloyd R. Snyder, Joseph J. Kirkland, and John W. Dolan. ISBN-13: 978-0470167540. [<http://www.lcresources.com/resources/resbooks.html>]
- Analytical chemistry book by H. Kaur Pragati Prakash Meerut
- Instrumental methods of chemical analysis by H. Kaur Pragati Prakash Meerut
- Introduction to Environmental Analysis, Wiley online library, Print ISBN: 9780471492948, Online ISBN:

  
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Sample Question Paper for End Semester Examination for 04.03 and 02 Credits

Roll No:.....

Total Pages.....

(June- 2023)

M.Sc. Environmental Sciences Examination

ENV-6102

Environmental Chemistry

Semester-I

Time: 3 Hours

Max. Marks: 60

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**

1. Define Gibbs' free energy. Prove that when a system changes from one state to another at constant temperature and pressure then decrease in the value of Gibbs' free energy is the net available work obtained from that change. (12)
2. Explain the following:
  - (a) Solubility of gases in water. (6)
  - (b) What are radionuclides? Add a note on its Environmental consideration. (6)

**SECTION-B**

3. Discuss the following:
  - (a) Photochemical Smog (6)
  - (b) Role of particles in the atmosphere (6)
4. Describe Photochemical and Thermochemical reactions in the atmosphere. Explain their impacts on the environment. (12)

**SECTION-C**

5. Give the significance and chemical methods used for the detection of the following:
  - (a) Dissolved Oxygen (DO) (6)
  - (b) Chemical Oxygen Demand (COD) (6)
6. What is PAN? Describe its formation, source and environmental consequences with a brief description of the following:
  - (a) Mist, Fog and Soot (6)

  
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## SECTION-D

7. Draw Nitrogen cycle. Describe typical  $-N$  additions and  $-N$  losses to show how a soil's nitrogen balance is obtained. (12)

8. Give Explanatory note on the following:

a) Explain Nuclear energy - fission and fusion. (6)

b) Give account about Biochemical aspects of heavy metals mercury and cadmium. (6)

## SECTION-E (Compulsory)

9. Attempt all the questions. Write short notes on the following:

(a) NPK in soil (2)


(b) COD (2)

(c) Defluoridation (2)

(d) Chlorofluorocarbons (2)

(e) Inorganic components of soil (2)

(f) Photochemical smog (2)

  
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ENV-6103 Ecology and Environment							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
4	0	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

### Course Objectives (COs)

- To provide students the fundamental concepts and principles of Ecology.
- To make students aware of the importance of biodiversity and its conservation.
- To introduce the modern tools and techniques available to study and understand the nature.
- To teach field techniques, data collection, mapping and analysis.

<b>UNIT I: Scope and Introduction of Ecology</b>	<b>15 Lectures</b>
Subdivisions of Ecology, major landmarks in Ecology, levels of organization hierarchy; Organisms and Environment-Holocoenotic nature of environment; biotic and abiotic components. Population characteristics- Population Size and Density, Dispersion, Age structure, Natality, Mortality and Life Tables; population dynamics and concept of carrying capacity; Regulation of population growth.	
<b>UNIT II: Community Ecology</b>	<b>15 Lectures</b>
Community concept and brief classification, community characteristic, characters used to describe community structure- analytical, qualitative and synthetic characters, methods of community studies, species diversity $\alpha$ , $\beta$ and $\gamma$ ; concept of ecological niche- types, ecotone & edge effect. Community Development: Ecological succession- concept causes and trends; Basic types of succession, General process of succession, Hydrosere, Lithosere, Heterotrophic succession, Ecosystem Development, concept of climax, Biome.	
<b>UNIT III: Ecosystem Organization</b>	<b>15 Lectures</b>
Concept of Ecosystem, Trophic structure of ecosystem, Examples of Ecosystem-A pond and an Old field or grassland ecosystem, Ecological pyramids-Pyramids of number, biomass and energy, Productivity of Ecosystem Primary, Secondary and Net Productivity, Grazing and detritus food chains, Food web, Energy flow in ecosystem (simplified energy flow diagram depicting three trophic levels in a linear food chain).	
<b>UNIT IV: Biodiversity Management</b>	<b>15 Lectures</b>
Introduction to biodiversity, Biodiversity magnitude and distribution, Threats to biodiversity, Wildlife and its management, Biodiversity hot spots-Concept, brief introduction to biodiversity hot spots of India.	

On 24/11/2020

*[Signature]*




### Course Learning Outcomes (CLOs)

- Students will understand the concepts and principles of Ecology.
- Students will understand the structural and functional aspects of biodiversity and the need for its conservation
- They will familiar with modern tools and techniques and their appropriate use to conduct research.
- They will aware of the suitable use of field techniques, data collection, mapping, analysis and interpretation.
- They will able to take up interdisciplinary research and teaching in Ecology

### Suggested Readings:

- Singh, H.R. and Kumar Neeraj (2006). Ecology and Environmental Sciences: Vishal Publishing Co. Books Market Road ( Gumber Market ) , Old Railway Road, Jalandhar -144008 ( Punjab).
- Sharma, P.D. (2010). Ecology and Environment: Rastogi Publications, Gangotri Shivaji Road, Meerut - 250002 (U.P)
- Sharma, P.D. (2011) Ecology and Environment Eleventh Revised Edition
- Dasman, R. F. (1982) Wildlife Biology: Wiley Eastern Lrd NDL.
- Giles, R. H. (ed.) (1980) Wildlife Management Techniques: Pub. Natural Publ. Dehradun.
- Deeksha, D and Katewa, S.S. (2012). Textbook of Environmental Studies: Cengage Learning India Pvt. Ltd

  
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**Sample Question Paper for End Semester Examination for 04.03 and 02 Credits**

Roll No:.....

Total Pages.....

(June- 2023)

**M.Sc. Environmental Sciences Examination**

**ENV-6103**

**Ecology and Environment**

**Semester-I**

**Time: 3 Hours**

**Max. Marks: 60**

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**

1. What is Environment? Define the Scope of Environment Science Education. (12)
2. Explain briefly
  - (a) Subdivision of Ecology (6)
  - (b) Organization hierarchy (6)

**SECTION-B**

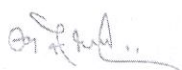
3. Describe the community structure. Explain concept and brief classification. (12)
4. Write a note on
  - (a) Concept of ecological niche (8)
  - (b) Ecotone and Edge Effect (4)


**SECTION-C**

5. Write a note on Concept of Ecosystem. (12)
6. Explain briefly the Concept of Energy flow in ecosystem. (12)

**SECTION-D**

7. Describe Biodiversity magnitude and its distribution. (12)
8. Explain the concept of community diversity and the different Gradients of biodiversity. (12)



  
Dr. Anand



## SECTION-E (Compulsory)

9. Attempt all the questions.

Write short notes on the following:

- (a) Threats to biodiversity (2)
- (b) Net Productivity (2)
- (c) Basic types of succession (2)
- (d) Species diversity (2)
- (e) Holocoenotic nature of environment (2)
- (f) Biodiversity hot spots of India (2)

  
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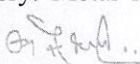
ENV-6104 Waste Management							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

#### Course Objectives (COs)

- To provide the basic knowledge of waste management
- To understand the methods available for solid waste disposal.
- To evaluate the health risks posed by abandoned waste sites and waste disposal operations and involve Chemistry and its associated applications.

<b>Unit 1: Introduction to Solid and Hazardous waste</b>	<b>08 Lectures</b>
Solid wastes: Definition, types, Waste Categorization: Biodegradable and non- biodegradable solid waste: Chemical composition and classification: Source and generation: Health hazards and Management Techniques.	
<b>Unit 2: Medical Waste and e-Waste</b>	<b>07 Lectures</b>
Hospital and Pharmaceutical Waste: Classification: Source and generation: Health hazards: Management Techniques, classification of e-waste and its management.	
<b>Unit 3: Disposal/Treatment of wastes</b>	<b>08 Lectures</b>
Concepts of waste reduction, recycling and reuse. Mechanical and thermal volume reduction. Composting, Vermicomposting, Incineration of solid wastes	
<b>Unit 4: Waste minimization techniques</b>	<b>07 Lectures</b>
Biological and chemical techniques for energy and other resource recovery: Metal recovery from waste using chemical, biological and hybrid techniques.	

  
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#### Course Learning Outcomes (CLOs)


- The students would understand the hierarchical structure in solid waste management and the need for a sustainable solution.
- To characterize the solid waste qualitatively as well as quantitatively for better management approaches.
- To integrate GIS techniques for the identification of better site and development of better management plans.



- To understand the main aspects of waste policy and regulations and would be able to come up with significant policy interventions needed

#### **Suggested Readings:**

- Kreith, Frank (ed.) (1994). Handbook of solid waste management. McGraw- Hill. Inc., New Delhi.
- Kumar, S. (2016). Municipal Solid Waste Management in Developing Countries, Taylor and Francis, ISBN-13:978-1-4987-3774-6.
- Michael D. LaGrega, Phillip I. Buckingham, Jeffrey C. Evans (2010). Hazardous Waste Management by Environmental Resource Management, ISBN 978-1-57766-693-6.
- George Tchobanoglous G. and Kreith F. Handbook of Solid Waste Management, Butterworth-Heinemann, 2003.
- Zhu D., Asnani P.U., Zurbrugg C. and Anapolsky S. Improving Municipal Solid Waste Management in India, World Bank, 2007.
- White P., Franke M. and Hindle P. Integrated Solid Waste Management: A Life Cycle Inventory; Springer, 2011.
- Reddy P.J. Municipal Solid Waste Management, CRC Press, 2011.
- Chandrappa R. and Das D.B. Solid Waste Management, Springer, 2012

  
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**Sample Question Paper for End Semester Examination for 04.03 and 02 Credits**

Roll No:.....

Total Pages.....

(June- 2023)

**M.Sc. Environmental Sciences Examination**

**ENV-6104**

**Waste Management**

**Semester-I**

**Time: 3 Hours**

**Max. Marks: 60**

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**

1. What is Solid Waste? Define Biodegradable and non- biodegradable solid waste. (12)
2. Explain briefly
  - (a) Chemical composition and classification of Solid Waste. (6)
  - (b) Waste Management Techniques. (6).

**SECTION-B**

3. Explain Hospital and Pharmaceutical Waste. Describe its Sources of generation . (12)
4. Write a note on
  - (a) e-waste and its management (8)
  - (b) Health hazards of Medical waste. (4)

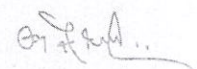
**SECTION-C**

5. Write a note on concepts of waste reduction. (12)
6. Explain briefly Mechanical and thermal volume reduction. (12)

**SECTION-D**

7. Describe Biological and chemical techniques for energy and other resource recovery. (12)
8. Explain the hybrid techniques for the metal recovery. (12)



  
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## SECTION-E (Compulsory)

9. Attempt all the questions.

Write short notes on the following:

- (a) Waste minimization techniques (2)
- (b) Incineration (2)
- (c) Recycling of waste (2)
- (d) Medical Waste handling rules (2)
- (e) Vermicomposting (2)
- (f) Metal Recovery (2)

  
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ENV-6105 Remote Sensing and Geographic Information System							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

#### Course Objectives (COs)

- To provide exposure to students in gaining knowledge on concept and applications leading to modeling of earth resource, management using remote sensing
- To acquire skills in storing, managing digital data for planning and development
- To acquire skills in advance techniques such as hyper spectral, thermal, and LiDAR scanning for mapping, modelling and monitoring

<b>Unit 1: Principles of Remote Sensing</b>	<b>07 Lectures</b>
Remote Sensing Concept & Principles, Electromagnetic Radiation (EMR), Electromagnetic Spectrum, Atmospheric Windows, Interactions with the Atmosphere, Radiation – Target, Passive vs. Active Sensing, Characteristics of Images	
<b>Unit 2: Sensors and Satellites</b>	<b>07 Lectures</b>
Sensors on the Ground, in the air, in Space, Satellite Characteristics, Pixel Size and Scale, Different Resolutions, Cameras and Aerial Photography, Different Satellites, Other Sensors	
<b>Unit 3: Image Analysis and Applications of Remote Sensing</b>	<b>08 Lectures</b>
Visual interpretation, Digital processing, Pre-processing, Enhancement, Transformations, Classification, Integration  Agriculture, Glaciology, Forestry, Geology, Hydrology, Sea Ice, Land Cover, Biomass Mapping, Oceans & Coastal.	
<b>Unit 4: Radar System</b>	<b>08 Lectures</b>
Radar Basic, Viewing Geometry & Spatial Resolution, Airborne vs Spaceborne Radars, Airborne & Spaceborne Radar Systems	

*Dr. R. K. Singh*

*Dr. R. K. Singh*  
Dean Academic



### Course Learning Outcomes (CLOs)

- Fully equipped with concept, methodologies and applications of remote sensing technology
- Prepare the students for national and global employability
- Acquire skills in handling instruments, tools, techniques and modeling while using remote sensing technology

### Suggested Readings:

- Lillesand & Keifer, (2011): Remote Sensing & Image Interpretation, John Wiley & Sons, ISBN: 9788126532230.
- James B.Campbell,(2007): Introduction to Remote Sensing, Taylor & Francis, ISBN: 9780415416887.
- J.R. Jensen, (2009): Remote Sensing of the Environment, Pearsons education Pub. ISBN: 9788131716809.
- George Joseph, (2005): Fundamental of Remote Sensing, University Press, India, ISBN: 9788173715358.
- Bruce Grubbs, (2005): Basic Essentials Using GPS, Falcon Press Publishing, ISBN: 9780762734214.
- Jensen, J.R. (2006). —Remote Sensing of the Environment – An Earth Resources Perspectivel, Pearson Education, Inc. (Singapore) Pvt. Ltd., Indian edition, Delhi.
- Burroughs, Peter A. and Rachael McDonnell (1998). Principles of Geographical Information Systems“ Oxford University Press, New York.
- Jensen, J.R. (1996). Introductory Digital Image Processing A remote sensing perspective. Prentice Hall Series in GIS, USA.
- Lillesand, Thomas M. and Kiefer, Ralph, W. (2007). —Remote Sensing and Image Interpretationll, 4th Edition, John Wiley and Sons, New York

  
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**Sample Question Paper for End Semester Examination for 04.03 and 02 Credits**

Roll No:.....

Total Pages.....

(June- 2023)

**M.Sc. Environmental Sciences Examination**

**ENV-6105**

**Remote Sensing and Geographic Information System**

**Semester-I**

**Time: 3 Hours**

**Max. Marks: 60**

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**

1. Explain briefly

(a) Electromagnetic Spectrum and Atmospheric Windows (8)

(b) Passive vs. Active Sensing (4)

2. What is Remote Sensing? Explain its concept and principle briefly. (12)

**SECTION-B**

3. Explain different types of sensors in air, space and in ground. (12)

4. Write a note on

(a) Aerial Photography (6)

(b) Pixel Size and Scale. (6)

**SECTION-C**

5. Write a note on Applications of Remote Sensing in:

(a) Agriculture and Hydrology (8)

(b) Biomass Mapping (4)

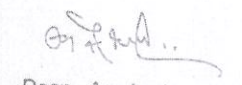
6. Explain briefly the image processing. (12)

**SECTION-D**

7. Describe Viewing Geometry & Spatial Resolution in remote sensing. (12)

8. Explain the Airborne vs Spaceborne Radars system (12)

  
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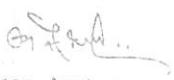


### SECTION-E (Compulsory)

9. Attempt all the questions.

Write short notes on the following:

- (a) Radar Basic (2)
- (b) LULC (2)
- (c) Characteristics of Satellite (2)
- (d) Pixel Size and Scale (2)
- (e) Electromagnetic Radiation (EMR) (2)
- (f) GIS (2)

  
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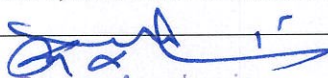
UHV-6100 Universal Human Values and Professional Ethics							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

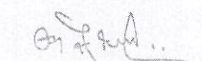
**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

### Course Objectives (COs)

- To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
- To enable the students to imbibe, internalize the values and ethical behavior in the personal and Professional lives.

<b>Unit I: Introduction to Value Education</b>	<b>08 Lectures</b>
Right understanding, Relationship and physical facility (holistic development and the role of education), Understanding value education, Self-exploration as the process for value education, Continuous happiness, and prosperity-the basic human aspirations exploring human consciousness, Happiness and prosperity-current scenario, Method to fulfil the basic human aspirations, Exploring natural acceptance.	
<b>Unit II: Harmony in the Human Being</b>	<b>08 Lectures</b>
Understanding human being as the co-existence of the Self and the Body, Distinguishing between the needs of the Self and the Body, Exploring the difference of needs of Self and Body, The Body as an instrument of the self-understanding, Harmony in the self-program to ensure Self-regulation and Health exploring harmony of Self with the Body.	
<b>Unit III: Harmony in the Family and Society</b>	<b>07 Lectures</b>
Harmony in the family-the basic unit of human interaction, 'Trust'-the foundational value in relationship, Exploring the feeling of trust, 'Respect'-as the right evaluation, Exploring the feeling of respect and other feelings, Justice in human-to-human relationship, Understanding harmony in the society, Vision for the universal human order, Exploring systems to fulfil human goal.	
<b>Unit IV:</b>	<b>07 Lectures</b>
Ethics -definitional aspects, Nature of ethics, Scope of ethics, The philosophical basis of ethics, Family ethics, Ethics at the workplace and professions, Relevance of ethics in society.	

