



# **Syllabus**

## **M.Sc. (Environmental Sc.)**

**(w.e.f. 2014-15)**

**DEPARTMENT OF ENVIRONMENTAL SCIENCE**

**Central University of Haryana**  
**Mahendergarh**

---

# Syllabus

## M.Sc. (Environmental Sc.)

w.e.f. 2014-15



**DEPARTMENT OF ENVIRONMENTAL SCIENCES  
CENTRAL UNIVERSITY OF HARYANA  
MAHENDERGARH, HARYANA**



## University Logo

University Logo is conceived with a globe at its centre surrounded by holy trinity of three arcs and at the bottom is a shloka taken from 'Neeti Shatkam' written by Bhartihari.

The arc at the bottom depicts an open book and a Veena, symbolising University's commitment to meeting the quest for acquiring knowledge, learning, enlightenment and promoting art and culture.

The arc at the right that depicts processes of science, technology and adventurism symbolises the University's commitment to promoting scientific progress and creating a culture of creativity, innovation and enquiring approach.

The arc at the left that depicts nature symbolises University's commitment to promoting education inculcating respect for environment, ecology and living in harmony with nature.

The globe at the centre surrounded by the human chain and the pigeon flying above expresses University's belief that commitments represented by the trinity of three arcs shall lead to global peace, prosperity and human solidarity-the real spirit of education.

The shloka at the bottom conveys that 'education' is the unrivalled treasure of all.

## **Vision Statement**

To develop enlightened citizenship for a knowledge society for peace and prosperity of individuals, nation and the larger world through promotion of innovation, creative endeavors and scholarly inquiry

## **Mission Statement**

- To be a leading model by defining learning, teaching and discovery in a global, national and local context
- To strive to create a learning ambience with diverse cultural backgrounds and enhance student's acquisition of useful knowledge, skills and analytical abilities through innovative teaching and holistic learning environment
- To facilitate cutting edge research in emerging areas and expanding research in traditional areas
- To progressively expand in phases academic and research areas to be pursued by the University from time to time into their diversified focuses
- To focus on relevance, quality and excellence in each area and discipline of study that University is to pursue
- To develop partnership with international and national institutions and facilitate providing international linkages for contextual and cultural learning for both faculty and students
- To involve stakeholders including Government, Industry, Community and others in providing relevant and quality education
- To create and maintain highest level of integrity, ethics and values on Campus and ensure zero tolerance for lack of these core commitments

## **University Objectives**

- To disseminate and advance knowledge by providing instructional and research facilities in such branches of learning as it may deem fit;
- To make special provisions for integrated courses in humanities, social sciences, science and technology in its educational programmes;
- To take appropriate measures for promoting innovations in teaching-learning process and inter-disciplinary studies and research;
- To educate and train manpower for the development of the country;
- To establish linkages with industries for the promotion of science and technology; and
- To pay special attention to the improvement of the social and economic conditions and welfare of the people, their intellectual, academic and cultural development.

## Central University of Haryana

The Central University of Haryana, established by MHRD, under the Central Universities Act-2009 (Act No. 25 of 2009) made a spirited beginning under the leadership of its sagacious and visionary founder Vice Chancellor Prof. Mool Chand Sharma, from a rented building in Gurgaon as transit office and Narnaul B.Ed. college building as campus. It has now shifted to its Permanent Campus sprawling over 488 acres of land at Jant-Pali Villages, Mahendergarh district of Haryana. The University, fully funded by the UGC, is all set to emerge as a seat of great learning in the Southern Haryana under the leadership of its reverent and visionary Acting Vice-Chancellor Prof. U. P. Sinha. Being at the nascent stage of establishment, the University immediately after getting possession of the land at Jant-Pali, Mahendergarh acted through various empowered Committees and Groups to chart out the course of development. After duly considering the recommendations of various empowered committees the Executive Council of the University approved the road map for the first phase of development of the campus on the site at Jant-Pali, Mahendergarh. The first phase of development comprises the construction of boundary wall and a block of four buildings. The construction of boundary wall is complete and the four blocks are functional to run the academic programmes. These blocks host separate hostels for boys and girls, modest accommodation for faculty and other staff, academic wing with class rooms, seminar rooms, tutorial rooms, laboratories, libraries, conferencing facilities, etc. These buildings will be integrated as a part of hostel zone when the development of the Campus enters in the final phase. Marching ahead on the journey of promoting grass root research and fruitful engagement with society many brainstorming sessions of idea generation are held. After comprehensive deliberations University has adopted **“Multidisciplinary Approach to Inclusive Education”** as motto.