  
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### Course Learning Outcomes (CLOs)

- Students will be able to understand the harmony in nature and existence, and work out their mutually fulfilling participation in nature.
- Students will be able to relate ethical concepts and materials to ethical problems in specific professions and professionalism.
- Students will be made available to aware about the types of ethical challenges.

### Suggested Readings:

- R R Gaur, R Asthana, G P Bagaria, The Textbook A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019.
- R R Gaur, R Asthana, G P Bagaria, The Teacher's Manual Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019.
- R. R. Gaur, R. Sangal, G. P. Bhagaria, A Foundation Course in Value Education, Excel Books Publisher.
- Ek Parichaya, A Nagaraj, Amar Kantak, Jeevan Vidya, Jeevan Vidya Prakashan, 1999.
- A.N. Tripathy, 2003, Human Values, A Foundation Course in Human Values and Professional Ethics, New Age International Publishers.
- Mohandas Karamchand Gandhi, The Story of My Experiments with Truth.

  
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ENV-6106P Environment Science Lab – I (Ecological Principles)							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
0	0	8	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

### Course Objectives (COs)

- The students will be trained in designing the scientific methods/experiments to study various ecological parameters and biodiversity in laboratory/field conditions.

*Note: Students are required to perform at least 7 experiments.*

Sr. No.	Name of the Experiment
1.	To study and enlist various biotic and abiotic components of pond and forest ecosystem.
2.	To determine minimum quadrat size for studying vegetation in a grassland.
3.	To calculate density, frequency, evenness and abundance of plant species in grassland using quadrat method.
4.	To determine basal area and dominance of species.
5.	To calculate Importance value index (IVI) of species.
6.	To study the ecology of exotic, invasive plant species in the locality.
7.	To study the indigenous medicinal plants and their uses in Himachal Himalaya.
8.	To document the plant biodiversity of Himachal Pradesh.
9.	To study the interactions between forest and pond ecosystems.

### Course Learning Outcomes (CLOs)

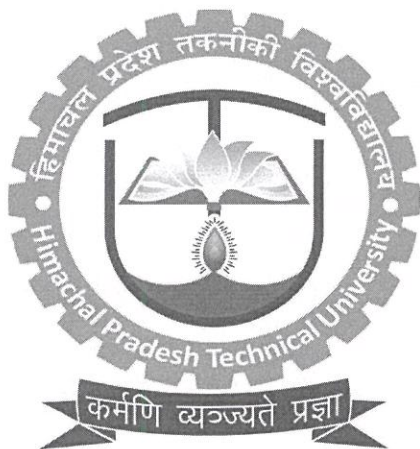
- To examine the positive and negative effects of living things on the environment they live in.
- Aims to minimize environmental problems and sustain the sustainability of life.
- To raise the awareness about the nature and green environment.
- Students will be able to understand the distribution of biotic and abiotic factors of living things in the environment.

### Suggested Readings:

- Sharma, P.D. (2010). Ecology and Environment: Rastogi Publications, Gangotri Shivaji Road, Meerut -250002 (U.P)
- Sharma, P.D. (2011) Ecology and Environment Eleventh Revised Edition
- Dasman, R. F. (1982) Wildlife Biology: Wiley Eastern Ltd NDL.



# HIMACHAL PRADESH TECHNICAL UNIVERSITY HAMIRPUR



## Syllabus

*for*

# M.Sc. Environmental Sciences

*(Semester - II)*

*(Two years program spread over four semesters)*

As per National Education Policy (NEP)-2020

(w.e.f. the Academic Year 2023-2024)

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**Scheme of Teaching and Examination**  
**Master of Environmental Sciences (M.Sc. Environmental Sciences)**

**Semester-II**

Subject Code	Course Category	Subject Title/ Subject Name	Periods			Credits	Evaluation Scheme				Total	
			L	T	P		ESE	Internal Assessment				
								PE-I & II	TA	A		Total
ENV-6201	CC	Atmospheric Science	04	0	0	04	60	20	15	05	40	100
ENV-6202	CC	Environmental Pollution & Engineering	04	0	0	04	60	20	15	05	40	100
ENV-6203	CC	Hydrology and Water Resources	04	0	0	04	60	20	15	05	40	100
ENV-6204	CC	Climate Change & Global Environmental Issues	02	0	0	02	60	20	15	05	40	100
IKS-6200	VAC	Indian Knowledge System	02	0	0	02	60	20	15	05	40	100
ENV ID-6201	ID		02	0	0	02	60	20	15	05	40	100
Lab Course												
ENV-6205P	LAB-II	Environment Science Lab - II	0	0	08	04	60	20	15	05	40	100
Total			18	0	08	22	420	140	105	35	280	700

<b>Legends:</b>	<b>CC - Core Course</b>	<b>PE-Periodical Examination</b>
	<b>SEC - Skill Enhancement Course</b>	<b>ESE - End Semester Examination</b>
	<b>VAC - Value Addition Course</b>	<b>TA - Teacher's Assessment</b>
	<b>DSE - Discipline Specific Electives</b>	<b>A - Attendance</b>
	<b>ID- Inter Departmental Elective Course</b>	<b>L - Lecture</b>
	<b>T - Tutorial</b>	<b>P - Practical</b>

- List of Inter Departmental Elective Courses (ID) offered by Department of Environmental Sciences:**  
(Note: Only for the students of other Departments, e.g., the students of M.Sc. Environmental Sciences will not opt the Inter-Departmental Elective Course offered by the parent department)

Sr. No.	Subject Code	Course Category	Subject Title/ Subject Name	Name of the Faculty
1.	ENV ID-6201 (i)	ID	Basic Concept of Environment Science	
2.	ENV ID-6201 (ii)	ID	Culture and Environment	



ENV-6201 Atmospheric Sciences							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
4	0	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

#### Course Objectives (COs)

- To possess quantitative scientific reasoning skills that can be applied to atmospheric problems.
- To produce general knowledge of a range of atmospheric phenomenon and applications.
- To produce graduate who are equipped to contribute to solving problems in the atmospheric sciences and related discipline.

<b>Unit I: Vertical Structure and Composition of Atmosphere</b>	<b>15 Lectures</b>
Chemical Composition and Structure of stratosphere, State of the Atmosphere, Atmospheric Density and Pressure, Hydrostatic Balance	
<b>Unit II: Atmospheric Dynamics</b>	<b>15 Lectures</b>
The Ideal Gas Law and First Law of Thermodynamics, Concept of Air Parcel and Lapse Rates, Atmospheric Stability, Mixing Height and Inversion, Pressure Belts and Winds, Pressure Gradient Force, Coriolis Force, Centrifugal Force, Friction, Global Circulation	
<b>Unit III: Atmospheric Radiation and Energy Balance</b>	<b>15 Lectures</b>
Radiation: Electromagnetic Radiations, Black Body Radiation, Laws of black body radiation, radiation transfer, solar radiation, latitudinal and seasonal variation, passage through the atmosphere – absorption, scattering and reflection, terrestrial radiation; absorption in the atmosphere, The Solar Constant and the Budget of Solar Radiation, Terrestrial Radiation, The Earth's Radiative Energy Balance, Green House Effect, Raleigh and Mie scattering; atmospheric window.	
<b>Unit IV: Atmospheric Chemistry</b>	<b>15 Lectures</b>
Thermo-chemical and Photo-chemical Reactions, Chemistry of Stratosphere, Stratospheric Ozone Depletion, Chemistry of Troposphere, Acid Rain, Atmospheric Aerosols, Atmospheric Trace Gases	

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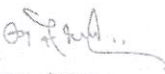
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### Course Learning Outcomes (CLOs)

- Students can demonstrate skills for interpreting and applying atmospheric observations.
- Students can demonstrate knowledge of the atmosphere and its evolutions
- Students can demonstrate the knowledge of the atmospheric dynamics, atmospheric chemistry and energy balance.

### Suggested Readings:

- Murry L. Salby (2012): Physics of the Atmosphere and Climate, Cambridge University Press, ISBN: 978-0521767187
- Wallace John M. Jr., Peter V. Hobbs (2006): Atmospheric Science: An Introductory Survey, 2nd Edition, Academic Press, ISBN: 978-0127329512
- John Green (2011): Atmospheric Dynamics, Cambridge University Press, ISBN: 978-0521249751
- Frederick K. Lutgens, Edward J. Tarbuck (2010): The Atmosphere: An Introduction to Meteorology, Phi (Prentice-hall New Arrivals), ISBN: 978-8120344150
- Mark Z. Jacobson (2005): Fundamentals of Atmospheric Modeling, Cambridge University Press, ISBN: 978-0521548656
- John H. Seinfeld, Spyros N. Pandis (2006): Atmospheric Chemistry and Physics, John Wiley & Sons Inc., ISBN: 978-0-471-72018-8

  
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**Sample Question Paper for End Semester Examination for 04.03 and 02 Credits**

Roll No:.....

Total Pages.....

(June- 2023)

**M.Sc. Environmental Sciences Examination**

**ENV-6201**

**Atmospheric Science**

**Semester-II**

**Time: 3 Hours**

**Max. Marks: 60**

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**

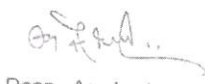
1. Draw a diagram (with brief introduction) showing the four main layers into which atmosphere can be divided. Label your diagram to show the following: (12)  
a) The distance the two layers closest to the earth extend out from earth surface  
b) The change in temperature with increasing distance from the surface of the earth
2. Describe the following:  
a) Atmospheric density and pressure (6)  
b) Hydrostatic balance (6)

**SECTION-B**

3. Discuss the following:  
a) First law of Thermodynamics. (6)  
b) Concept of air parcel and Adiabatic lapse. (6)
4. Give explanatory note on Electromagnetic radiation and Earth's Radiative balance. (12)

**SECTION-C**

5. Describe the following:  
a) Solar constant and Budget of solar radiation. (6)  
b) Black-black body radiation and its laws. (6)
6. Discuss the following:  
a) Terrestrial radiation (6)  
b) Greenhouse effect (6)



  
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## SECTION-D

7. Write notes on the following:

- a) Thermochemical reaction in atmosphere (6)
- b) Chemistry of Stratosphere and Stratospheric Ozone depletion. (6)

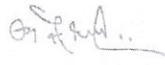
8. Explain the following:

- a) Pressure belts (6)
- b) Atmospheric trace gases (6)

## SECTION-E (Compulsory)

9. Attempt all the questions. Write short notes on the following:

- a) Saturated adiabatic lapse rate (2)
- b) Subsidence inversion of temperature (2)
- c) Solar constant (2)
- d) Coriolis force (2)
- e) London smog (2)
- f) Polar cell. (2)

  
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ENV-6202 Environmental Pollution and Engineering							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
4	0	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

#### Course Objectives (COs)

- To provide a coherent development to the students for the courses in sector of environment like Waste Water treatment, solid Waste Management, house drainage etc.
- To analyse the Waste water sources and waste water characteristics.
- To develop various waste water and Air treatment process.
- To give an experience in the implementation of engineering concepts which are applied in field of waste Water treatment process.

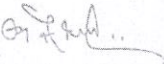
<b>Unit I: Mass and Energy Transfer</b>	<b>15 Lectures</b>
Concentrations and other units of measure, Material Balance, Thermodynamics, Chemical Equilibrium.	
<b>Unit II: Water Quality Engineering</b>	<b>15 Lectures</b>
Water Pollutants, Water Quality Regulations and Treatment Systems - Physical Treatment Methods - Chemical and Physicochemical Treatment Methods - Biological Waste Water Treatment.	
<b>Unit III: Air Quality Engineering</b>	<b>15 Lectures</b>
Air Pollutants Emissions, Control methods for particulates - gravitational settling chambers, Centrifugal collectors, Wet collectors, Fabric filters, electro static precipitators. Control methods for gaseous pollutants adsorption, absorption, condensation, combustion. High Volume Air Sampler.	
<b>Unit IV: Global Climate Change and Geo-engineering</b>	<b>15 Lectures</b>
Green House Effect, Radiative Forcing, Global warming Potential, Global Energy Balance, Global Warming, Climate Change, Mitigation Strategies, Geo-engineering.	

### Course Learning Outcomes (CLOs)

- To have obtained a working knowledge in the environmental engineering areas of water and wastewater treatment, environmental health and safety, solid and hazardous waste engineering, sustainability, and water resources.
- To be able to locate, assess, and compile data, and to conduct experiments to gather data, and analyze and interpret data using engineering judgement to draw conclusions.

### Suggested Readings:

- Gilbert M. Masters, Wendell P. Ela (2008): Introduction to Environmental Engineering and Science, PHI Learning, ISBN: 978-8120336919
- P. Venugopala Rao (2004): Textbook of Environmental Engineering, Phi Learning, ISBN: 978-8120319301  
David A. Cornwell, Mackenzie L. Davis (2010): Introduction to Environmental Engineering, Tata McGraw-Hill Education, ISBN: 978-0070671171
- K. N. Duggal (2008). Elements of Environmental Engineering, S. Chand Publishing, ISBN: 978-8121915472
- Clair Sawyer, Perry McCarty, Gene Parkin (2002). McGraw Hill Chemistry for Environmental Engineering and Science. ISBN: 9780072480665
- P. Aarne Vesilind, Susan M. Morgan, Lauren G. Heine (2009). Introduction to Environmental Engineering , Third Edition, CL-Engineering, ISBN: 9780495295839

  
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Sample Question Paper for End Semester Examination for 04.03 and 02 Credits

Roll No:.....

Total Pages.....

(June- 2023)

M.Sc. Environmental Sciences Examination

ENV-6202

Environmental Pollution and Engineering

Semester-II

Time: 3 Hours

Max. Marks: 60

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**

1. Explain Mass and Energy Transfer in relation to Thermodynamics. (12)
2. Describe the following:
  - a) Chemical Equilibrium (6)
  - b) Material Balance (6)

**SECTION-B**

3. Discuss the following:
  - a) Chemical and Physicochemical Treatment Methods for Waste Water Treatment. (6)
  - b) Biological Treatment methods for waste water. (6)
4. Give explanatory note on Water Pollution and its health effects. (12)

**SECTION-C**

5. Define Air Pollution. Discuss briefly about the air pollutants and their environmental effects in relation to rise in temperature. (12)
6. Discuss the following:
  - a) Particulate Matter (4)
  - b) High Volume Air Sampler (8)

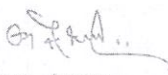
**SECTION-D**

7. Write notes on the following:
  - a) Climate Change (6)
  - b) Radiative Forcing (6)
8. Explain Global warming Potential and Global energy balance. (12)

  
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9. Attempt all the questions. Write short notes on the following:

- a) Global Warming (2)
- b) Green House Effects (2)
- c) Solar constant (2)
- d) Control methods for gaseous pollutants (2)
- e) London smog (2)
- f) Chemical Equilibrium (2)

  
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ENV-6203 Hydrology And Water Resources							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
4	0	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

#### Course Objectives (COs)

- To study the occurrence movement and distribution of water that is a prime resource for development of a civilization.
- To know diverse methods of collecting the hydrological information, which is essential, to understand surface and ground water hydrology.

<b>Unit I: Introduction to Hydrology</b>	<b>15 Lectures</b>
Introduction: Hydrology, The hydrologic cycle; Structure and properties of water. Hydrogeology of India. Application of isotopes in hydrology. Inventory of Earth's water, quality and quantity. Limits of cations and anions in portable water including fluoride and arsenic, phosphate, nitrate and heavy metals.	
<b>Unit II: Surface and Groundwater Resources and their Properties</b>	<b>15 Lectures</b>
Surface water resources: precipitation, infiltration, water balance, Evapo-transpiration and runoff, Drainage basin. Groundwater resources: rock properties affecting ground water, vertical distribution of ground water, zone of saturation. Darcy's law: permeability, transmissivity and storage coefficient. Viscous character of groundwater flow. Geologic formations as aquifers, type of aquifers. Distribution of water - local, regional and global. Ground water exploration.	
<b>Unit III: Environmental Influences on water resources</b>	<b>15 Lectures</b>
Surface and groundwater resources of arid and semiarid regions, Snowmelt hydrology from glaciers, fluctuations due to urbanization, Evapo-transpiration and tides. Recent development in surface and groundwater resources monitoring and assessing processes. Water logging and soil salinity-conjunctive use of surface water and ground water.	
<b>Unit IV: Water resource management</b>	<b>15 Lectures</b>
Flood and flood plain management; Water-shed management, water harvesting and artificial recharge to ground water; water pollution and water treatment. Wetland and riparian management; forest management on water resources.	

  
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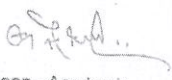
### Course Learning Outcomes (CLOs)

This course is designed

- To provide a basic understanding of the impact of water and water-related issues in a global, economic, environmental, and societal context.
- Students will comprehend the hydrologic cycle and related major water quantity and quality challenges and their relevance to human health and well-being, ecosystems, and the food supply.
- Students will understand the role of hydrology, water resources management and the legal and economic frameworks associated with addressing these challenges.

### Suggested Readings:

- Aggarwal, A., 1991, Floods, Floodplains and Environmental Myths. Centre for Science and Environment, New Delhi.
- Andrew D. Ward and Stanley Trimble, 2004, 2nd Ed., Environmental Hydrology, Lewis Publishers.
- Karanth, K.R.C., 1988, Ground Water: Exploration, Assessment and Development. TataMcgraw Hill, New Delhi.
- Mahajan, G., 1989, Evaluation and Development of Groundwater. Ashish Publishing House, New Delhi

  
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Sample Question Paper for End Semester Examination for 04.03 and 02 Credits

Roll No:.....

Total Pages.....

(June- 2023)

M.Sc. Environmental Sciences Examination

ENV-6203

Hydrology and Water Resources

Semester-II

Time: 3 Hours

Max. Marks: 60

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**


1. Write about the following:
  - a) Structure and properties of water. Write down the drinking water standards (6)  
(BIS) for pH, TDS, cations, anions, As, Hg, Pb, U and Se.
  - b) Note on hydrology of India. (6)
2. Discuss about following:
  - a) Applications of isotopes in hydrology? Explain. (6)
  - b) Inventory of earth's water in terms of quality and quantity. (6)

**SECTION-B**

3. Discuss the various factors affecting surface water resources quantitatively and (12)  
qualitatively. Also explain about Darcy's Law.
4. Discuss the following:
  - a) What are different groundwater resources? How do rock properties affect (6)  
groundwater? Explain.
  - b) Discuss in brief the vertical distribution of groundwater with a suitable sketch. (6)

**SECTION-C**

5. Discuss the following:
  - a) Discuss the recent developments in surface and groundwater monitoring and (6)  
explorations.
  - b) How do climatic changes affect water availability? Explain. (6)
6. Justify the statement "Conjunctive use coping with waterlogging and salinity". (12)  
Discuss snowmelt hydrology from glaciers in brief.

  
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### SECTION-D

7. What are the different methods of Water Resource Management? Discuss Wetland and Riparian Management. (12)
8. What is Watershed Management? What are its key components and importance? (12)

### SECTION-E (Compulsory)

9. Attempt all the questions. Write short notes on the following:
- a) What is MPN count? (2)
- b) Define Waterlogging (2)
- c) Why is water termed as a universal solvent? (2)
- d) Define the term Hydrograph (2)
- e) Define the term Permeability and Transmissibility. (2)
- f) Why does watershed deterioration occur? (2)

  
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ENV-6204 Climate Change and Global Environmental Issues							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

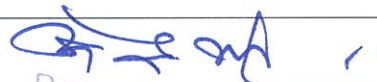
**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

#### Course Objectives (COs)

- Students will become aware about the global environmental issues and their managements etc.
- To distinguish between climate variability and climate change.
- To understand Natural and Human Drivers of Climate Change.
- To understand the roles of atmospheric aerosols and gases in the present process of Climate Change.
- To know about the observations of climate change in the various spheres of the Earth's Environment.

<b>Unit I: Environmental Education and Issues</b>	<b>07 Lectures</b>
Environmental education, awareness, ethics and global imperatives, Global environmental problems: Ozone depletion, Global warming, Climate change, Desertification and its control, Depletion of Natural resources, Wet land conservation, Water Crises-Conservation of water, Eutrophication and restoration of Lakes, Epidemiological issues.	
<b>Unit II: The Climate System: an overview</b>	<b>08 Lectures</b>
Weather Vs Climate, Components of the Climate System, The Driving Forces of Climate, Natural Vs Anthropogenic Climate Change, The Sun and the Earth Geometry,	
<b>Unit III: International Conventions and Protocols</b>	<b>07 Lectures</b>
The Kyoto Protocol to the UN Convention on Climate Change, Basel Convention on the Control of Tran boundary Movements of Hazardous Wastes and Their Disposal, The Convention on Biological Diversity, Convention on Long-Range Tran boundary Air Pollution, The Montreal Protocol on Substances that Deplete the Ozone Layer and the United Nations Convention to Combat Desertification.	
<b>Unit IV: Radiative effects of Aerosol and Gases</b>	<b>08 Lectures</b>
Green House Effect, Radiative forcing, Radiative forcing due to stratospheric ozone changes, Tropospheric Aerosols: Direct forcing due to Sulphate aerosols and Soot aerosols,	

  
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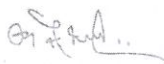
  
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### Course Learning Outcomes (CLOs)

- At the end of the course students will be able to understand the main legal issues concerning the environmental law and the interactions between international and national laws, as far as land and sea are concerned.

### Suggested Readings:

- Bell Stuart & Mc Gillvray Donal, 2001, Environmental Law, Universal Law Publishing Co.
- Diwan Shyam and Rosencranz Armin, 2002, Environmental Law and Policy.
- Mohanty. S. K., 2004, Environment and Pollution Law, Universal Law Publishing Co. Pvt. Ltd.
- Singh Gurdip, 2004, Environmental Law in India, Mcmillan & Co.
- Shastri. S. C., 2005, Environmental Law, Eastern Book Company.
- Smith, P. and Warr, K., 1991, Global Environmental issues, Hodder and Stoughton, London.

  
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Sample Question Paper for End Semester Examination for 04.03 and 02 Credits

Roll No:.....

Total Pages.....

(June- 2023)

M.Sc. Environmental Sciences Examination

ENV-6204

Climate Change and Global Environmental Issues

Semester-II

Time: 3 Hours

Max. Marks: 60

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**

1. What are Wetlands? Discuss ecosystem services provided by wetlands and wetlands fight climate change? (12)
2. What are the major reasons behind water crisis around the world? Make a note on water conservation strategies. (12)

**SECTION-B**

3. Differentiate between convention and protocol. Give example of each. Give a short note on Kyoto Protocol. (12)
4. Define biological diversity. How does climate change affect biological diversity? (12)

**SECTION-C**

5. Define sustainable development. Discuss strategies set in Brundtland Report, 1987 for "Our Common Future". (12)
6. Make a note on Johannesburg Summit, 2002 and its agenda for conserving our natural resources and safeguarding our common future. (12)


**SECTION-D**

7. Define hazardous waste and hazardous substances. Discuss Hazardous Waste Management and Handling Rule, 1989. (12)
8. Why biodiversity is at risk? Discuss strategies set in Biodiversity Act, 2002. (12)

**SECTION-E (Compulsory)**

9. Attempt all the questions. Write short notes on the following:
  - a) Desertification (2)
  - b) Global warming (2)
  - c) Ozone-depleting substances (2)
  - d) Montreal Protocol (2)
  - e) Fundamental Duty-Article 51A (g) of the Constitution (2)
  - f) Forest Act 1927 (2)

  
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IKS-6200 Indian Knowledge System							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

### Course Objectives (COs)

- To equip the students with the knowledge and understanding related to Indian knowledge systems, origin, evolution and the approaches used in ancient and modern times.
- To promote the youths to do research in the various fields of Bhāratīya knowledge system.

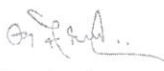
<b>Unit-I: Bhāratīya Civilization and Development of Knowledge System</b>	<b>08 Lectures</b>
Genesis of the land, On the trail of the Lost River, Discovery of the Saraswatī River, The Saraswatī-Sindhu civilization, Traditional knowledge system, The introduction to Vedas, Main Schools of Philosophy (6+3), Ancient education system, The Takṣaśilā University, The Nālandā University, Alumni, Knowledge export from Bhārata.	
<b>Unit-II: Arts, Literature and Scholars</b>	<b>08 Lectures</b>
Art, Music, and Dance, Naṭarāja– A masterpiece of Bhāratīya Art, Literature, Life and works of Agastya, Lopāmudrā, Ghoṣā, Vālmiki, Patañjali, Vedavyāsa, Yājñavalkya, Gārgī, Maitreyī, Bodhāyana, Caraka, Suśruta, Jīvaka, Kaṇāda, Patañjali, Kauṭīlyā, Pāṇini, Thiruvalluvar, Āryabhaṭa, Varāhamihira, Bhāskarācārya, Mādhavācārya.	
<b>Unit-III: Engineering, Science and Management</b>	<b>08 Lectures</b>
Engineering, science and technology in the Vedic Age, Post-Vedic period and Saraswatī-Sindhu civilization, Concept of matter, life and universe, Bhāratīya Kāla-gaṇanā, Concepts of Zero, Pi and number system, Vedic Mathematics, Āyurveda, Astronomy in India, Agriculture in India, Water Management in India, Trades in Ancient India, Seals, Coins and Marine Technology.	
<b>Unit-IV: Cultural Heritage and Indian Traditional Practices</b>	<b>06 Lectures</b>
Temple architecture in ancient India, Sculptures, Theatre, Drama and Martial arts traditions, Fairs and festivals, Yoga, Integrated approach to healthcare, Approaches and strategies to the protection and conservation of environment.	

### Course Learning Outcomes (CLOs)

- The students will be able to understand and appreciate the rich heritage that resides in our traditions.
- The students will be able to improve mindfulness and more maturity leading to an effective process of learning.
- The students will be able to create awareness amongst the youths about the true history and rich culture of the country.

### Suggested Readings:

- Bhag Chand Chauhan, IKS: The Knowledge of Bharata, Garuda Prakashan, 2023.
- Pradeep Kohle et. Al. Pride of India- A Glimpse of India's Scientific Heritage edited by Sanskrit Bharati, 2006.
- Keshav Dev Verma, Vedic Physics, Motilal Banarsidass Publishers, 2012.
- Suresh Soni, India's Glorious Scientific Tradition, Ocean Books Pvt. Ltd., 2010.
- Sibaji Raha, et al, History of Science in India Volume-1, Part-I, Part-II, Volume VIII, National Academy of Sciences, India and The Ramkrishna Mission Institute of Culture, Kolkata, 2014.

  
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ENV ID-6201 (i) BASIC CONCEPT OF ENVIRONMENT SCIENCE							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

### Course Objectives (COs)

The course should enable the students to:

- Analyze the interrelationship between living organism and environment.
- Understand the importance of environment by assessing its impact on the human world.
- Enrich the knowledge on themes of environmental conservation and management.

<b>Unit 1: Introduction to Environment and Ecosystem</b>	<b>07 Lectures</b>
Environmental Science – definition, principles and scope, multidisciplinary approach – chemistry, physics, biology, mathematics. Environmental ethics and role of education in solving environmental issues. Ecosystem: Definition, scope and importance of ecosystem, classification, structure and function of an ecosystem, food chains, food web and ecological pyramids, flow of energy.	
<b>Unit 2: Structure of Environment and Biodiversity</b>	<b>07 Lectures</b>
Definition, Structure and composition of Environment, Atmosphere, Hydrosphere, Lithosphere and Biosphere, Biodiversity and biotic resources: Introduction, definition, types of biodiversity; Values of biodiversity, India as a mega diversity nation; Endangered and Endemic species, Hot spots of biodiversity. Threats to biodiversity: Conservation of biodiversity: In situ and ex situ conservation	
<b>Unit 3: Global Environmental Issues and Global Efforts</b>	<b>08 Lectures</b>
Green House Effect - Greenhouse gases its sources, impacts, consequences and remedial measures; global warming. Global Climate change, World and Indian scenario, Acid Rain; Brown Haze, Photochemical smog, nuclear winter; Ozone depletion. Environmental pollution: air pollution, water pollution, soil pollution, noise pollution; Solid waste management, composition and characteristics of e-waste and its management; Pollution control technologies, EMP and Environmental Auditing, Bhopal gas tragedy, Fukushima and Chernobyl disaster, Love Canal tragedy, Minimata Accident	
<b>Unit 4: Environmental Conventions and Protocols</b>	<b>08 Lectures</b>
Creation of UNEP and its role, World earth summits; Agenda 21, UNFCCC, Convention on Biodiversity and Convention on Climate Change, CoPs, Ramsar convention, Kyoto protocol and Montreal protocol.	

*Signature*

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### Course Learning Outcomes (CLOs)

- Knowledge in ecological perspective and value of environment.
- Understand the significance of various natural resources and its management.
- Demonstrate a comprehensive understanding of the world's biodiversity and the importance of its conservation.
- Categorize different types of pollutions and their control measures.
- Discover effective methods of waste Management.
- Analyze global environmental problems and come out with best possible solutions.

### Suggested Readings:

- Benny Joseph, —Environmental Studiesll, Tata Mc Graw Hill Publishing Co. Ltd, New Delhi, 1 st Edition, 2006.
- Erach Bharucha, -Textbook of Environmental Studies for Under Graduate Coursesll, Orient Black Swan, 2nd Edition, 2013.
- Dr. P. D Sharma, -Ecology and Environmentll, Rastogi Publications, New Delhi, 12th Edition, 2015.
- Tyler Miller, Scott Spoolman, -Environmental Sciencell, Cengage Learning, 14th Edition, 2012.
- Anubha Kaushik, —Perspectives in Environmental Sciencell, New Age International, New Delhi, 4 th Edition, 2006.
- Gilbert M. Masters, Wendell P. Ela, —Introduction to Environmental Engineering and Science, Pearson, 3rd Edition, 2007
- Ahluwalia, V. K. (2015). Environmental Studies: basic concepts. The Energy and Resources Institute (TERI).
- Beheim, E., Rajwar, G. S., Haigh, M. and Krecek, J. (Eds.). (2012). Integrated watershed management: Perspectives and problems. Springer Science & Business Media.
- Bhatt, S. (2004). Environment protection and sustainable development. APH Publishier
- Burchett, S. and Burchett, S. (2011). Introduction to wildlife conservation in farming. John Wiley & Sons.
- Das, S. K. (2008). Watershed development and livelihoods: people's action in India. Routledge India.
- Fa, J. E., Funk, S. M., & O'Connell, D. (2011). Zoo conservation biology. Cambridge University Press.
- Fatik B.M. and Nepal C. (2009). Nandi. Biodiversity: concepts, conservation and biofuture, Asian Book

  
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**Sample Question Paper for End Semester Examination for 04.03 and 02 Credits**

Roll No:.....

Total Pages.....

(June- 2023)

**M.Sc. Environmental Sciences Examination**

**ENV-6201 (i)**

**BASIC CONCEPT OF ENVIRONMENT SCIENCE**

**Semester-II**

**Time: 3 Hours**

**Max. Marks: 60**

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**Section-A**

1. Discuss Environmental Ethics. (12)
2. Write a note on the role of education in solving issues of environment. (12)

**Section-B**

3. Describe the layers of the atmosphere. (12)
4. Discuss Hydrosphere, lithosphere and Biosphere. (12)

**Section-C**

5. Explain, how greenhouse gases affect Earth's radiation budget. (12)
6. Write a note on Global Warming. (12)

**Section-D**

7. Discuss Love canal tragedy. (12)
8. Write a note on convention on climate change. (12)

**Section-E (Compulsory Question)**

9. Attempt all the questions. Write short notes on the following:

- (a) Describe the composition of the air. (2)
- (b) What is Smog? (2)
- (c) What is the role of IPCC? (2)
- (d) What is Environmental science? (2)
- (e) What do you mean by ecology of environment? (2)
- (f) What is acid rain? (2)

  
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ENV ID-6201 (ii) Culture and Environment							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

### Course Objectives (COs)

This course focuses on the following aspects as also on the

- Various cultural formations through which humans have adapted to the environment.
- Different cultural traditions conceive of the environment in different ways, and enjoin different attitudes towards it.
- Defining a sphere as environmental is itself a cultural choice. Religions have played a role both in environmental destruction and conservation.

<b>Unit I: Introduction</b>	<b>08 Lectures</b>
Concepts and Theories: Concept of Culture, Material Culture, technology; role of culture in adaptation of human populations, Environmental Culture in Business Organizations: Development of environmentally aware corporate cultures, Linkage between Organizational Environmental Culture and Environmental Strategy.	
<b>Unit II: Social, Cultural and Environmental Adaptation</b>	<b>08 Lectures</b>
Social and Cultural implications of various forms of adaptation: Evolution of political organizations, distribution and exchange of resources; Political economy of the state (land and forest policies: colonial to post-colonial), 23 Basic Forms of Human adaptation to environment: Hunting and Food gathering Pastoralism; Shifting Cultivation; Agriculture; Transition to Market economy and Industrialization.	
<b>Unit III: Development and Environment</b>	<b>07 Lectures</b>
Development and Environment: Cities for a Sustainable Future: Sustainable development goals, inclusive and low carbon and smart cities, Environmental degradation, Climate and Clean Air, Nature for People: sustainable food systems, protecting oceans, nature-based solutions, Sustainability Transitions: Green growth, Agenda 2030. Environmental governance.	
<b>Unit IV: Landscapes</b>	<b>07 Lectures</b>
Landscapes: Definitions, Types of landscapes, Cultural landscape, Human conceptions and representations of landscape: Landscape gardens, architecture, literature, art, changes in landscape over time and their cultural and ecological implications.	

  
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### Course Learning Outcomes (CLOs)

Students will develop critical-thinking skills, analyse real-world problems, and understand the power of narrative to create sustainable solutions for local and global communities for the environmental and social justice.

### Suggested Readings:

- Baruah, Sanjib, 2005, Durable Disorder: Understanding the Politics of Northeast India, O.U.P.
- Gadgil Madhav and Guha Ramachandra, 1992, This Fissured land: An Ecological History of India, O.U.P.
- Gold, Ann and Bhoju Ram Gujar, 2002, In the Time of Trees and Sorrows: Nature, Power, and Memory in Rajasthan, Durham, Duke University Press.
- Guha, Ramachandra, Social Ecology, 1998, Oxford University Press.
- Ingold Tim, 1994, Companion Encyclopedia of Anthropology, Routledge.
- Kelley Alley, 2002, On the banks of the Ganga: when waste water meets a sacred river, University of Michigan Press, Ann Arbor.
- Leach, M. and R. Mearns (Ed.), 1996, The Lie of the Land: Challenging Received Wisdom on the African Environment, London and Oxford: The International African Institute and James Curry.
- Milton, Kay, 1993, Environmentalism: The view from Anthropology, Routledge
- Mehta, Lyla, 2001, The Manufacture of Popular Perceptions of Scarcity: Dams and Water related Narratives in Gujarat, India. World Development 29 (12), pp. 2025-2042.
- Schama, Simon, 1995, Landscape and Memory, London, Harper Collins.
- Savyasachi, 1994, The Tiger and the Honeybee. Seminar 423: 30-35
- Thorner, Daniel ed, 1996 Agricultural Atlas of India , 1920, Karachi, Oxford University Press.
- White, Leslie A., 1959, The Evolution of Culture, McGraw-Hill, New York.
- Zimmerman, F. 1982, The Jungle and the Aroma of Meats, Berkeley, University of California Press.