## DEPARTMENT OF ENVIRONMENTAL SCIENCE

*Department of Environmental Sc.*, Central University of Haryana has been opened in the academic year 2014-15 by offering M.Sc. (Environmental Sc.) programme. This *Department* is functioning under the School of Earth & Space Studies and is the founding department of the School along with Department of Geography. This school right now have the following departments

- Department of Environment Sciences
- Department of Geography

*Department of Environmental Sc.* offers PG programme i.e. M.Sc. (Environmental Sc.) of two years duration which are divided into four semesters & based on choice based credit system (CBCS).



Course Structure for M.Sc. - Environmental Sc. under Choice Based Credit System has been given on the next page.



<b>SEMESTER –I</b>				
<b>Course Code</b>	<b>Title of the Course</b>	<b>Core/ Elective</b>	<b>Hours per week</b>	<b>No. of Credit</b>
SEE EVS 01 101 C 3104	Fundamentals of Ecology	Core	4	4
SEE EVS 01 102 C 3104	Natural Resource Conservation and Management	Core	4	4
SEE EVS 01 103 C 3104	Physical Environment	Core	4	4
<b>Elective (any one)</b>				
SEE EVS 01 101 E 2103	Forest and Wildlife Ecology	Elective	3	3
SEE EVS 01 102 E 2103	Natural Disasters	Elective	3	3
<b>Practical</b>				
SEE EVS 01 104 C 0033	Lab course – I	Core	6	3
SEE EVS 01 105 C 0033	Lab course – II	Core	6	3
<b>Total Credits</b>				<b>21</b>

<b>SEMESTER –II</b>				
<b>Course Code</b>	<b>Title of the Course</b>	<b>Core/ Elective</b>	<b>Hours per week</b>	<b>No. of Credit</b>
SEE EVS 01 201 C 3104	Environmental Chemistry	Core	4	4
SEE EVS 01 202 C 3104	Biostatistics, Instrumentation and Computer application	Core	4	4
SEE EVS 01 203 C 3104	Environmental Meteorology and Remote Sensing	Core	4	4
<b>Elective (any one)</b>				
SEE EVS 01 201 E 2103	Environmental Microbiology	Elective	3	3
SEE EVS 01 202 E 2103	Environmental Engineering	Elective	3	3
<b>Practical:</b>				
SEE EVS 01 204 C 0033	Lab course III	Core	6	3
SEE EVS 01 205 C 0033	Lab course IV	Core	6	3
<b>Total Credits</b>				<b>21</b>

<b>SEMESTER -III</b>				
<b>Course Code</b>	<b>Title of the Course</b>	<b>Core/ Elective</b>	<b>Hours per week</b>	<b>No. of Credit</b>
SEE EVS 01 301 C 3104	Environmental Biotechnology	Core	4	4
SEE EVS 01 302 C 3104	Environmental Management and Impact Assessment	Core	4	4
SEE EVS 01 303 C 3104	Environmental Pollution Management	Core	4	4
<b>Elective (any one)</b>				
SEE EVS 01 301 E 2103	Environmental Geoscience	Elective	3	3
SEE EVS 01 302 E 2103	General Environmental Aspects	Elective	3	3
<b>Practical:</b>				
SEE EVS 01 304 E 0033	Lab course V	Core	6	3
SEE EVS 01 305 E 0033	Lab course VI	Core	6	3
SEE EVS 01 306 C 0011	Summer training (4-5 weeks) at the end of Sem II S/US only (Presentation based evaluation)	Core	0	1
<b>Total Credits</b>				<b>22</b>
<b>SEMESTER -IV</b>				
<b>Course Code</b>	<b>Title of the Course</b>	<b>Core/ Elective</b>	<b>Hours per week</b>	<b>No. of Credit</b>
SEE EVS 01 401 C 3104	Environmental Policies and Laws	Core	4	4
SEE EVS 01 402 C 0011	Seminar	Core	0	1
<b>Elective (any one)</b>				
SEE EVS 01 401 E 2103	Environmental Health and Toxicology	Elective	3	3
SEE EVS 01 402 E 2103	Environmental Modeling	Elective	3	3
<b>Project Work</b>				
SEE EVS 01 403 C 001212	Concise Dissertation** work or Review-essay or Project Report Evaluation ** Dissertation shall begin in Semester III (Part-II) and examined by internal as well as external examiner.	Core	24	12
<b>Total Credits</b>				<b>20</b>
<b>Grand Total (Credits)</b>				<b>84</b>

**Note: For more details, Ordinance relating to PG Programmes may be referred.**



**ORDINANCE RELATING TO PROGRAMMES  
LEADING TO THE AWARD OF POST GRADUATE DEGREES / DIPLOMAS**

**1. Definitions:**

- 1.1 “Course” means a Semester course.
- 1.2 “Credit” (c) is the weightage assigned to a course in terms of contact hours.
- 1.3 “Grade” means a letter grade assigned to a student on the basis of evaluation of a course on a ten point scale.
- 1.4 “Grade point” (g) means the numerical equivalent of a letter grade assigned to a student in the ten point scale.
- 1.5 Semester Grade Point Average (SGPA) means the grade point average of a student for a semester calculated in the following manner:  
$$SGPA = (g_1 \times c_1) + (g_2 \times c_2) + \dots$$
(in respect of all courses for which the student has registered in the semester concerned) divided by the total number of credits offered by the student in the semester.
- 1.6 “Cumulative Grade Point Average” (CGPA) means a cumulative index grade point average of a student calculated in the following manner:  
$$CGPA = (g_1 \times c_1) + (g_2 \times c_2) + \dots$$
(in respect of all the courses for which the student has registered up to and including the semester for which the cumulative index is required) divided by the total number of credits offered by the student in the said courses.
- 1.7 “Final Grade Point Average” (FGPA) is the final index of a student at the time of award of a degree, calculated in the following manner:

$$FGPA = \frac{\sum_{i=1}^n g_i \times c_i}{\sum_{i=1}^n c_i}$$

Where  $\sum_{i=1}^n c_i$

$c_i$  = credit in the  $i^{\text{th}}$  course

$g_i$  = grade point secured by the student in the  $i^{\text{th}}$  course

n = total number of courses prescribed for the student for the entire programme.

- 1.8 “Final Grade” is the letter equivalent assigned to a student on the basis of his/her FGPA at the time of the award of the degree.

**2. Eligibility for admission:**

A candidate may be admitted to the Master’s programme if he/she has obtained a Bachelor’s degree under 10+2+3 system recognized by the University, or a degree recognized as its equivalent, provided such a candidate has attained the minimum proficiency in the subject at the time of admission as decided by the University from time to time.

**3. Semesters:**

3.1 An academic year shall consist of two semesters, viz.:Odd semester and Even semester.

3.2 Ordinarily an Odd semester shall extend from July to December, and an Even semester from January to May.

3.3 A semester normally extends over a period of 15 weeks, each week having 30 hours of instruction spread over a week.

#### 4. Type of courses:

Each programme may have three types of courses, viz. core courses, elective courses and self-study-courses.

##### 4.1. Core courses:

4.1.1 Core courses are those, knowledge of which is deemed essential for students registered for a particular Master's programme. Where feasible and necessary, two or more programmes may prescribe one or more common core courses.

4.1.2 Core courses shall be mandatory for all students registered for that Master's programme.

4.1.3 Core courses shall be spread over all the semesters of the programme.

##### 4.2 Elective courses:

Elective courses are intended to:

- allow students to specialize in one or more branches of the broad subject area; or
- acquire knowledge and skills in a related area that may have applications in the broad subject area; or
- bridge any gap in the curriculum and enable acquisition of essential skills (e.g. statistical, computational, language, communication skills, etc.); or
- help pursue an area of interest to the student.

##### 4.3 Self-study courses:

4.3.1 Self-study courses are optional, not mandatory. They are not taken into account for awarding grades.

4.3.2 Students may also choose 3 additional courses to enable them to acquire extra credits through self-study.

4.3.3 Self-study courses shall be in advanced topics in a course (core or elective) under the supervision of a faculty member.

**Note:** A course (Core/Elective/Self-study) may also take the form of a Dissertation/ Project work/ Practical training/ Field work/ Internship/ Seminar, etc.

#### 5. Credits:

Credit defines the quantum of contents/syllabus prescribed for a course and determines the number of hours of instruction required per week. Thus, in each course, credits are assigned on the basis of the number of lectures/tutorials/laboratory work/field work and other forms of learning required completing the contents in a 15 week schedule. 2 hours of laboratory work/field work is generally considered equivalent to 1 hour of lecture.