  
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Sample Question Paper for End Semester Examination for 04.03 and 02 Credits

Roll No:.....

Total Pages.....

(June- 2023)

M.Sc. Environmental Sciences Examination

ENV ID-6201 (ii)

Culture and Environment

Semester-II

Time: 3 Hours

Max. Marks: 60

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**Section-A**

1. Explain the concept of Culture. Describe the role of culture in adaptation of human populations. (12)
2. Write a note on Linkage between Organizational Culture and Environmental Strategy. (12)

**Section-B**

3. Describe Social and Cultural implications of various forms of adaptation. (12)
4. Write a note on distribution and exchange of resources as Political economy of the state. (12)

**Section-C**

5. Explain development and Environment. (12)
6. How development policy defines environmental degradation. (12)


**Section-D**

7. Define Landscapes. Explain how landscapes are invested with cultural meaning. (12)
8. Write a note on changes in landscape over time and their cultural and ecological implications. (12)

**Section-E (Compulsory Question)**

9. Attempt all the questions. Write short notes on the following:

- (a) Landscape (2)
- (b) Inequities and environmental exploitation (2)
- (c) Hunting and Food gathering Pastoralism (2)
- (d) Shifting Cultivation (2)
- (e) Material Culture vs Environment (2)
- (f) Development of environmentally aware corporate cultures (2)

  
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ENV ID-6201 (iii) General Science in daily life							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

#### Course Objectives (COs)

- To study about food additives, adulterants and contaminants.
- To learn about dyes, cosmetics, soaps and detergents.
- To aware students about the chemistry involved in the daily life.

<b>Unit I: General science in surroundings</b>	<b>07 Lectures</b>
Chemical composition and effects: red and silver liquids in thermometers, eco-friendly thermometer, disappearing inks, blue color in blue jeans, permanent hair straightening, no tear phenomenon of shampoos, fire extinguishers, puffiness of pastry, chlorine addition in swimming pool, Difference between hard and soft contact lenses, cool sensation in tooth paste and mouthy fresheners.	
<b>Unit 2: Dyes, cosmetics, Soaps and detergents</b>	<b>8 Lectures</b>
Dyes: Classification, composition and effects on human health – paints and varnish. Cosmetics: composition and effects - Hair dye, hair spray; shampoo; suntan lotions; Face powder; Lipstick, Talcum powder; Nail enamel; Creams (cold, shaving creams). Alcohol free cosmetics, Soaps & Detergents: Definition, classification, manufacturing and composition.	
<b>Unit 3: Food additives, adulterants, and contaminants</b>	<b>7 Lectures</b>
Composition and effects: Food preservatives like benzoates, propionates, sorbates, disulphites. Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose, and sodium cyclamate. Flavors: Vanillin, alkyl esters, and monosodium glutamate.	
<b>Unit 4: Vitamins, Plastics- polymers</b>	<b>8 Lectures</b>
Vitamins: Classification, Sources, deficiency diseases of Vitamin A1, Vitamin B1, Vitamin C, Vitamin D, Vitamin E & Vitamin K1. Plastics – polymers composition and applications - Bakelite and celluloid, polyethylene, polyvinyl chloride, polystyrene, polypropylene.	

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### Course Learning Outcomes (CLOs)

- Provide knowledge about the general science involved in daily life style.
- Aware about various food preservatives, adulterants and additives.
- Build knowledge about the Sources, role and deficiency symptoms of Vitamins
- Be aware of the applications of polymers in daily life.

### Suggested Readings:

- Chemistry in daily life – Kirpal Singh, PHI Pvt Ltd, New Delhi, 3rd edition, 2012
- B. K. Sharma: Introduction to Industrial Chemistry, Goel Publishing, Meerut (1998)
- Medicinal Chemistry- Ashtoush Kar. Analysis of Foods – H.E. Cox: 13
- Fred Billmeyer: Textbook of polymer science; Willey 3rd addition

  
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**Sample Question Paper for End Semester Examination for 04.03 and 02 Credits**

Roll No:.....

Total Pages.....

(June- 2023)

**M.Sc. Environmental Sciences Examination**

**ENV ID-6201 (iii)**

**General Science in daily life**

**Semester-II**

**Time: 3 Hours**

**Max. Marks: 60**

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**

1. Write about Chemical composition and effects of red and silver liquids in thermometers, eco-friendly thermometer. (12)
2. Give explanatory note on Chlorine addition in swimming pool, Fire Extinguishers and no tear phenomenon of shampoos and Cool sensation in tooth paste and mouth fresheners. (12)

**SECTION-B**

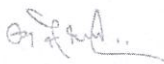
3. What are Dyes? Give its classification. Explain about the composition and effects on human health in reference to paints and varnish. (12)
4. Give short note on the composition and effects of Alcohol free cosmetics, Hair dye, Suntan lotions and Classification as well as composition of Detergents. (12)


**SECTION-C**

5. Explain the Composition and effects of Flavors i.e. Vanillin, alkyl esters, and monosodium glutamate in food. (12)
6. Give explanatory note on the following Food preservatives and artificial sweetners:
  - a) Benzoates and Propionates (4)
  - b) Aspartame and Saccharin (8)

**SECTION-D**

7. Explain Classification, sources of Vitamin A1, Vitamin B1 and Vitamin C. Also discuss deficiency diseases of these. (12)
8. Discuss about the composition and applications of Bakelite and celluloid, polyethylene polymers. (12)

  
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### SECTION-E (Compulsory)

9. Attempt all the questions. Write short notes on the following:

- a) Difference between soft and hard contact lenses (2)
- b) Composition of soap (2)
- c) Effect on human health due to artificial sweetners (2)
- d) Bakelite (2)
- e) Polystyrene (2)
- f) Diseases caused due to deficiency of Vitamin C and Vitamin K1 (2)

  
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ENV-6205P Environment Science Lab – II							
Environmental Monitoring Analysis (Water And Soil Analysis)							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	8	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

#### Course Objectives (COs)

- The students will be trained in designing the scientific methods/experiments to study various physicochemical parameters of water and soil in laboratory/field conditions and basic knowledge of green technology.

#### List of Experiments

*Note: Students are required to perform at least 7 experiments*

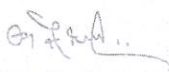
Sr No	Name of Experiment
1	Determination of pH and Conductivity of water.
2	Determination of oil and grease in water.
3	Determination of DO, BOD, COD/Total Organic Content.
4	Determination of hardness of water.
5	Determination of Turbidity of water.
6	Determination of sulphate in a given sample of water
7	To estimate phosphate/Nitrate/Nitrite in a given sample of water.
8	Determination of Total solids, Suspended Solids and Total dissolved solids in water.
9	To study the chemical reactions involved in green nanotechnology: Nanoparticle production and characterization.
10	Determination of Salinity of soil/ water.

#### Course Learning Outcomes (CLOs)

- To examine the chemistry and composition of water.
- To know the concept of physical and chemical properties of soil and water.
- Will be familiar practically with basic knowledge of Green technology.

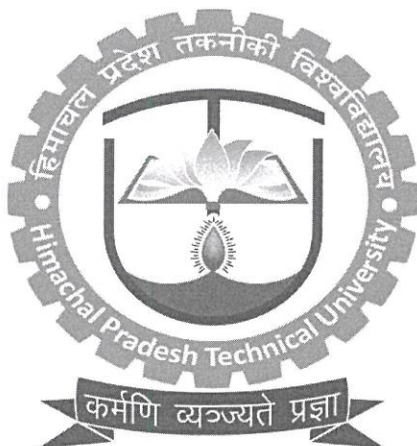
#### Suggested Readings:

- H. Kaur, (2016). Environmental Chemistry: Pragati Prakashan, Meerut-250001, ISBN-10 9385904515
- Manahan, Stanley E. "FRONTMATTER" Environmental Chemistry Boca Raton: CRC Press LLC, 2000.
- A K De Environmental Chemistry, 4th Edition, New Age International (P) Ltd., New Delhi 110002.

  
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**HIMACHAL PRADESH TECHNICAL UNIVERSITY  
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**Syllabus**

*for*

**M.Sc. Environmental Sciences**

*(Semester - III)*

*(Two years program spread over four semesters)*

As per National Education Policy (NEP)-2020

(w.e.f. the Academic Year 2023-2024)

  
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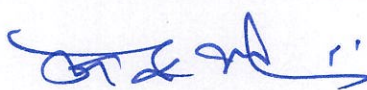


**Scheme of Teaching and Examination**  
**Master of Environmental Sciences (M.Sc. Environmental Sciences)**

**Semester-III**

Subject Code	Course Category	Subject Title/ Subject Name	Periods			Credits	Evaluation Scheme					Total
			L	T	P		ESE	Internal Assessment				
								PE-I & II	TA	A	Total	
ENV-7301	CC	Environmental Analytical Techniques	04	0	0	04	60	20	15	05	40	100
ENV-7302	CC	Natural hazards and disaster management	02	0	0	02	60	20	15	05	40	100
ENV-7303	CC	Toxic and Hazardous Waste Management	04	0	0	04	60	20	15	05	40	100
ENV-7304	CC	Environmental Impact & Risk Analysis	02	0	0	02	60	20	15	05	40	100
ENV-7305	CC	Natural Resource Conservation	02	0	0	02	60	20	15	05	40	100
ENV-7306	CC	Research methodology, Statistics and Computer Applications	04	0	0	04	60	20	15	05	40	100
ENV RP-7307	RP-I	Research Project-I/Seminar-I (Minor)	02 (Contact Hrs 02 per week group wise)			02	60	20	15	05	40	100
Lab Course												
ENV-7308P	LAB-III	Environment Science Lab - III	0	0	08	04	60	20	15	05	40	100
Total			20	0	08	24	480	160	120	40	320	800

<b>Legends:</b>	<b>CC - Core Course</b>	<b>PE-Periodical Examination</b>
	<b>SEC - Skill Enhancement Course</b>	<b>ESE - End Semester Examination</b>
	<b>VAC - Value Addition Course</b>	<b>TA - Teacher's Assessment</b>
	<b>DSE - Discipline Specific Electives</b>	<b>A - Attendance</b>
	<b>ID - Inter Departmental Elective Course</b>	<b>L - Lecture</b>
	<b>P - Practical</b>	<b>T - Tutorial</b>
	<b>RP- Research Project</b>	

  
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ENV-7301-ENVIRONMENTAL ANALYTICAL TECHNIQUES							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
4	0	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

#### Course Objectives (COs)

- The course teaches students how to identify fundamental phenomena, how to formulate theoretical models, and how to quantitatively test models by comparison to observations.
- Students are provided with real datasets so that they can engage in these processes independently and creatively.

<b>Unit I: Sampling Methods</b>	<b>15 Lectures</b>
Types of Sampling and Their Method, Probability Sampling, Random Sampling, Systematic Sampling, Stratified Sampling, Non-Probability Sampling, Quota Sampling, methods of air, water, soil sampling, Precision, Accuracy and Error.	
<b>Unit II: Instrumental Techniques in Environmental Analysis</b>	<b>15 Lectures</b>
Principles of Analytical Methods: Titrimetric method, Gravimetric method, Colorimetric method, Spectrophotometry, Atomic Absorption Spectrophotometry and Flame Photometry, Fourier Transform Infrared (FTIR), Inductively Coupled Plasma Atomic Emission Spectroscopy (ICPAES).	
<b>Unit III: Biophysical methods</b>	<b>15 Lectures</b>
Fluorescence, UV, Visible, NMR and ESR spectroscopy, Analysis of biomolecules using UV/visible, X-ray fluorescence, X-ray diffraction and NMR, analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods, GC - MS/LC - MS.	
<b>Unit IV: Principles and applications of Gel-filtration</b>	<b>15 Lectures</b>
Ion exchange and Affinity chromatography; Thin layer gas chromatography; GLC, HPLC; Electrophoresis and Electrofocusing; Ultracentrifugation	

  
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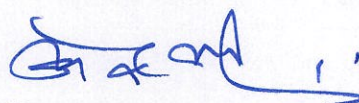


### Course Learning Outcomes (CLOs)

- Students will receive hands-on training in key analytical methods, data interpretation and the scientific reporting of results.
- Students taking this course will develop a thorough understanding and hands on experience of modern laboratory techniques by analysing a suite of samples.
- The students will summarise their critical understanding of these techniques and the data generated in the form of an independent scientific report which include a full environmental interpretation of the results.

### Suggested Readings:

- Cochran, W.G. (1963) Sampling Technique. 2nd Edition, John Wiley and Sons Inc., New York
- Handbook of HPLC. Danilo Corradini, Elena Eksteen (Katz), Roy Eksteen, Peter Schoenmakers, Neil Miller. CRC Press.
- Introduction to Modern Liquid Chromatography, 3rd Ed. Lloyd R. Snyder, Joseph J. Kirkland, and John W. Dolan. ISBN-13: 978-0470167540.
- Wilson K. and Walker J. (Eds.) (1995). Practical Biochemistry: Principles and Techniques, Cambridge University Press, U.K.
- Riley, T. and Tomilson, C. (1987). Principles of Electroanalytical Methods. John Wiley and Sons Ltd, Chichester, England.
- Sheehan, D. (2000). Physical Biochemistry: Principles and Applications, John Wiley and Sons Ltd., Chichester, England.
- Pungor, E. (1995). A Practical Guide to Instrumental Analysis. CRC Press LCC, U.S.A
- Mahmood Barbooti (2015). Environmental Applications of Instrumental Chemical Analysis, ISBN 9781774633694
- Karan Sareen, Instrumental Methods Of Environmental Analysis 2001, ISBN-10: 817890005X, ISBN-13: 978-8178900056
- Keith A. Smith, Malcolm S. Cresser, Soil and Environmental Analysis, Modern Instrumental Techniques, CRC Press, eBook ISBN 9780429223594
- Pradyot Patnaik, Handbook of Environmental Analysis, CRC Press, eBook ISBN 9781315151946, doi:<https://doi.org/10.1201/9781315151946>



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*Sample Question Paper for End Semester Examination for 04.03 and 02 Credits*

Roll No:.....

Total Pages.....

(June- 2024)

**M.Sc. Environmental Sciences Examination**  
**ENV-7301**  
**ENVIRONMENTAL ANALYTICAL TECHNIQUES**  
**Semester-III**

**Time: 3 Hours**

**Max. Marks: 60**

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**

1. What do you understand by sampling? Discuss different types of sampling methods in case of soil sampling. (12)
2. Write in detail about Stratified Sampling and Non-Probability Sampling methods in detail. (12)

**SECTION-B**

3. Explain in detail about the principle of following instrumental techniques: (6,6)
  - a) Titrimetric method
  - b) Gravimetric method
4. Explain the following:
  - a) ICPAES (8)
  - b) Atomic Absorption Spectrophotometry (4)

**SECTION-C**

5. What do you know about Mass spectrometry? Discuss different types of Mass spectrometry in detail. (12)
6. Write note on the following spectroscopic techniques:
  - a) UV-Visible (6)
  - b) NMR (6)

**SECTION-D**

7. Discuss in detail basic Principle and Methodology of Gas Chromatography. (12)
8. Discuss applications of Gas Chromatography.

  
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### SECTION-E (Compulsory)

9. Attempt all the questions. Discuss following:

- a) Ion Exchange Chromatography (2)
- b) NMR spectroscopy in analysis (2)
- c) HPLC (2)
- d) Gas Chromatography (2)
- e) Quota Sampling (2)
- f) Colorimetric method (2)



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ENV-7302 NATURAL HAZARDS AND DISASTER MANAGEMENT							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

#### Course Objectives (COs)

- Impart basic concepts of disaster, its causes, and its historical background.
- Enhance student's knowledge about disaster management planning.
- Make the students learn advanced approaches to deal with disaster management.
- To understand approaches of Disaster Risk Reduction with the relationship among disaster vulnerability, prevention, and risk reduction

<b>Unit I: Introduction to Hazards</b>	<b>08 Lectures</b>
Hazards and Disasters, Hazard Classification – Natural hazards and Technological hazards, Effects of hazards, Vulnerability and susceptibility of hazards, Assessing hazards and risks, Hazard prediction and warning, A brief introduction to biological hazards- Biological warfare, Anthrax.	
<b>Unit II: Earthquakes, Landslides and Volcanoes</b>	<b>08 Lectures</b>
Earthquakes - Types and Distribution of earthquakes, Prediction and control of earthquakes, Tsunami, mass movements; types, affecting factors, prediction, prevention & control and effect of mass movements. Volcanoes- Distribution, types, eruption processes, Factors, Products.	
<b>Unit III: Water related hazards</b>	<b>07 Lectures</b>
Different kinds of floods, Factors leading to floods, Factors affecting floods, Floods and their associated hazards, Flood control measures, Prediction of floods. Factors leading to drought, drought consequences, strategies for drought mitigation, Desertification – Factors causing desertification, famine, El Nino and their effects.	
<b>Unit IV: Weather related Hazards</b>	<b>07 Lectures</b>
Effects of cyclones, genesis of a cyclone, Behavior of a cyclone and their forecast, Factors affecting cyclone hazards, Structure of a tropical cyclone, Size of tropical cyclones, Cyclone risk and mitigation strategies, Storm surge, Hurricane, cyclones and tornadoes, thunderstorms, lightning.	