- 1 credit = 1 hour of instruction per week (1 credit course = 15 hours of instruction per semester)

- 3 credits = 3 hours of instruction per week (3 credit course = 45 hours of instruction per week)

A Core course may carry 3 to 4 credits; an elective/ Self-study will not normally carry more than 3 credits. However, a dissertation/ project work may carry up to 6 credits; a semester-long field work may carry 10-15 credits.

#### **6. Auditing:**

Students may be permitted by the individual faculty member at his/her discretion to audit two courses without assigning any credits.

#### **7. Course numbering:**

Each course offered by a faculty/department is identified by a unique course code: e.g. SSS C 001 Eco 3003, where

- SSS stands for School of Social Sciences;
- C stands for core course;
- 001 stands for the serial number of the course;
- The figures 3,0,0,3 stand for credits attached to lectures (practical, if it is a practical course), tutorials, practical work (theory, if it is a practical course) and total number of credits for the course respectively.

#### **8. Duration of programme:**

The minimum duration for completion of a one-year Post Graduate Diploma programme shall be two consecutive semesters (one odd and one even semester), for a two-year Master's programme in any subject shall be four consecutive semesters (two odd and two even semesters) and for a three-year Master's programme - six semesters, i.e. three odd and three even semesters. The maximum period for completion shall be four semesters, six semesters and eight semesters respectively.

Provided that a semester or a year may be declared by the Academic Council zero semester or zero year in the case of a student if he/she could not continue with the academic work during that period due to illness and hospitalization, or due to accepting a foreign scholarship/fellowship, subject to fulfillment of requirements laid down in this respect by regulations. Such zero semester/year shall not be counted for calculation of the duration of the programme in case of such a student.

#### **9. Student Advisor:**

The Department in which the student gets admitted shall appoint an Advisor for him/her from amongst the members of the faculty concerned. All faculty members of the department shall function as Student Advisors and shall have more or less equal number of students. The Student Advisor shall advise the student in choosing courses and render all possible help to the student.

#### **10. Course Registration:**

- 10.1 Registration of courses is the sole responsibility of a student. No student shall be allowed to do a course without registration, and no student shall be entitled to any credits in the course unless he/she has been formally registered for the course by the scheduled date fixed by the University.

- 10.2 Every student has to register in each semester (in consultation with his/her Student Advisor) for the courses he/she intends to undergo in that semester by applying in the prescribed proforma in triplicate, duly signed by him/her, the Student Advisor and the Head of the Department, within the deadline notified for the purpose by the University.
- 10.3 Late registration may be permitted by the Dean of the faculty upto a maximum of two weeks after the commencement of the semester on payment of prescribed late registration fee.
- 10.4 A student shall register for a minimum of 15 credits and can register for a maximum of 24 credits in a semester.
- 10.5 Withdrawal from a course shall be permitted up to one week from the date of registration, provided the courses registered after withdrawal shall enable the student to earn a minimum of 15 credits. Withdrawal from a course shall not be allowed for those who had late registration.
- 10.6 A student shall be allowed to add a course or substitute a course for another course of the same type (core, elective or self study) for valid reasons with the consent of the Student Advisor not later than two weeks from the date of commencement of the semester.
- 10.7 A student may take more elective courses than prescribed in the programme, in which case in the calculation of the Semester/ Cumulative/ Final Grade Point Average only the prescribed number of elective courses in the descending order of the grades obtained by him/her shall be included.

#### **11. Evaluation & examination:**

- 11.1 Sessional evaluation shall be done on a continuous basis, taking into account the student's class performance, fulfillment of home assignments and performance at the compulsory sessional tests (2 best out of 3 tests to be conducted in a semester). For uniformity, particularly for interdepartmental transfer of credits, there shall be a uniform procedure of examination to be adopted by all faculty members. There shall be three sessional tests and one end-semester examination in each course during every semester.
- 11.2 Sessional Test 1 shall be held during the sixth week of the semester for the syllabi covered till then.
- 11.3 Sessional Test 2 shall be held during the eleventh week for the syllabi covered between seventh and eleventh week.
- 11.4 Sessional test 3 shall be held during the fourteenth week of the semester for the remaining syllabus after the sessional test 2.
- 11.5 Sessional tests may employ one or more assessment tools such as objective tests, assignments, paper presentation, laboratory work, etc. suitable to the course.
- 11.6 The pattern of assessment of sessional work, including the weightages to be given to different elements like class performance, home assignments and the sessional tests, for each course shall be prescribed by the School Board on the recommendation of the Board of Studies of the Department concerned and shall be made known to the students at the commencement of each semester.

- 11.7 A student cannot repeat sessional tests.
- 11.8 The sessional work and the end semester examination shall have equal weightage i.e. 50% each. The 50% weightage allotted to sessional work shall consist of 30% for class performance and home assignments and the remaining 20% for the two compulsory sessional tests (i.e. 10% each), or 20% for class performance and home assignments and 30% for the two sessional tests, depending upon the nature of the course.
- 11.9 A student clears the sessional work in a course if he / she has participated in the sessional work and secured a grade higher than F in it.
- 11.10 End semester Examinations covering the entire syllabus prescribed for the course and carrying 50% of weightage shall be conducted under the direction of the Dean of the School.
- 11.11 Examiners or Board of Examiners shall be appointed for each course by the School Board on the recommendation of the Board of Studies of the Department concerned.
- 11.12 The distribution of weightage for the valuation of semester-long project work/ dissertation shall be:
- i) Periodic presentation : 20%
  - ii) Concise dissertation : 60%
  - iii) Viva voce : 20%
- Or as decided by the School Board on the recommendations of the Board of Studies of the Department concerned.
- 11.13 An application for admission to the semester examination shall be made in the prescribed form and forwarded to the Dean of the School through the HOD concerned and shall be accompanied by the following documents:
- i) Clearance in sessional evaluation;
  - ii) Clearance of all dues.

## 12. Grades and Grade points:

The students shall be graded in sessional tests, end semester examinations, etc. in each course on the following ten point scale:

Grade	Grade Point
A+	9.00
A	8.25
A-	7.50
B+	6.75
B	6.00
B-	5.25
C+	4.50
C	3.75
C-	3.00
F	0

**Note:**

1. There shall be no rounding of SGPA/CGPA/FGPA.
2. The SGPA/CGPA/FGPA obtained by a student is out of a maximum possible 9 points. The Final Grade Point Average obtained by a student shall be classified into the following divisions:

<b>FGPA</b>	<b>Class/ Division</b>
8.5 and above	First Class with Distinction
7.0 and above, but less than 8.5	First Class
5.0 and above, but less than 7.0	Second Class
4.0 and above, but less than 5.0	Pass

**13. Credit requirements:**

- 13.1 For a one-year Post Graduate programme, the credit requirements for the award of the Post Graduate Diploma shall be 40 credits ( $\pm 10\%$ ), including a minimum of 9 credits from elective courses (of which at least 3 credits shall be from elective course offered by another Department).
- 13.2 For a two-year Master's programme, the credit requirements for the Master's degree shall be 80 credits ( $\pm 10\%$ ), including a minimum of 18 credits from elective courses (**of which at least 6 credits shall be from elective courses offered by other Departments**).
- 13.3 For a three-year Master's programme, the credit requirements for the Master's degree shall be 120 credits ( $\pm 10\%$ ), including 27 credits from elective courses (of which 9 credits shall be from elective courses offered by other Departments).

**14 Grade point requirements:**

A student in order to be eligible for the award of the Master's degree of the University must have fulfilled the following requirements:

- i) He/she has taken and passed all the prescribed courses as laid down;
- ii) He/she has obtained a FGPA of 4.00 at the end of the programme.

Provided that students who are otherwise eligible for the award of the degree / diploma but have secured a FGPA less than 4.00 at the end of the permissible period of semesters may be allowed by the Department / School concerned to repeat the same course/s or other courses of the same type in lieu thereof in the two extra semesters provided in clause 8 on "Duration of Programme".

**15 Removal of name of a student from the programme:**

- a. The name of a student falling under the following categories shall automatically stand removed from the rolls of the University:
  - (a) A student who fails to fulfill the minimum grade point requirements under clause 14.
  - (b) A student who has already exhausted the maximum duration allowed for completion of the Programme and has not fulfilled the requirements for the award of the degree / diploma.
- b. The School Board, on the recommendation of the Board of Studies of the Department concerned, may remove the name of a student from the programme of study if
  - (a) he / she fails to clear at least 50% of the prescribed core courses at the end of the 1<sup>st</sup> semester.
  - (b) he / she has still to clear courses which cannot possibly be cleared in the remaining period of the programme which he/ she is allowed to register for the normal load in the said period.

Notwithstanding what is contained in the foregoing clauses of this Ordinance, the Academic Council may, in exceptional circumstances and on the recommendations of the Board of Studies of the Department and the School Board as well as on the merits of each individual case, consider at its discretion and for reasons to be recorded relaxation of any of the provisions except those prescribing CGPA / FGPA requirements.