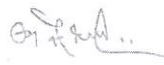
  
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### Course Learning Outcomes (CLOs)

- Explain various types of Environmental disasters and responsible factors.
- Interpret and discriminate different stages of disaster management planning and utility tools in every stage.
- Understand the administrative structure of disaster management in India and know the ethical and humanitarian values.
- Apply advanced techniques in disaster management and disaster risk reduction.

### Suggested Readings:

- Abbott, Patrick L. 2004. Natural disasters. 4th ed. Boston, McGraw-Hill Higher Education. Alexander, David. 2000. Confronting catastrophe: new perspectives on natural disasters. New York, Oxford University Press.
- Allison, I. S. and Palmer, D. F. 1980. Geology, the science of a changing Earth. VII Edition. McGraw-Hill Inc.
- Cesare Emiliani 1992. Planet Earth -Cosmology, geology and the evolution of life and the environment. Cambridge University press U.K.
- Robinson, A.G. 2002. Earthshock: hurricanes, volcanoes, earthquakes, tornadoes, and other forces of nature. Rev. Ed. New York,
- Thames & Hudson, 2002. Smith, Keith. 2002. Environmental hazards: assessing risk and reducing disaster. 3rd ed. London, New York, Routledge.
- Disaster Management Guidelines, GOI-UND Disaster Risk Program (2009-2012)
- Damon, P. Copola, (2006) Introduction to International Disaster Management, Butterworth Heineman.
- Gupta A.K., Niar S.S and Chatterjee S. (2013) Disaster Management and Risk Reduction, Role of Environmental Knowledge, Narosa Publishing House, Delhi.
- Murthy D.B.N. (2012) Disaster Management, Deep and Deep Publication PVT. Ltd. New Delhi.
- Modh S. (2010) Managing Natural Disasters, Mac Millan publishers India LTD. Waugh, William L. Jr. (2000). Living with Hazards, Dealing with Disasters: An Introduction to Emergency Management. Armonk, New York: M.E. Sharpe.
- Burby, Raymond (1998). Cooperating with Nature: Confronting natural hazards with land-use planning for sustainable communities. Joseph Henry Press

  
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Sample Question Paper for End Semester Examination for 04.03 and 02 Credits

Roll No:.....

Total Pages.....

(June- 2023)

M.Sc. Environmental Sciences Examination

ENV-7302

NATURAL HAZARDS AND DISASTER MANAGEMENT

Semester-III

Time: 3 Hours

Max. Marks: 60

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**

1. Describe Hazards Vulnerability Analysis along with its significance. Explain hazard prediction and warning. (12)
2. What do you understand by Biological Hazards? Give examples. (12)

**SECTION-B**


3. Describe the classification and distribution of earthquakes with suitable diagrams. (12)
4. Describe in detail the classification of mass movement. What are the factors affecting mass movement. (12)

**SECTION-C**

5. What are the causes for floods and factors affecting flood? What measures can be taken for flood mitigation? (12)
6. What is desertification? Explain various causes of desertification and the role of desertification in climate change. (12)

**SECTION-D**

7. Describe the structure of a tropical cyclone. What are the factors affecting cyclone formation? (12)
8. What are the various types of disaster? Discuss with examples. (12)

  
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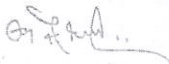
  
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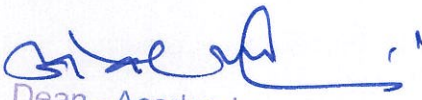


### SECTION-E (Compulsory)

9. Attempt all the questions. Discuss following:

- a) What is the difference between a hazard and a disaster? (2)
- b) What is the rationale behind Disaster Management Act, 2005? (2)
- c) What is the difference between hurricane and cyclone? (2)
- d) What is a tornado? (2)
- e) What is a storm surge? (2)
- f) Define El Nino and their effects. (2)

  
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ENV-7303 TOXIC AND HAZARDOUS WASTE MANAGEMENT							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
4	0	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

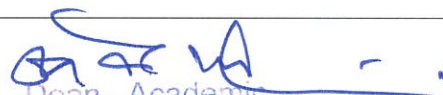
**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

#### Course Objectives (COs)

- To understand the methods available for solid waste disposal.
- To evaluate the health risks posed by abandoned waste sites and waste disposal operations.
- To understand the Life cycle inventory of Solid Waste Management.
- To evaluate the legislation designed to control the production, clean up and disposal of solid and hazardous waste disposal operations.

<b>Unit I: Introduction of toxic and hazardous waste</b>	<b>15 Lectures</b>
Chemical pollutant: Pathway of entry, Bioactivation, Detoxication, oxidation, hydrolysis, biodegradation, groundwater contamination, and overall persistence in the environment related to physical properties: Vapour pressure, Vapour density, Solubility.	
<b>Unit II: Cancer causing chemicals</b>	<b>15 Lectures</b>
Concept of carcinogenesis, Insecticides, Aesbestos, Flyash, ozone and PAN pesticides as carcinogens, Biochemical aspects of Arsenic, Cadmium, Lead, Mercury and Carbon monoxide.	
<b>Unit III: Toxic and hazardous substances</b>	<b>15 Lectures</b>
Toxic and hazardous characteristics of various organic chemicals: Acids, Aldehydes, Amines, Dioxins, Ethers, Cyanides. Common Toxic and Flammable Gases including: Hydrogen, Nitrogen Oxide, Carbon mono and dioxide.	
<b>Unit IV: Carbon management</b>	<b>15 Lectures</b>
Various chemical reaction involved in carbon management like as Kolbe-Schmitt, Carboxylation, cyclization, polymerization, amination, Boudouard reaction, Friedel-Crafts acylation, Reductive hydrogenation, photochemical and Formato-metal complex reactions, Carbon capture from adsorbents, Membrane based separation.	

  
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### Course Learning Outcomes (CLOs)

- The students would understand the hierarchical structure in solid waste management and the need for a sustainable solution.
- To characterize the solid waste qualitatively as well as quantitatively for better management approaches.
- To integrate GIS techniques for the identification of better site and development of better management plans.
- To understand the main aspects of waste policy and regulations and would be able to come up with significant policy interventions needed.

### Suggested Readings:

- Kreith, Frank (ed.) (1994). Handbook of solid waste management. McGraw- Hill. Inc., New Delhi.
- Kumar, S. (2016). Municipal Solid Waste Management in Developing Countries, Taylor and Francis, ISBN-13:978-1-4987-3774-6.
- Michael D. LaGrega, Phillip I. Buckingham, Jeffrey C. Evans (2010). Hazardous Waste Management by Environmental Resource Management, ISBN 978-1-57766-693-6.
- George Tchobanoglous G. and Kreith F. Handbook of Solid Waste Management, Butterworth-Heinemann, 2003.
- White P., Franke M. and Hindle P. Integrated Solid Waste Management: A Life Cycle Inventory; Springer, 2011.
- Reddy P.J. Municipal Solid Waste Management, CRC Press, 2011.
- Chandrappa R. and Das D.B. Solid Waste Management, Springer, 2012
- P. Patnaik, A Comprehensive Guide to the Hazardous Properties of Chemical Substances (III Ed.) John Wiley & Sons, Inc., Hoboken, New Jersey
- H. K. Moffatt and Shuckburgh, Environmental Hazards, Imperial College Press. (ISBN 978-981-4313-28-5)
- L. C. Batty and K. B. Hallberg, Ecology of Industrial Pollution, Cambridge University press, New Delhi.
- C. Oloman, Material and Energy Balance for Engineers and Environmentalist, Imperial College Press. (ISBN 978-1-84816-368-3).
- T. F. Yen, Chemical Processes for Environmental Engineering, Imperial College Press. (ISBN 978-1-86094-759-9).
- C. N. Madu, Environmental Planning and management, Imperial College Press. (ISBN 978-1-86094-671-4).
- Health Hazards of Environmental Arsenic Poisoning, Imperial College Press. (ISBN 978-981-4291-81-1)

  
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*Sample Question Paper for End Semester Examination for 04.03 and 02 Credits*

Roll No:.....

Total Pages.....

(June- 2023)

M.Sc. Environmental Sciences Examination

ENV-7303

TOXIC AND HAZARDOUS WASTE MANAGEMENT

Semester-III

Time: 3 Hours

Max. Marks: 60

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**

1. Explain the following:
  - a) Chemical pollutant and its pathway of entry. (4)
  - b) Oxidation, hydrolysis and biodegradation of the chemical pollutant. (8)
2. Describe groundwater contamination and overall persistence in the environment (12)  
related to physical properties Vapour pressure, Vapour density and Solubility.

**SECTION-B**

3. Describe carcinogenesis and role of Insecticides and PAN pesticides as carcinogens (12)  
in the Environment.
4. Explain the Biochemical aspects of the following:
  - a) Arsenic, Cadmium and Lead (6)
  - b) Mercury and Carbon monoxide. (6)

**SECTION-C**

5. Write about Toxic and hazardous characteristics organic chemicals:
  - a) Acids and Aldehydes (6)
  - b) Dioxins and Ethers (6)
6. What is the role and effects of following Toxic and Flammable Gases: (6)
  - a) Hydrogen and Nitrogen Oxide. (6)
  - b) Carbon mono and carbon dioxide.

**SECTION-D**

7. Explain the following reactions and their role in carbon management:
  - a) Kolbe-Schmitt reaction and Boudouard reaction. (6)
  - b) Friedel-Crafts acylation reaction. (6)
8. Describe in detail Carbon capture from various adsorbents. (12)

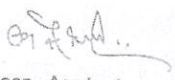


  
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### SECTION-E (Compulsory)

9. Attempt all the questions. Write short notes on the following:

- a) Bioactivation (2)
- b) Detoxication (2)
- c) Carcinogenesis (2)
- d) Membrane based separation (2)
- e) Carbon adsorbent (2)
- f) PAN (2)

  
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ENV-7304 ENVIRONMENTAL IMPACT & RISK ANALYSIS							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

#### Course Objectives (COs)

- To explain the basic principles of environmental impact and risk assessment
- To understand the different steps within environmental impact assessment.
- To discuss the implications of current jurisdictional and institutional arrangements in relation to environmental impact assessment.
- To understand how to liaise with and the importance of stakeholders in the EIA process.

<b>Unit I: Introduction to EIA and Environmental Planning</b>	<b>07 Lectures</b>
Origin, aims and needs of EIA, EIA guidelines 1994, EIA notification and amendments; Environmental Impact Assessment (EIA) as a tool in environmental management, EMS, ISO 14001. Baseline information and predictions (Land, water, atmosphere, energy etc.), Restoration and rehabilitation technologies.	
<b>Unit II: EIA Methodology</b>	<b>08 Lectures</b>
Types of Projects requiring Environmental Clearance, Types of EIA, Project screening, Scoping, Base-line study, Impact identification, Prediction and assessment of impacts, Mitigation measures. Public participation, review and decision making, Generic structure of EIA Document, Composition of EAC, SEAC, Benefits and future of EIA.	
<b>Unit III: Environmental Audit</b>	<b>07 Lectures</b>
Introduction, concepts, steps, methodology. Environmental Auditing: Procedure, Matrix methods and Batelle method of auditing, National Environmental Policies and guidelines for environmental audit in India, Environmental impact statement.	
<b>Unit IV: Prediction, Assessment and Case Studies</b>	<b>08 Lectures</b>
Prediction and Assessment of Impacts on Water Environment, Air Environment, Noise Environment, Biological Environment, Cultural and Socio-cultural Environment, Strategic Environmental Assessment (SEA), Environmental Impact Assessment of major developmental projects – river valley projects, mining projects, thermal power plants, transport (rail, road highway), oil refineries and petrochemicals. Prediction and assessment of impacts on the biological, cultural and socioeconomic environments.	

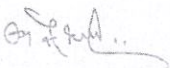
## Course Learning Outcomes (CLOs)

By the end of the course, the student should be able to:

- Understand the basics of EIA and legal implications.
- Understand the strategic and organizational context of environmental management in different settings and design and deliver practical outcomes that contribute positively to environmental performance.
- Synthesize and prioritize information from desktop and field environmental assessments, rank the relative values identified, assess the risks imposed by the development, and determine appropriate environmental management strategies.
- Articulate and justify specific policies or courses of action on complex environmental issues using discipline based knowledge and established management principles.

## Suggested Readings:

- Glasson, J. Therivel, R. and Chadwick, A. (2006). Introduction to Environmental Impact Assessment. Routledge, London.
- Jain, R.K., Urban L.V. and Stacey, G.S. (1981). Environmental Impact Analysis: A New Dimension in Decision Making. Van Nostrand Reinhold Company, New York.
- Kreske, D.L. (1996). Environmental Impact Statement: A practical guide for agencies, citizens and consultants. John Wiley and Sons Inc., New York.
- Kulkarni, V.S., Kaul, S.N. and Trivedi, R.K. (2002). A Handbook of Environmental Impact Assessment. Scientific Publishers, India.
- Petts, J. (2005). Handbook of Environmental Impact Assessment-Volume 1 and 2, Blackwell Publishers, UK.
- Anjaneyulu, Y. and Manickam, V. Environmental Impact Assessment Methodologies. B.S. Publications. 2002.
- Cutter, S. L. Environmental Risks and Hazards. Prentice Hall of India, New Delhi. 1999.
- Morris, P. and Therivel R. (Eds) Methods of Environmental Impact Assessment. 2nd ed, Spon Press London. 2001.
- Rao, P. S. and Rao, P.M. Environmental Management and Audit. Deep and Deep Publications. 2000.

  
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Sample Question Paper for End Semester Examination for 04.03 and 02 Credits

Roll No:.....

Total Pages....

(June- 2023)

M.Sc. Environmental Sciences Examination

ENV-7304

ENVIRONMENTAL IMPACT & RISK ANALYSIS

Semester-III

Time: 3 Hours

Max. Marks: 60

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**

1. Explain the origin aim and the need of EIA. (12)
2. Explain the principle, objectives and procedure of restoration and rehabilitation technologies (12)

**SECTION-B**

3. What are the type of EIA? Explain in detail. (12)
4. Write note on:
  - a) Baseline study (6)
  - b) Public participation in EIA. (6)

**SECTION-C**

5. Explain environment audit process in detail. Discuss the importance of EIA activities for developing country. (12)
6. Give detail account of National Environmental Policies in India. (12)

**SECTION-D**

7. Explain case study on River Valley project and oil refineries. (12)
8. Describe the impacts of prediction and assessment on cultural and biological environment. (12)

  
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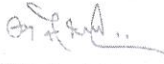
  
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### SECTION-E (Compulsory)

9. Attempt all the questions. Write short notes on the following:

- a) SEAC (2)
- b) Screening (2)
- c) EIS (2)
- d) ISO 14001 (2)
- e) Generic structure of EIA document. (2)
- f) Noise Environment (2)

  
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ENV-7305 NATURAL RESOURCE CONSERVATION							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

#### Course Objectives (COs)

- To impart knowledge to become part of professional organizations working in the field of conservation.
- To generate a skilled postgraduate who can research in the field of Biodiversity, Wildlife biology, and nature conservation.
- To provide an alternate avenue for students to specialize as —environmental entrepreneurs| in areas such as environmental audits, Environmental education, Ecotourism, etc.
- To create awareness about Biodiversity and Nature Conservation.

<b>Unit I: Introduction to Natural Resources</b>	<b>08 Lectures</b>
Concept and classification of resource and natural resources, valuation of natural resources, Factors influencing resource availability, distribution, and uses. Inter-relationships among different types of natural resources. Factors influencing resource availability, distribution and uses, Need for Conservation of Natural Resources.	
<b>Unit II: Water and Wildlife Resources</b>	<b>08 Lectures</b>
Water Resources, degradation of water, conservation of water, Principles and key elements of IWRM, Wildlife, need and methods for the conservation of wildlife, wildlife reserves in India and legislation for wildlife conservation, Ocean, Land Resources: Land as a resource, land degradation, anthropogenic landslides, soil erosion, and desertification, Minerals, Soil Erosion Causes of soil Erosion and Conservation of Soil.	
<b>Unit III: Biological Energy Resources</b>	<b>07 Lectures</b>
Biological Resources, threat to biodiversity, conservation of biodiversity, Energy resources: Growing energy needs, Types of energy resources, conventional and non-conventional source of energy, use of alternate energy sources: bio fuel and its advantages, Human Resource.	
<b>Unit IV: Management and Conservation of Natural Resources</b>	<b>07 Lectures</b>
Conservation of Natural Resources and Traditions of India: Sacred Grooves, Management of Common International Resources: Ocean, climate, International fisheries and management commissions; Antarctica: the evolution of an international resource management regime.	

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## Course Learning Outcomes (CLOs)

By the end of the course, the student should be able to understand

- Students will be competent in basic natural resources.
- Students will gain knowledge of the components of natural resources.
- Students will be able to apply knowledge to solve problems related to natural resources conservation and management.
- Students will be able to write in a style appropriate for technical or informative publications for various audiences related to wildlife & natural resources conservation and management.

## Suggested Readings:

- Chiras D D, Reganold J Pand Owen O S. Natural resource Conservation: Management for a sustainable future. Prentice Hall Publishers, ISBN 0-13-145832.
- Kesler S E. Mineral resources Economics and the Environment. Prentice Hall Publishers (Pearson Education), ISBN: 0023628421.
- Gangstad E O 1990. Natural resource management of water and land. Van Nostrand Reinhold. ISBN 0442004818, 9780442004811
- Daniel, D., Chiras and Reganold, John P. Natural Resource Conservation: Management for a Sustainable Future (X Ed.), Addison Wesley, Boston. 2009.
- Singh, N. Irabanta. Endemic Bioresources of India, Bishan Singh Mahendra Pal Singh, Dehradun. 2008.
- Enger, E.D. and Smith, B.F. Environmental Science: A Study of Interrelationships. 11th ed. McGraw Hill Inc., USA. 2006.
- Heywood, V.H. and Watson, R. T. Global biodiversity Assessment. UNEP Cambridge, 1995.
- Hunter, Malcolm L., Jr., and Gibbs, James P. Fundamentals of Conservation Biology. 3rd ed. Wiley-Blackwell. 2006.