**M.Sc. (Environmental Sc.)  
SEMESTER-I**

**PRACTICALS**

**Semester- I**

**ENS-106: LAB COURSE – 1**

**Time: 6-8 HOURS**

**A. To determine the following parameters of grassland vegetation**

(Two exercise to be done in examination)

1. Minimum size and number of quadrat
2. Frequency of plant species and its comparison with Raunkiaer's standard diagram.
3. Density of plant species
4. Importance Value Index (IVI)
5. Index of dominance and Diversity

**B. To calculate the following parameters**

(Two exercise to be done in examination)

1. To calculate the lambda max of the given compound by spectrophotometer.
2. To calculate the lambda max of the given compound by Colorimeter.
3. RF value of the given sample by Thin Layer Chromatography.
4. RF value of the given sample by Paper Chromatography
5. To Study the morphological and anatomical adaptation of the following.

**A-** Hydrophytes **B-** Xerophytes

**C. Determination of Primary Productivity by following methods:**

(One exercise to be given)

1. Harvest method
2. Chlorophyll content method.
3. Light and dark bottle method.

**D. Comment on the following.**

(Two comments to be given)

1. Ecological pyramid
2. Biosphere reserves
3. Biome
4. Ecological Models
5. Principle of Gause
6. Inter and intra specific Interaction
7. Ecological Efficiency
8. Edge Effect
9. Standing crops
10. Commensalisms

**E. Viva Voce**

**F. Practical record/Chart/Model**

**Total** 50

**PRACTICALS**

**ENS-107: LAB COURSE – II**

**TIME: 6-8 HOURS**

**M.M. 50**

**A. Determine the following air pollutants by HVS/Gas analyzer** (Two exercises to be given)

- |                   |                    |                    |
|-------------------|--------------------|--------------------|
| 1-NO <sub>x</sub> | 2- SO <sub>x</sub> | 3- CO <sub>2</sub> |
| 4- RSPM           | 5- SPM             |                    |

**B. Determine the following water parameters** (Two exercises to be given)

- |               |        |        |
|---------------|--------|--------|
| 1-DO          | 2- BOD | 3- COD |
| 4- Alkalinity | 5- TDS |        |

**C. Analysis of soil for the following parameters**

(Two exercise to be given)

- |                         |             |                                |
|-------------------------|-------------|--------------------------------|
| 1- Organic matter       | 2- Nitrogen | 3- Soil water holding capacity |
| 4- Phosphate phosphorus |             |                                |

**D. Comments on the following** (Two comments to be given)

- |                                |                            |               |
|--------------------------------|----------------------------|---------------|
| 1- Important value Index (IVI) | 2- Productivity            | 3- Food Chain |
| 4- Autecology and Synecology   | 5- Liebig's law of minimum |               |
| 6- Shelford's law of Tolerance | 7. Law of Thermodynamics   | 8. Biomes     |
| 9. Material balance            | 10. Energy flow            |               |

**E. Viva Voce**

**F. Practical record/Chart/Model**

**Total** 50

**PRACTICALS Sem-II**

**ENS-206: LAB COURSE – III**

**TIME: 6-8 HOURS**

**M.M. 50**

**A. Analysis of the following parameters:**

(Two exercises

to be given)

1. Hardness
2. Transparency
3. Turbidity
4. Chloride ion/salinity
5. Total dissolved solids
6. Conductivity
7. Composition of solid waste
8. Chlorophyll content estimation in road side plants

**B. Statistical analysis**

To calculate the

student “t” test by recorded data.

1. To evaluate heterogeneity of Given population. ( $\chi^2$  test).
2. To test for interspecific association.
3. To test for independence.
4. To calculate the mean value of observed data.

**C. Comments on the following:**

(Two exercises to be given for comments)

- |                       |                            |
|-----------------------|----------------------------|
| 1. pH meter           | 2. DO meter                |
| 3. Conductivity meter | 4. Jackson turbidity meter |
| 5. Nephelometer       | 6. Spectrophotometer       |
| 7. Flame Photometer   | 8. Lux meter               |
| 9. Anemometer         | 10. Sound meter            |

**D. Viva Voce:**

**E. Practical record/Chart/Model**

**Total**

**50**

**PRACTICALS**

**ENS-207: LAB COURSE – IV**

**TIME: 6-8 HOURS**

**M.M. 50**

**A. Analysis of Heavy metals in given samples by Atomic Absorption Spectrophotometer.**

(Two experiment to be given)

1. Ag 2. Al 3. Ca 4. Cd 5. CO 6. Cr 7. Cu 8. Fe 9. Hg 10. Mg  
11. Mn 12. Ni 13. Pb

**B. Hypothetical EIA of following:**

(One

exercise to be given)

1. Urbanization  
2. Dam construction  
3. Hydroelectric power generation  
4. Tourism  
5. Sugar mills

**C. HPLC Practical**

(One exercise to be given)

1. To determine the concentration of metals by HPLC.  
2. Identify the metals by HPLC

**D. Comments on the following**

(Two comments to be given)

1. Teratogenesisity      2. Redox Potential      3. Physics of Remote Sensing  
4. GIS                      5. Environmental Ethics      6. IT Tools  
7. Electrophoresis      8. Biochips                      9. COD  
10. Albedo

**E. Viva Voce:**

**F. Practical record/Chart/Model:**

**Total**                      50

**PRACTICALS**

**ENS-306: LAB COURSE – V**

**TIME 6-8 HOURS**

**M.M. 50**

**A. To record the following parameters by weather monitoring station**

(Two exercise to be given)

1. Atmospheric Pressure
2. Rain fall
3. Out door, Indoor Temperature
4. Wind Speed and Direction
5. Wind Chill and Temperature
6. Humidity and Dew point

**B. Microbial studies:**

(Two slides to be given)

1. Bacteria, Fungi and Protozoa studies- identification and comments.
2. To Study the pollen grains in the given area.

**C. Experiments to perform:**

(Two exercise

to be given)

1. Preparation of nutrient broth/Glucose broth
2. Inoculation of inoculum (Any polluted water)
3. Preparation of Nutrient Agar Medium (NAM)
4. Preparation of Potato Agar Medium (PAM)
5. Demonstration of pouring and streaking techniques
6. Grams staining of *Lacto bacilli*
7. Faecal colliform
8. SPC

**D. Comments on the following**

(Two comments to be given)

**10**

1. Algal Blooms
2. Hyper Sensitivity
3. Bioremediation
4. Pasteurization
5. El-Nino
6. Energy Budget of the earth
7. Trace Elements
8. Food Poisoning
9. Bioleaching
10. Xenobiotics

**F. Viva Voce:**

**G. Practical record/Chart/Model:**

**Total**

**50**

**PRACTICALS**

**ENS-307: LAB COURSE – VI**

**TIME: 6-8 HOURS**

**M.M.50**

**A. Environmental Engineering Practical**

(Two

Exercise to be given)

1. To determine the Flow of liquid by Laminar Flow Bench
2. Separation of Oil and grease from the given samples
3. To determine the SO<sub>x</sub>, NO<sub>x</sub>, RSPM, SPM TPM through Stack Assembly.
4. To determine the DO Saturation in given water sample.

**B. Experiments on Remote Sensing:**

(One

exercise to be given)

1. Study of toposheets, satellite imageries and interpretations of images.
2. Study of 3-D vision test cards with the help of pocket stereoscope.

**C. Comments on the following**

(Two comments to be given)

- |                                |                         |                |
|--------------------------------|-------------------------|----------------|
| 1. Environmental Polices       | 2. Eco Mark             | 3. Evaporators |
| 4. Heat Transfer               | 5. Reflux Ratio         | 6. cyclones    |
| 7. Electrostatic Precipitators | 8. Principals of fluids |                |
| 9. Rault's and Henry Law       | 10. Land use plan       |                |

**D. Viva voce:**

**E. Practical record/Chart/Model:**

**Total**

**50**



## SEMESTER – I

### ENS-101 FUNDAMENTALS OF ECOLOGY

M.M. 50

- Unit I** Introduction to ecology and environmental sciences: Definition, Objectives, subdivisions and scope. Basic ecological tools and techniques. Relation between ecology and environmental sciences. General concepts of level of organization, Biosphere, Autecology and Synecology.
- Unit II** Environment and abiotic components of ecosystem: Atmosphere, lithosphere and hydrosphere. Abiotic environmental factors (temperature, light, water, etc). Different environmental laws and limiting factors (Liebig's law of minimum, Shelford's law of Tolerance, Combined concept of limiting Factors).
- Unit III** Biotic components of ecosystem: Biotic community (General characteristics of a community. Interdependence in a community and community metabolism) and ecological niche (concept, definition and types of niche, Gause's Principle), ecological succession and community evolution. Population ecology: Population characteristics and regulation of population size. Inter and intra specific interaction (Positive and negative interaction). Ecological genetics, Quantitative analysis of plant community, Quadrates, Frequency, Density, Important value Index (IVI).
- Unit IV** Dynamics of Ecosystems: Bio-geochemical cycle. Food chain and energy flow in eco-systems. Concepts of productivity and standing crops, ecological indicators, Ecological efficiencies, edge effect.
- Unit V** Diversity of Ecosystems: Bio geography and different ecosystems of the world (Lake, Pond, marine, estuarine and terrestrial ecosystems)