  
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Sample Question Paper for End Semester Examination for 04.03 and 02 Credits

Roll No:.....

Total Pages....

(June- 2023)

M.Sc. Environmental Sciences Examination

ENV-7305

NATURAL RESOURCE CONSERVATION

Semester-III

Time: 3 Hours

Max. Marks: 60

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**

1. Explain the role of individuals in conservation of natural resources. (12)
2. Describe the significance of equitable use of resources for sustainable living. (12)

**SECTION-B**

3. Discuss on the types of soil erosion and control methods to prevent soil erosion. (12)
4. Explain the strategies for watershed management (12)

**SECTION-C**


5. Give environmental impacts of different non-conventional energy resources. (12)
6. Explain the major threats to biodiversity. (12)

**SECTION-D**

7. Discuss the global mitigation strategies for climate change. (12)
8. Explain the management of international resources. (12)

**SECTION-E (Compulsory)**

9. Attempt all the questions. Write short notes on the following:
  - a) Chipko movement (2)
  - b) Conventional Energy sources (2)
  - c) Ground water depletion (2)
  - d) Rare species (2)
  - e) Biodiesel (2)
  - f) IPCC (2)

  
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ENV-7306 RESEARCH METHODOLOGY, STATISTICS AND COMPUTER APPLICATIONS							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
4	0	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

#### Course Objectives (COs)

- To develop an understanding of the basic framework of the research process
- The course aims to augment the aptitude of research among students
- To facilitate the students in understanding the tools and techniques of conducting research
- To develop an understanding good laboratory practice.

<b>Unit I: Introduction to Research and Scientific Writing</b>	<b>15 Lectures</b>
Characteristics and types of Scientific Research, Organizing Scientific Research: Experimental Design, Research Methodology, Sampling designs, Writing research proposals, research paper, reviews, thesis, conference reports, book reviews, project reports, reference writing and scientific abbreviations, Preparation and delivery of scientific presentations.	
<b>Unit II: Basic Concepts of Statistics</b>	<b>15 Lectures</b>
Importance and scope of Statistics, Attributes and Variables, types of variable, Scales of measurements, level of measurement, Diagrammatic (Line, bar, pie diagram) and Graphic (Histogram, frequency polygon, frequency curve, cumulative frequency curve) representation of data, Measures of central tendency – Mean (AM, GM and HM), Mode and Median.	
<b>Unit III: Probability Distribution and Statistical Tests</b>	<b>15 Lectures</b>
Measures of dispersion, Skewness and Kurtosis, Probability distribution - Binomial distribution, Poison distribution, Normal distribution, Test of hypothesis: t-test, ANOVA, two types of errors, Chi square tests and its application, Co-relation and regression, Principles of design of experiments. Examples of CRD and RBD, Analysis of variance (one way and two way analysis of variance)	
<b>Unit IV: Computer Application and Environment System Analysis</b>	<b>15 Lectures</b>
Basics of Computer, structure of Central Processing Unit (CPU); Software: Meaning and types, Application of Software, Operating System and Memory: meaning and types of operating systems, i.e. UNIX, LINUX, MS-DOS, Microsoft Windows; Memory: meaning and types, Storage capacity and Storage media. Application of computers in Environmental Sciences, Environment System.	




## Course Learning Outcomes (CLOs)

The student will be able to:

- Work on the identification of research questions, review the research literature.
- Identify different ways to collect and analyse qualitative and quantitative data
- Develop a good research proposal and further completion of thesis and research publications
- Understanding of good laboratory practices.

## Suggested Readings:

- Environmental Statistics- Handbook of statistics. Ganapati P. Patil, Calyampudi Radhakrishna Rao. Elsevier Science Pub
- Coding for Beginners in easy steps: Basic programming for all ages. Mike McGrath. In Easy Steps Pub
- Jay L Devore: Probability and Statistics for Engineering and the Sciences: CENAGAGE, Learning. Print in India.
- Rice, J.A. (2007): Mathematical Statistics and Data Analysis: CENAGAGE Learning Pvt. Ltd.
- Spiegel M.R. and Stephens J.L. (2010) Statistics, Tata McGraw Hill.
- Das N.G. (2011): Statistical Methods, Tata McGraw Hill.
- Bernard A. Rosner (2011), Fundamentals of Biostatistics, 7th Ed., Cenagage Learning Pvt. Ltd.
- L.W. Neuman. 1997. Social Research Methods: Quantitative and Qualitative approaches. Allyn & Bacon. 560 pp6.
- Vinay Kumar Srivastava. 2004. (ed) Methodology and Fieldwork, Oxford University Press, New Delhi
- Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS 9. Publishers' Distributors
- Kothari, C.R., 1985, Research Methodology- Methods and Techniques, New Delhi,
- C. R. Kothari (2009) "Research Methodology: Methods & Techniques" (Second Revised Edition), New Age International Publishers, New Delhi.
- Kothari C.R., Research Methodology Method and Techniques, New age international (p) Ltd., New Delhi, 2007.
- Wiley Eastern Limited. 12. Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners (2nd Edition), Pearson Education.
- Kendra Cherry: Introduction to Research Methods : available for download at <http://psychology.about.com/od/researchmethods/ss/expdesintro.htm>
- Davis S. Walonick: Elements of a research proposal and report: available for download at <http://www.statpac.com/research-papers/research-proposal.htm>

  
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Sample Question Paper for End Semester Examination for 04.03 and 02 Credits

Roll No:.....

Total Pages....

(June- 2023)

M.Sc. Environmental Sciences Examination

ENV-7306

RESEARCH METHODOLOGY, STATISTICS AND COMPUTER APPLICATIONS

Semester-III

Time: 3 Hours

Max. Marks: 60

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**

1. Define Research. Explain the need and importance of research in Business. (12)
2. a) What is criteria of a good Research? (6)  
b) What is criteria of a good Research? (6)

**SECTION-B**


3. Explain problem identification process in detail with component of research problem. (12)
4. Define hypothesis, How it is formulated and explain various types of research hypothesis. (12)

**SECTION-C**

5. Write short notes on:  
a) Descriptive research design. (6)  
b) Exploratory Research design. (6)
6. What is research design and classification of research design? What is the use of factorial design? (12)

**SECTION-D**

7. What do you mean by collection of research data? Explain in detail various methods? (12)
8. a) Write the importance of personal interview in research. (6)  
b) What are the merit and limitations of group discussion? (6)

  
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### SECTION-E (Compulsory)

9. Attempt all the questions. Discuss following:

- a) Meaning of research. (2)
- b) Research application in social science. (2)
- c) Type of research proposal. (2)
- d) Descriptive Research Design. (2)
- e) Advantages of secondary data. (2)
- f) What is hypothesis? (2)

  
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ENV-7308P Environment Science Lab – III							
HYDROLOGICAL PARAMETERS AND SPECTROSCOPY TECHNIQUES							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
0	0	8	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

#### Course Objectives (COs)

- The students will be trained in designing the scientific methods/experiments to study various parameters for the water balance of river/stream and detection of drinking water standard violations to determination of the environmental state and analysis of temporal water and soil quality trends and characterization of the materials by spectroscopic techniques.

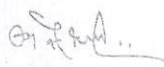
*Note: Students are required to perform at least 7 experiments*

Sr. No	Name of Experiment
1	Determination of chlorine/ fluorine in water.
2	Determination of cadmium/Arsenic/Selenium/copper/iron etc. Metal ions in water.
3	Determination of Acidity and Alkalinity of water.
4	Evaluation of Catchment Characteristics.
5	To determine Flow rate, velocity and volume.
6	To calculate runoff.
7	To determine the soil moisture content.
8	To find the absorbance of sample at different wavelengths.
9	Bio fuel production method and characterization for biodiesel/bioethanol.
10	To study the chemical reactions involved in green nanotechnology: Nanoparticle production and characterization.

#### Course Learning Outcomes (CLOs)

- Aims to raise awareness for the water and soil quality parameters and safeguarding against adverse biological effects from multiple chemical contaminations arising from anthropogenic diffuse emissions and point sources.
- Students will able to understand the role of green technology in environment.
- Characterization of materials will help to understand their properties.



  
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### Suggested Readings:

- H. Kaur, Environmental Chemistry: Pragati Prakashan, Meerut-250001, ISBN-10 9385904515, 2016
- Manahan, Stanley E. "FRONTMATTER" Environmental Chemistry Boca Raton: CRC Press LLC, 2000.
- Lynn Goldman, Christine Coussens, Implications of nanotechnology for environmental health research, National Academic Press, Washington, 2007
- Caye Drapcho, Nhuan Phú Nghiêm, Terry Walker. Biofuels Engineering Process Technology. [McGraw-Hill]. 2008
- Akhlesh Lakhtakia, The Handbook of Nanotechnology. Nanometer Structures: Theory, Modeling, and Simulation. SPIE Press, Bellingham, WA, USA, 2004
- 6. Gurdeep R, Chatwal, Sham K. Anand, Instrumental methods of chemical analysis: Himalaya Publishing House, ISO 9001:2008, ISBN-13: 978-9351420880, 2019.

  
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**HIMACHAL PRADESH TECHNICAL UNIVERSITY  
HAMIRPUR**



**Syllabus**

*for*

**M.Sc. Environmental Sciences**

*(Semester - IV)*

*(Two years program spread over four semesters)*

As per National Education Policy (NEP)-2020

(w.e.f. the Academic Year 2023-2024)

  
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**Scheme of Teaching and Examination**  
**Master of Environmental Sciences (M.Sc. Environmental Sciences)**

**Semester-IV**

Subject Code	Course Category	Subject Title/ Subject Name	Periods			Credits	Evaluation Scheme					Total
			L	T	P		ESE	Internal Assessment				
								PE-I & II	TA	A	Total	
ENV-7401	CC	Meteorology and Climatology	04	0	0	04	60	20	15	05	40	100
ENV-7402	CC	Energy and Environment	04	0	0	04	60	20	15	05	40	100
ENV-7403	CC	Environmental Legislation	02	0	0	02	60	20	15	05	40	100
ENV-7404	DSE	Any one of the following: (i) Green Technology (ii) Toxicology and Occupational Safety	04	0	0	04	60	20	15	05	40	100
ENV-7405	DSE	Any one of the following: (i) Soil Biology (ii) Glaciology (iii) Occupational Hazards	04	0	0	04	60	20	15	05	40	100
ENV RP-7406	RP-II	Research Project-II/Seminar-II (Major)	04 (Contact Hrs 04 per week group wise)			04	60	20	15	05	40	100
Total			22	0	00	22	360	120	90	30	240	600

<b>Legends:</b>	CC - Core Course	PE-Periodical Examination
	SEC - Skill Enhancement Course	ESE - End Semester Examination
	VAC - Value Addition Course	TA - Teacher's Assessment
	DSE - Discipline Specific Electives	A - Attendance
	ID - Inter Departmental Elective Course	L - Lecture
	P - Practical	T - Tutorial
	RP- Research Project	

  
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ENV-7401 Meteorology and Climatology							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
4	0	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

#### Course Objectives (COs)

- To produce graduates who possess quantitative, scientific reasoning skills that can be applied to atmospheric problems.
- To produce graduates who have a general knowledge of a range of atmospheric as well as climatic phenomena and applications, and have expertise in one or more program sub-disciplines or related interdisciplinary areas.
- To produce graduates who are equipped to contribute to solving problems in the meteorological sciences and related disciplines, through service in business or as educators, researchers, and leaders in academia, government, the private sector, and civil society.

<b>Unit 1: Introduction to Meteorology Fundamentals</b>	<b>15 Lectures</b>
Thermal structure of the atmosphere and its composition, Pressure, temperature, wind and wind belts, humidity, virtual temperature, radiation, radiation from sun, solar constant, albedo, emission and absorption of terrestrial radiation, greenhouse effect, net radiation budget.	
<b>Unit II: Atmospheric Air Dynamics</b>	<b>15 Lectures</b>
Atmospheric stability diagrams, turbulence, diffusion, thermodynamic diagrams, T-phigram and mixing height, thermodynamics of dry and moist air, specific gas constant, adiabatic and isentropic processes, entropy and enthalpy, adiabatic processes of moist air.	
<b>Unit III: Climatology Fundamentals</b>	<b>15 Lectures</b>
Classification of climate- Koppen's and Thornthwaite' scheme, Climatic types and their distribution, cloud formation and precipitation, fronts: frontogenesis and frontolysis, Air masses.	
<b>Unit IV: Atmospheric Disturbances</b>	<b>15 Lectures</b>
Monsoon, jet stream, cyclones and anticyclones, tropical disturbances: Hurricanes, Thunderstorms, Tornadoes, Applied climatology.	

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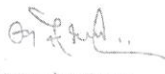
### Course Learning Outcomes (CLOs)

After completion of the course the students will be able to:

- To figure out what the climate will be like in the future.
- The use of latitude and longitude to determine the chance of snow and hail reaching the surface.
- To gain a better understanding of the atmospheric conditions that cause changes in weather patterns and temperature over time.

### Suggested Readings:

- Byers, H.R., General Meteorology, McGraw Hill, 1959.
- Cole, F.W., Introduction to Meteorology, Wiley, 1975.
- Lal, D.S., Climatology, Sharda Pustak Bhawan, Allahabad, ISBN 81-86204-12-1, 2003.
- Griffith, J.F., Applied Climatology, Oxford University Press, 1966.

  
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Sample Question Paper for End Semester Examination for 04.03 and 02 Credits

Roll No:.....

Total Pages....

(June- 2023)

M.Sc. Environmental Sciences Examination

ENV-7401

Meteorology and Climatology

Semester-IV

Time: 3 Hours

Max. Marks:

60

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**

1. a) Explain the Thermal structure of atmosphere and its composition. (8)  
b) Write notes on Wind and Wind Belts. (4)
2. Explain Solar radiation, Solar constant, Albedo and Absorption of terrestrial radiation. (12)

**SECTION-B**

3. Explain the following:  
a) Atmospheric stability and Turbulence (6)  
b) Diffusion and Mixing height. (6)
4. What is thermodynamics of atmosphere explain dry and moist air thermodynamics? (12)

**SECTION-C**

5. Give explanatory note on Koppen's and Thorn Thornwaite scheme for classification of climate. (12)
6. What do you understand by fronts, frontogenesis and frontolysis? Give explanatory note on these. (12)

**SECTION-D**

7. Describe the cyclone warning system in India. How can cyclone risk reduction be carried out in India? (12)
  8. Describe the structure of a tropical cyclone. What are the factors affecting cyclone formation? (12)
- Amal*



### SECTION-E (Compulsory)

9. Attempt all the questions. Discuss following:

- a) Net radiation budget. (2)
- b) Greenhouse gases. (2)
- c) Hurricanes (2)
- d) Geostrophic winds. (2)
- e) Frontolysis. (2)
- f) Cyclone and anticyclone. (2)

  
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ENV-7402 ENERGY AND ENVIRONMENT							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
4	0	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

#### Course Objectives (COs)

- To understand the physical principles underlying Earth's energy and interaction with the environment.
- To understand the effect of the implementation of environmental technologies and policies on sustainable energy usage.
- To understand the broader view of energy, environment and climate change impacts.

<b>Unit 1: Introduction</b>	<b>15 Lectures</b>
Introduction to energy sources, Energy scenario in world and India, Potential and perspectives of various energy sources in India, classification of energy resources-conventional and non-conventional, renewable and non-renewable, environmental implications of energy resources.	
<b>Unit II: Conventional energy</b>	<b>15 Lectures</b>
Fossil fuels (Coal, petroleum, LPG and natural gas) – origin, composition and physico chemical characteristics and energy content, sources properties and production process; nuclear energy– fission and fusion, technologies – nuclear enrichment, nuclear reactors, nuclear waste disposal, policies and regulations.	
<b>Unit III: Non -Conventional energy</b>	<b>15 Lectures</b>
Prospects of renewable non-conventional energy, Types-solar energy, wind energy, hydel, tidal and geothermal energy, OTEC: introduction, principle, generation. Solar collectors, applications of solar energy: Solar water heating, solar heating and cooling of buildings, solar photo-voltaics, solar distillation, solar cooking and solar ponds. Basic components of wind energy conversion system, types and applications of wind energy.	
<b>Unit IV: Waste to Energy and Energy Conservation</b>	<b>15 Lectures</b>
Bioenergy - Biomass energy as an energy source, characteristics of biomass, Energy plantations, Biomass conversion technologies. Types of biofuels - Biodiesel, bioethanol, biogas, biohydrogen - importance, production, technologies and applications. Waste to resource recovery and recycling for energy, conversion technologies. Feed stocks, factors affecting biogas generation, Biogas plants: Classification of biogas plants, advantages and disadvantages of biogas plants, community biogas plants. Microbial fuel cell – principle, types and challenges. Environmental impacts of over exploitation of solar, wind and ocean energy. Energy conservation – principles and approach, energy conservation in buildings, green buildings, solar passive architecture, cooehening, energy audit, national and international norms	

### Course Learning Outcomes (CLOs)

- Students would be able to exhibit an ability to integrate major factors affecting the Earth's energy resources, environment, and climate change.
- The students would be able to demonstrate expertise in energy supply and demand. Understanding technologies for sustainable energy usage.
- Conservation of energy, alternate energy efficiency, security and their association with environmental effects in a global and societal context.
- The students would exhibit innovative and creative solutions to energy and environmental problems through projects.

### Suggested Readings:

- Gupta, H. K., & Roy, S. (2006). Geothermal energy: an alternative resource for the 21st century. Elsevier.
- Lal, B., and Sarma, P. M. (Eds.). (2011). Wealth from waste. The Energy and Resources Institute (TERI).
- MNRE, Griha manual volume - 3: Technical manual for trainers on building and system design optimization renewable energy application, Ministry of New and Renewable Energy.
- Edenhofer, O., Pichs-Madruga, R., Sokona, Y., Seyboth, K., Kadner, S., Zwickel, T., Eickemeier, P., Hansen, G., Schlomer, S., von Stechow, C., and Matschoss P.(Eds). (2011). Renewable energy sources and climate change mitigation: Special report of the intergovernmental panel on climate change. Cambridge University Press.
- Andrew R.W., Jackson & Julie M. Jackson, Environmental Science – The Natural Environment and Human Impact, Addison Wesley Longman Limited, 1996.
- David Elliott, Sustainable Energy, Opportunities and Limitations, Sustainable Energy: Opportunities and Limitations (Energy, Climate and the Environment) Publisher: Palgrave Macmillan; 2007
- David Baker, General Chemistry, 5th edition, Darrell D. Ebbing. Houghton Mifflin: Boston, 1996
- Santra, S.C. Environmental Science, 3rd Edition, New Central Book Agency (P) Ltd, Kolkata, India, 2011.
- United Nations Scientific Committee on Effects of Atomic Radiation Report 2000, New York, USA, 2000

  
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**Sample Question Paper for End Semester Examination for 04.03 and 02 Credits**

Roll No:.....

Total Pages.....

(June- 2023)

**M.Sc. Environmental Sciences Examination**

**ENV-7402**

**ENERGY AND ENVIRONMENT**

**Semester-IV**

**Time: 3 Hours**

**Max. Marks: 60**

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**

1. Give introduction to energy resources and also discuss potential and perspectives (12)  
of various energy sources in India.
2. Discuss classification of energy resources on the basis of conventional and non- (12)  
conventional resources and also discuss about Environmental implications of  
Energy resources.


**SECTION-B**

3. What is the origin of Petroleum and what are the geological features that are (12)  
required for the formation of Petroleum in amounts that can be extracted from the  
earth?
4. Give explanatory note on Nuclear fission and fusion reactions and also explain (12)  
principle and working of Nuclear reactor.

**SECTION-C**

5. Explain the principle and working of solar photo voltaic cell along with diagram (12)  
and also discuss their advantages and disadvantages?
6. What are the basic components of wind energy conversion system? Also give (12)  
information about types and applications of wind energy.

**SECTION-D**

7. Give detailed information about Microbial fuel cell technology with its principle, (12)  
types and future challenges?
  8. Describe importance and applications of biodiesel and bioethanol production. Are (12)  
these wastes to resource recovery technologies?
- 

### SECTION-E (Compulsory)

9. Attempt all the questions. Discuss following:

- a) What is solar pond (2)
- b) Nuclear fusion (2)
- c) What is OTEC (2)
- d) Green building (2)
- e) Bio hydrogen (2)
- f) Octane Number (2)

  
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ENV-7403 ENVIRONMENTAL LEGISLATION							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
2	0	0	2	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

### Course Objectives (COs)

- To acquaint the students with the environmental issues, pollution, and control and the measures taken for its protection along with the prevailing norms.
- To develop an understanding of the prevailing national and international provisions of environmental policies and legislations.

<b>Unit 1: Environmental Policy</b>	<b>05 Lectures</b>
National Environmental Policy, National Policy on EIA and Regulatory framework, State Environmental issues and policy framework. Constitutional Provisions (Article 48A, 51A). Role of Ministry of Environment, Forests and Climate Change (MOEF & CC), Central and State Pollution Control Boards.	
<b>Unit II: Acts, Rules and Regulations</b>	<b>10 Lectures</b>
Wildlife (Protection) Act 1972, Water (Prevention and Control of Pollution) Act 1974; Forest Conservation Act 1980, Environment (Protection) Act 1986, the Environmental Protection Act & Environmental rules 1986. Air (Prevention and Control of Pollution) Act 1981; Bio-Medical Waste (Management & Handling) Rules, 1998; Hazardous Waste (Management, Handling Rules, 1989); Transboundary Movement Rules, 2008. Plastics manufacture, Sale and Usage Rules, 1999. Coastal Regulation Zones (CRZ) Rules 1991. Public Liability Insurance Act, 1991. Rules, Regulations and Guidelines for Municipal Solid Waste [MSW]; Electronic Waste [EW].	
<b>Unit III: Environmental Treaties and Conventions</b>	<b>08 Lectures</b>
Evolution and development of International Environmental laws with reference to Stockholm conference on Human Environment, 1972, Ramsar Convention on Wetlands, 1971, Montreal Protocol, 1987, Basel Convention (1989, 1992), Earth Summit at Rio de Janeiro, 1992, UNEP, GEF, UNFCCC and IPCC, Kyoto Protocol, 16 1997; Earth Summit at Johannesburg, 2002. UN Summit on Millennium Development Goals 2000	
<b>Unit IV: Environmental Ethics and Landmark Judgments</b>	<b>07 Lectures</b>
Value education, individual, community, corporate social responsibility. Movements related to Environment – Sacred groves, Bishnoi tradition, Chipko movement, Tehri dam, Sardar Sarovar, Narmada dam, Almatti dam, Silent Valley. Role of NGOs. Sustainable Development: Definition and concepts. Supreme Court directive on the introduction of the subject of environmental studies at different levels. Compensatory Afforestation.	



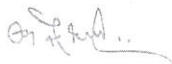
### Course Learning Outcomes (CLOs)

By the end of the course, the student should be able to

- Get basic knowledge of environmental policies, its relevance, and various principles.
- Understand various acts and legislation in place and suggest solutions of the gaps in the existing policies and legislation.
- Know about international treaties and conventions
- Know the significance of various historical environmental movements.

### Suggested Readings:

- Shelton D. and Kiss A. C. Judicial Handbook on Environmental Law, United Nations Environment Programme, 2005.
- Jaswal, P.S. and Jaswal, N. Environmental Law. Pioneer Publications, Delhi. 2003.
- Tiwari, R. K. Global Environmental Policies. ABD Publishers, 2007.
- Trivedy R. K. Handbook of Environmental Laws, Guidelines, Compliance & Standards, Vol. 1 & 2 Environ – Media Karad, India, 2004.
- Kuttingayloan G. M. Conventions, Treaties and other Responses to Global Issues, Vol. 1 & 2 EOLSS Publishers Co Ltd, 2009.

  
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**Sample Question Paper for End Semester Examination for 04.03 and 02 Credits**

Roll No:.....

Total Pages.....

(June- 2023)

**M.Sc. Environmental Sciences Examination**

**ENV-7403**

**ENVIRONMENTAL LEGISLATION**

**Semester-IV**

**Time: 3 Hours**

**Max. Marks: 60**

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**

1. Describe briefly National Policy on EIA and its Regulatory framework. (12)
2. Write note on the following:
  - (a) Role of Ministry of Environment, Forests and Climate Change (8)
  - (b) Central and State Pollution Control Boards. (4)

**SECTION-B**

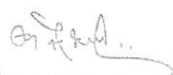
3. Write a short note on:
  - (a) Water (Prevention and Control of Pollution) Act 1974 (6)
  - (b) Wildlife (Protection) Act 1972 (6)
4. Describe the regulations and Guidelines for Municipal Solid Waste management. (12)

**SECTION – C**

5. Explain briefly the Ramsar Convention on Wetlands. (12)
6. Describe Earth Summit at Rio de Janeiro, 1992 and Earth Summit at Johannesburg, 2002. (12)

**SECTION – D**

7. Write in detail about:
  - (a) Sustainable Development (6)
  - (b) Sacred groves (6)
8. Role of NGOs for Sustainable Development. (12)

  
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## SECTION-E (Compulsory)

9. Attempt all the questions.

Write short notes on the following:

- (a) Chipko movement (2)
- (b) Afforestation (2)
- (c) Kyoto Protoco (2)
- (d) E-Waste (2)
- (e) Coastal Regulation Zones (CRZ) Rules (2)
- (f) EIA (2)

  
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ENV-7404 (i) GREEN TECHNOLOGY							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
4	0	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

#### Course Objectives (COs)

- To provide basic knowledge on green technology.
- To understand the principles of green chemistry and eco-friendly methodologies.
- To create awareness on Cleaner development mechanisms.
- To develop concepts on various energy efficient systems and green buildings.

<b>Unit 1: Introduction to Green Technology</b>	<b>15 Lectures</b>
Overview of green chemistry, principles of sustainable and green chemistry. Basic principles of green technology, concepts of atom economy and carbon trading, tools of green technology. Waste minimization and climate change, Zero waste technology, chemistry of atmosphere, greenhouse effect, climate change, photochemical smog.	
<b>Unit II: Green Synthetic methods and designs</b>	<b>15 Lectures</b>
Green chemicals, catalytic methods in green synthesis, selection of auxiliary substances (solvents, separation agents), green solvents, green solvents, immobilised solvents and ionic liquids. solvent less processes: microwave assisted reactions: in water - Hofmann elimination, methyl benzoate to benzoic acid, oxidation of toluene and alcohol; in organic solvents – Diels alder reaction and decarboxylation reaction. Ultrasound assisted reactions – sonochemical Simmons-smith reaction. Green synthesis of compounds: adipic acid, catechol, disodium iminodiacetate.	
<b>Unit III: Green Nanotechnology and characterization</b>	<b>15 Lectures</b>
Introduction to Nanomaterials and green nanotechnology, Fullerene, carbon nanotubes, Nanoparticles; Green nanoparticle production and characterization; basic principle of Scanning and Transmission electron microscopy, X-ray diffraction, Atomic force microscope, UV-visible and FTIR spectroscopy. Biocompatibility.	
<b>Unit IV: Green Technology Applications</b>	<b>15 Lectures</b>
Green chemistry in industries: green polymers, green energy: fuel cell and electric vehicles, solar energy and hydrogen production and storage, Solar photovoltaic cell, microbial fuel cell, polymer electrolyte membrane fuel cell, Biofuel production (bio-ethanol and biodiesel), Applications of nanomaterial in the in- space, defense,	

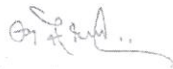
## Course Learning Outcomes (CLOs)

By the end of the course, student will be able to:

- Realise the importance of green technologies in sustainable growth of Industry and society.
- Adopt alternative methods and solvents for green synthesis.
- Develop cleaner production and treatment mechanism for pollution prevention.
- Plan and use of selective materials for green buildings.

## Suggested Readings:

- M. H. Fulekar (2010) Nanotechnology Importance and applications, I K international publishing house Pvt.Ltd.
- Lynn Goldman, Christine Coussens, Implications of nanotechnology for environmental health research, National Academic Press, Washington, 2007
- Matlack, A. S. Introduction to Green Chemistry. Marcel Dekker: New York, 2001
- Anastas, P. T.; Warner, J. C. Green Chemistry: Theory and Practice. Oxford Univ. Press:Oxford, 1998. 5)
- Lynn E. Foster: Nanotechnology: Science, Innovation, and Opportunity, December 21, 2005, Prentice Hall
- Fei Wang & Akhlesh Lakhtakia (eds) (2006). Selected Papers on Nanotechnology—Theory & Modeling (Milestone Volume 182). SPIE Press
- Caye Drapcho, Nhuan Phú Nghiêm, Terry Walker (2008). Biofuels Engineering Process Technology. [McGraw-Hill].
- Akhlesh Lakhtakia (ed) (2004). The Handbook of Nanotechnology. Nanometer Structures: Theory, Modeling, and Simulation. SPIE Press, Bellingham, WA, USA

  
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**Sample Question Paper for End Semester Examination for 04.03 and 02 Credits**

Roll No:.....

Total Pages.....

(June- 2023)

**M.Sc. Environmental Sciences Examination**

**ENV-7404 (i)**

**GREEN TECHNOLOGY**

**Semester-IV**

**Time: 3 Hours**

**Max. Marks: 60**

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**

1. Describe the basic principles of green technology, concepts of atom economy and carbon trading. (12)
2. Write about Waste minimization, Zero waste technology and climate change. (12)

**SECTION-B**


3. Define Green chemicals and Explain about green solvents, immobilised solvents, ionic liquids and catalytic methods in green synthesis. (12)
4. Explain the following:
  - a) Microwave assisted reactions in water - Hofmann elimination reaction and methyl benzoate to benzoic acid reaction. (8)
  - b) Ultrasound assisted reactions – sonochemical Simmons-smith reaction (4)

**SECTION-C**

5. What are the Nanomaterials? Explain about Fullerene, carbon nanotubes and green nanotechnology. (12)
6. Explain the basic principle of following characterization Techniques:
  - a) Scanning and Transmission electron microscopy and X-ray diffraction. (6)
  - b) UV-visible and FTIR spectroscopy. (6)

**SECTION-D**

7. What is Green Energy? Describe about Solar photovoltaic cell, hydrogen production and storage. (12)
8. Describe Microbial fuel cell and polymer electrolyte membrane fuel cell and their role in Green Energy. (12)

  
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**SECTION-E (Compulsory)**

9. Attempt all the following:

- a) Biofuel (2)
- b) Green Nanomaterials (2)
- c) Principle of Atomic Force Microscopy (2)
- d) Applications of nanomaterial in the in space (2)
- e) Photochemical smog (2)
- f) Green solvents (2)



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ENV-7404 (ii) TOXICOLOGY AND OCCUPATIONAL SAFETY							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	End Semester Examination	Total	
4	0	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

### Course Objectives (COs)

- To give an understanding of the relatedness of occupations and public health and health hazards in occupations.
- To impart knowledge on various concepts of prevention/protection to occupational Health and safety mechanisms.

<b>Unit 1: Ecotoxicology</b>	<b>15 Lectures</b>
Ecotoxicology as a Synthetic Science; Major classes of Environmental Pollutants; Inorganic, Heavy Metals, Organics, Organometalics, Radioactive Isotopes, Gases Routes of Entry into Ecosystems – Surface waters, Land, Atmosphere; Long-range movement and global transport of pollutants. Fate of pollutants in Ecosystems: Biotransformation, Bioaccumulation & Biomagnification.	
<b>Unit II: Analysis methods</b>	<b>15 Lectures</b>
Test organisms used in Bioassays. Biomonitoring: Definition of toxicity, F, As, Hg problems Toxicity Testing, Concept of Dosimetry: lethal, sub-lethal & chronic tests, dose response curves, LC50, MATC-NOEC, Brief statistical methodology Toxicant Effects: - Cellular, organismic, population & Ecosystem-Level Effects; Global Effects – Acid rain etc.	
<b>Unit III: Environmental Health</b>	<b>15 Lectures</b>
Toxicology & Epidemiology and occupational health Sources: Solid & Hazardous wastes, untreated sewage, Automobile exhausts, Industrial Effluents, Industrial emissions into atmosphere, Agricultural run-off of Pesticides	
<b>Unit IV: Environmental Issues</b>	<b>15 Lectures</b>
Environmental Carcinogens, Mutagens, Asbestos issues Human adaptation to cold and hot climates, high altitude environment and man-made environments. Water pollution – Caused diseases (Gastroenteritis, Hepatitis etc.). Air pollution caused diseases (allergies, respiratory diseases). Food-borne diseases (Food poisoning, parasites etc). Vector transmitted diseases. Radioactive effects. Risk assessment.	

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## Course Learning Outcomes (CLOs)

By the end of the course, the student should be able to learn

- Relate health promotion/prevention/protection concepts to the occupational health and safety program.
- Demonstrate a base of knowledge in the recognition and assessment of types of health hazards in the workplace.
- Identify and understand the types and related safety measures of occupational health and safety.
- Recognize the interrelatedness of public health, management, employees, and the government to the goals of occupational health and safety.

## Suggested Readings:

- Newman, M.C, Lawrence, C.A., and Unger. M.A., 2002. Ecotoxicology: Fundamentals of Ecotoxicology, 2 nd Ed., CRC Press, Boca Raton, Florida.
- Walker, C.H., Hopkin, S.P., Sibly, R.M., and Peakall, D.B. 2001. Principles of Ecotoxicology. 2 nd Ed. Taylor & Francis, London. Environmental Health.
- Moore, G.S., 2002, Living with the Earth: concepts in Environmental Health Science (2 nd Ed.), Lewis publishers, Michigan.
- Selinus, Alloway, Centeno, Finkelman, Fuge, Lindh, Smedley; 2005, Essential of Medical Geology; Elsevier Academic Press.
- S. K. Haldar, Industrial and Occupational Health, CBS Publishers & Distributors, Genre: Health and Fitness
- Benjamin O. Alli, Fundamental Principles of Occupational Health and Safety
- Author, International Labour Office; 2nd Revised edition edition (1 September 2008)
- Barry S. Levy, David H. Wegman, Sherry L. Baron, Rosemary K. Sokas, Occupational and Environmental Health: Recognizing and Preventing Disease and Injury 6th Edition, Oxford University Press; 6 edition 2011

  
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Sample Question Paper for End Semester Examination for 04.03 and 02 Credits

Roll No:.....

Total Pages.....

(June- 2023)

M.Sc. Environmental Sciences Examination

ENV-7404 (ii)

TOXICOLOGY AND OCCUPATIONAL SAFETY

Semester-IV

Time: 3 Hours

Max. Marks: 60

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**

1. Describe the concept of Ecotoxicology in brief. (12)
2. Explain the Routes of Entry of the Environmental Pollutants into Ecosystems. (12)

**SECTION-B**

3. Describe the terminology of Biomonitoring. (12)
4. Explain the following:
  - (a) Concept of Dosimetry (8)
  - (b) Ecosystem-Level Toxicant Effects (4)

**SECTION-C**

5. Briefly describe the concept of Toxicology & Epidemiology in relation to Hazardous wastes. (12)
6. Write a brief note on following:
  - (a) Impacts of Industrial emissions into atmosphere (6)
  - (b) Effects of Agricultural run-off of Pesticides in the environment. (6)

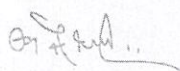
**SECTION-D**

7. Define water Pollution. Explain its causes, environmental effects and control measures. (12)
8. Describe Environmental Carcinogens and Asbestos issues on Human adaptation. (12)

**SECTION-E (Compulsory)**

9. Attempt all the following:
  - (a) Long-range transport of pollutants (2)
  - (b) Bioaccumulation & Bio magnification (2)
  - (c) Acid rain (2)
  - (d) Toxicology of untreated sewage (2)
  - (e) Vector transmitted diseases (2)
  - (f) Environmental Risk assessment (2)

  
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ENV-7405 (i) SOIL BIOLOGY							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
4	0	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

### Course Objectives (COs)

- Understand the relationships between minerals, rocks, geological processes, and soil formation.
- Describe the physical and chemical characteristics of the soil
- Provide a basic understanding of the influence of underlying geology on soil functions
- Develop an understanding between soil fertility and plant nutrition.

<b>Unit 1 : Introduction to Soil</b>	<b>15 Lectures</b>
Definition of soil- Soil composition, Pedosphere, Soil organic matter: sources, composition, microbial decomposition of organic matter, Humus formation, Significance of soil fertility, Soil reaction- Biological properties of soil- nutrient availability.	
<b>Unit II: Soil Habitat</b>	<b>15 Lectures</b>
Soil as a habitat for organisms: micro flora and soil fauna, ecological interactions. Taxonomy and biology of soil organisms, Position and role of soil fauna in soil, ecological niche. Economic importance of soil microbes.	
<b>Unit III: Soil and Biogeochemical Cycles</b>	<b>15 Lectures</b>
Role of soil biota in nutrient cycles: Carbon, Nitrogen, Sulphur, Phosphorous cycles. Soil mutualistic symbioses –Mycorrhizal symbioses and Nitrogen fixing symbioses, Underground interactions: Rhizosphere, root exudates	
<b>Unit IV: Soil and Pollution</b>	<b>15 Lectures</b>
Environmental problems related to soils in India: desertification, salinization, erosion. Bioremediation of contaminated soils and ground water, Fate of plant allelochemicals in soil, Composting, a value addition to our wastes.	

  
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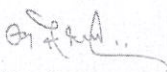
### Course Learning Outcomes (CLOs)

By the end of the course, the student should be able to

- Describe the various mineral and organic components of soils, including how changes in various quantities affect soil physical and chemical properties.
- Understand the soil components and the nature of the interactions between these components.
- Identify the ways to improve soil fertility as well as reduce soil erosion and improve water quality and availability.
- Understand the issues related to soil resource and management practices.

### Suggested Readings:

- Alexander, M., 1977, 2nd Edn., Introduction to Soil Microbiology, Wiley John.
- Alexander, M., 1994, Biodegradation and Bioremediation, Academic Press. 28
- Coleman and Crossley, 2004, 2nd Ed., Fundamentals of Soil Ecology, Academic Press.
- Killham, K., 1994, Soil Ecology, Cambridge University Press.

  
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Sample Question Paper for End Semester Examination for 04.03 and 02 Credits

Roll No:.....

Total Pages.....

(June- 2023)

M.Sc. Environmental Sciences Examination

ENV-7405 (i)

SOIL BIOLOGY

Semester-IV

Time: 3 Hours

Max. Marks: 60

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**

1. Define Soil organic matter. Explain its sources, composition and its microbial decomposition. (12)
2. Describe the following:
  - a) Humus formation (6)
  - b) Biological properties of soil- nutrient availability (6)

**SECTION-B**

3. Discuss the following:
  - a) Micro flora and Soil fauna (6)
  - b) Taxonomy and biology of soil organisms (6)
4. Give explanatory note on Economic importance of soil microbes (12)

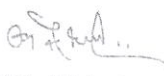
**SECTION-C**

5. Explain briefly about Biogeochemical cycle in soil. (12)
6. Discuss the following:
  - a) Soil mutualistic symbioses (4)
  - b) Root exudates (8)

  
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**SECTION-D**

7. Write notes on the following:
  - a) Bioremediation of contaminated soils (6)
  - b) Salinization (6)
8. Explain desertification its causes and control measures. (12)

  
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### SECTION-E (Compulsory)

9. Attempt all the questions. Write short notes on the following:

- a) Soil Erosion (2)
- b) Nitrogen fixing symbioses in soil (2)
- c) ecological niche (2)
- d) Significance of soil fertility (2)
- e) Soil reaction- Biological properties of soil (2)
- f) Fate of plant allelochemicals in soil (2)

  
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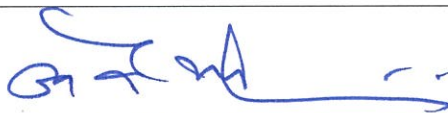
ENV-7405 (ii) GLACIOLOGY							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
4	0	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

### Course Objectives (COs)

- To stimulate interest and encourage research into the scientific and technical problems of snow and ice in all countries.
- To facilitate and increase the flow of glaciological ideas and information.
- To give a deeper and more quantitative understanding of glacial processes and the interaction between weather/climate and glaciers.

<b>Unit 1: : Introduction to Glacier and Glaciology</b>	<b>15 Lectures</b>
Glacier systems- Structure and morphology of glaciers- Classification and types of glaciers, Process of formation of glaciers; Snow, firn and ice; crystallization of ice; areal distribution of glaciers/snow cover and factors controlling the distribution of snow cover. The importance of glacier; Himalayan glaciers and their characteristic features, regional and global importance of glaciers	
<b>Unit II: Paleoglaciation and Glacier landforms</b>	<b>15 Lectures</b>
Milankovitch cycles and Greenhouse effect, Little ice age (LIA), Glacial and interglacial cycles, Depositional and Erosional Glacial landforms: Glacial deposits; Moraines and its types; Glacier velocity; Flow of valley glaciers and concept of glacier surges, Avalanches, Crevasses and icefall, tide water glaciers, Permafrost, criques, dead ice, Ice sheets, Ice stream and ice shelves.	
<b>Unit III: Glacier Mass Balance</b>	<b>15 Lectures</b>
Mass Balance: Definition, Measurement of Mass Balance Methods: Direct Measurement (Stake Method), Geodetic Method, Gravimetric Methods, ELA, AAR methods, Glacier hydrology methods, Remote sensing methods, Annual Mass Balance Cycles, Mass Balance gradients. Snow and melt water chemistry of Glaciers.	
<b>Unit IV: Approaches to Glaciology</b>	<b>15 Lectures</b>
Approaches to Glaciology- Glacier modeling, Glacier and climate change impact, permafrost and Glacial Lakes, Glacier and water resources, Recent advances in Glaciology, Glacial hazards and concept of GLOF, Glaciers as tool for palaeo climate studies.	



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### Course Learning Outcomes (CLOs)

- Students will explain in a quantitative way the interaction between snow, ice and climate.
- Students will explain the principles for mass balance modelling
- Students will explain the temperature conditions and distribution in glaciers and ice sheets.
- Explain how water flows in glaciers (glacier hydrology), the principles for glacier movement and glacier dynamics.

### Suggested Readings:

- Michael J. Hambrey (1994). Glacial Environment, UBC Press Limited Canada, University of British Columbia, ISBN 0-7748-0509-9.
- Robert P. Sharp (1988). Living ice: Understanding Glaciers and Glaciation, Cambridge University Press, New York, ISBN 0-521-30009-2.
- Douglas I. Benn and David J.A. Evans (2010), Glaciers and Glaciation. Published by Hodder Education, Taylor and Francis, ISBN 13: 978-0-340-90579-1.
- Physics of glacier, Fourth edition, 2011, Kurt M. Cuffey, W. S. B. Paterson, Elsevier.
- Fundamentals of Glacier Dynamics, second edition, 2013, C.J. Van der Veen, CRC Press, Taylor & Francis group.
- Glaciers and Glaciation, 2010, 2<sup>nd</sup> edition Douglas Benn and David J A Evans, Holder Arnold Publication.

  
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Sample Question Paper for End Semester Examination for 04.03 and 02 Credits

Roll No:.....

Total Pages.....

(June- 2024)

M.Sc. Environmental Sciences Examination

ENV-7405 (ii)

GLACIOLOGY

Semester-IV

Time: 3 Hours

Max. Marks: 60

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**

1. Describe the structure and morphology of various type of Glaciers. (12)
2. Explain the transformation of snow into ice and distribution of glacier cover. (12)

**SECTION-B**

3. Describe depositional and erosional glacial landform and little ice ages. (12)
4. Explain Glacial, Interglacial and Milankovitch cycles. (12)

**SECTION-C**

5. Describe Glacier mass balance and its types to measure glacier mass balance. (12)
6. Write note on Stake, AAR, Glacier hydrology methods and Englacial, subglacial process (12)

**SECTION-D**

7. Explain Hazards associated with glaciers and impact of climate change on glaciers. (12)
8. Describe the glaciers and water resources. (12)

**SECTION-E**

9. Attempt all Questions: Discuss following:
  - a) Zones of glacier (2)
  - b) Surging glacier (2)
  - c) Permafrost (2)
  - d) Tide water glacier (2)
  - e) ELA (2)
  - f) Cryoshere (2)

  
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ENV-7405 (iii) OCCUPATIONAL HAZARDS							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P		Internal Assessment	End Semester Examination	Total	
4	0	0	4	Maximum Marks: 40	Maximum Marks: 60	100	3 Hours
				Minimum Marks: 16	Minimum Marks: 24	40	

**Guidelines for setting Question Paper:** Question paper of end semester examination will be of 60 Marks. The question paper will consist of five sections A, B, C, D and E. Sections A, B, C and D will have 02 questions of 12 marks each and section E has short answer type questions consisting of six parts of 02 marks each. The candidates will attempt five questions in all, i.e. one question each from the sections A, B, C, D and the compulsory question from section E. In the question paper, the questions available in sections A, B, C and D will be covered from Unit-I, Unit-II, Unit-III and Unit-IV, respectively and Section-E will cover whole syllabus.

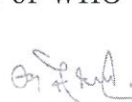
### Course Objectives (COs)

- To give an understanding of the relatedness of occupations and public health and health hazards in occupations.
- To impart knowledge on various concepts of prevention/protection to occupational Health and safety mechanisms

<b>Unit 1: Introduction and Basics</b>	<b>15 Lectures</b>
History of concept, Recognition and evaluation of health hazards Organisational factors, Human factors.	
<b>Unit II: Types of Hazards</b>	<b>15 Lectures</b>
Physical Hazards - mechanical, noise, radiation, temperature, light, structures, electrical, fire, explosion, confined space; Chemical Hazards -Vapors, mists, solids, fumes, aerosols; Biological Hazards - Fungi, molds, virus, bacteria, animals.	
<b>Unit III: Occupational diseases</b>	<b>15 Lectures</b>
Pneumoconiosis, Silicosis, Anthracosis, Byssinosis, Bagasosis, Asbestosis, Farmer's lung, Metal poisoning, Occupational cancer, Occupational dermatitis, Radiation Hazards.	
<b>Unit IV: Safety Management</b>	<b>15 Lectures</b>
Risk Control, Regulating health and safety, Occupational hazards in industries and other sectors, Industrial hygiene and Occupational health- Indian Scenario. Role of WHO in occupational health, Global Occupational Health Network (GOHNET)	

### Course Learning Outcomes (CLOs)

By the end of the course, the student should be able to learn

  
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- Demonstrate a base of knowledge in the recognition and assessment of types of health hazards in the workplace.
- Identify and understand the types and related safety measures of occupational health and safety.
- Recognize the interrelatedness of public health, management, employees, and the government to the goals of occupational health and safety.

**Suggested Readings:**

- S. K. Haldar, Industrial and Occupational Health, CBS Publishers & Distributors, Genre: Health and Fitness
- Benjamin O. Alli, Fundamental Principles of Occupational Health and Safety
- Author, International Labour Office; 2nd Revised edition edition (1 September 2008)
- Barry S. Levy, David H. Wegman, Sherry L. Baron, Rosemary K. Sokas, Occupational and Environmental Health: Recognizing and Preventing Disease and Injury 6th Edition, Oxford University Press; 6 edition 2011

  
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**Sample Question Paper for End Semester Examination for 04.03 and 02 Credits**

Roll No:.....

Total Pages.....

(June- 2023)

**M.Sc. Environmental Sciences Examination**

**ENV-7405 (iii)**

**OCCUPATIONAL HAZARDS**

**Semester-IV**

**Time: 3 Hours**

**Max. Marks: 60**

**Note:** Attempt five questions in all, selecting one question from each section A, B, C and D and section-E is compulsory. All questions carry equal marks.

*The candidates shall limit their answers precisely within the answer book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**SECTION-A**

1. Give detail account of History of concept, Recognition and evaluation of health hazards. (12)
2. Explain in detail about the Organisational factors and Human factors. (12)

**SECTION-B**

3. Explain the following Physical Hazards:
  - a) Noise, Temperature and Explosion (6)
  - b) Mechanical and Radiation (6)
4. Explain the Chemical and Biological Hazards of Aerosols, mist, Fungi and Bacteria. (12)

**SECTION-C**

5. Write an explanatory note on the Pneumoconiosis, Silicosis and Anthracosis. (12)
6. Describe the following:
  - a) Metal poisoning (4)
  - b) Occupational cancer (8)

**SECTION-D**

7. Give an explanatory note on Occupational hazards in industries and Industrial hygiene in the Indian Scenario. (12)
8. Discuss about the Role of WHO in occupational health. (12)

**SECTION-E (Compulsory)**

9. Attempt all the questions. Write short notes on the following:
  - a) Define Occupational Hazards (2)

  
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- |               |     |
|---------------|-----|
| b) Mist       | (2) |
| c) Aerosol    | (2) |
| d) Byssinosis | (2) |
| e) Asbestosis | (2) |
| f) GOHNET     | (2) |



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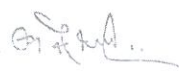
ENV RP-7406 M.Sc. Research Project/ Seminar (Major)							
Teaching Scheme			Credit	Marks Distribution			Duration of End Semester Examination
L	T	P	C	Internal Assessment	External Assessment	Total	
04			04	40	60	100	3 Hours

All the M.Sc. Environmental Sciences Students will do a supervised Research Project/Seminar in IV Semester. Department considers it an important culmination of training in the field of Environmental Sciences learning and research. This project/seminar supervised may be taken from any component of Environment and other current areas of research.

The project will aim to introduce student to the basic knowledge and methodology of research in Environmental Sciences, which is done via field survey, theory, computation and experiments either all together or separately by one of these approaches. It is intended to give research exposure to students at M.Sc. level itself. Students may also get the opportunity to participate in some on-going research activity in any institution.

Students will be allotted a teacher in groups and how to prepare for project/seminar will be discussed accordingly. Students will be allotted a topic by the teacher may be in the end of sem- III or at the start of Sem-IV. The topic for the presentation of the project/seminar may be from the syllabus or relevant to the syllabus of the program. During the presentation being given by a student, all the other students of his/her group will attend the Seminar and will do the same. The assessment/evaluation will be done by the teacher. However, the Head of the Department and other faculty members (external/ internal) will also be present in the Seminar for questioning and suggestions. This is a turn wise continuous process during the semester and each student will give minimum two presentations in a Semester before the final presentation before the external as well as the internal examiner.

- The students will be allotted M.Sc. IV Semester project/seminar in consultation with their teachers well in time. To develop team spirit and group learning, students will be allotted projects in group of three to four students but not more than four students in any case.
- Students will be informed about their respective groups ( three/four students per group) which will be formed by inviting applications from the students who want to together as a group in the office of Environment Science Department, after due recommendation from the supervisor under whose supervision they wish to work along with a tentative title/topic.
- Students can choose topics from the following major fields or any other field decided from time to time for which department has the faculty and facilities.
- Students will discuss the topic with the supervisors and submit a one page typed abstract giving the plan of the same and start working on the project/seminar utilizing time for gathering resource material, references, setting up the experiments, understanding the theoretical frame work, and

  
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give a seminar as per the schedule notified by the Department.

- Three copies of the project/seminar report will be required to be submitted in the office of the Environment Science Department for the final evaluation by the external examiner.

Format of the project report as per the details given in below:

### **Title Page**

#### **M.Sc. Research Project/Seminar Report**

**On**

**Title of the Project/Seminar**

**Logo of the University**

**School of Environment Science**

**Himachal Pradesh Technical University, Hamirpur (H.P.) 177 001**

**Session: Month/Year**

**Supervised by:**

**Submitted by:**

**Name1, Name 2, Name 3**

### **Page 2**

#### **Certificate**

This is to certify that the project entitled **-Title of Project/Seminar** aimed at **-Project/Seminar purpose** was worked upon by the following students under my supervision in the Department of Environment Science, H.P. Technical University, Hamirpur.

Head/Coordinator

Signature & Name of Supervisor

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Acknowledgement

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Abbreviations Used

  
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**Study Area**


**Objectives**

**Methodology**

**Result and Discussion**

**Conclusion**

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