---

**Note:** Each theory paper shall consist of ten questions. Two questions will be set up from each unit. Candidate will have to attempt five questions in all selecting one question from each unit. The duration of each theory paper will be of three hours. The duration of practical will be of 6-8 hours depending on the nature of exercises, spread over 1 or 2 days as may be required, according to the type of problems/questions to be solved.

**ENS-102 NATURAL RESOURCE CONSERVATION AND MANAGEMENT**

**M.M.50**

- Unit I** Natural resources- Concept, classification and natural resources. Crisis of Water, Management of water resources – Concept and classification, Integrated water resources management. Watershed Management- Rain Water Harvesting. National lake and river conservation programme. Wetland management. Coastal zone management- Concept, scope, issues and strategies.
- Unit II** Mineral resources and Environment : Resources and reserves. Minerals and population, Ocean as new area for exploration of mineral resources. Ocean ore and recycling of resources.
- Unit III** Soil management, soil loss-soil erosion. Conservation and management strategies. Role of organic matter and its maintenance, diagnosis of nutrient deficiencies. Remedial measures and management techniques.
- Unit IV** Energy resources: solar radiation and its spectral characteristics. Fossil fuels-classification, composition, physico-chemical characteristics and energy content of coal, petroleum and natural gas. Principles of generation of hydroelectric power, tidal, ocean thermal energy conversion, wind, geothermal energy. Solar collectors, photovoltaic, solar ponds. Nuclear energy- fusion and fission. Magneto hydrodynamic power, bio-energy-energy from biomass and biogas, anaerobic digestion. Energy use pattern in different parts of world.
- Unit V** Forest management : Forest- land use changes in India- future demands of forest lands. captive plantation, community forest management, Forest rehabilitation, urban forestry, Protected area management and conservation. Integrated development programme in forest area, biodiversity of India- Aquatic and terrestrial. Endangered and threatened species.

---

**Note:** Each theory paper shall consist of ten questions. Two questions will be set up from each unit. Candidate will have to attempt five questions in all selecting one question from each unit. The duration of each theory paper will be of three hours. The duration of practical will be of 6-8 hours depending on the nature of exercises, spread over 1 or 2 days as may be required, according to the type of problems/questions to be solved.

**ENS-103      PHYSICAL ENVIRONMENT**

**M.M. 50**

**Unit-I**

**Atmospheric Environment:** Composition of atmosphere, vertical distribution of temperature in atmosphere, relationship of earth with sun, heat budget of the earth-atmospheric system, scales of meteorology, hydrostatic equilibrium, various kinds of lapse rates, vertical stability of atmosphere, cloud classification and formation, winds, wind roses, Coriolis force, global pressure belt system, monsoons, El nino.

**Unit-II**

**Aquatic Environment :** Global water balance. Ice sheets and fluctuations of sea levels. Origin and composition of sea water. Hydrological cycle. Inland water bodies like lakes, streams, rivers, estuaries and wetlands.

**Unit-III**

**Terrestrial Environment:** Igneous, sedimentary and metamorphic rocks, weathering, erosion, transportation and deposition of earth`s material by running water, wind, glaciers. The land use plan, soil surveys in relation to land use planning, methods of site selection and evaluation.

**Unit-IV**

**Global climate change:** History of climate change, Milankovitch`s theory of climate change, greenhouse gases and their effects, role of humans, climatic feedback mechanisms, possible impacts of global climate change.

**Unit V:**

**Biophysics:** Cellular function of cell, membrane structure and transport origin and conduction of impulses in nerve cell muscles, methods in bioelectric measurements. Radiation and molecular response, elementary aspects of atomic and molecular excitation, biointeractions with environment, bioacoustics, biomedical aspects of laser.

---

**Note:** Each theory paper shall consist of ten questions. Two questions will be set up from each unit. Candidate will have to attempt five questions in all selecting one question from each unit. The duration of each theory paper will be of three hours. The duration of practical will be of 6-8 hours depending on the nature of exercises, spread over 1 or 2 days as may be required, according to the type of problems/questions to be solved.

**ENS-104      FOREST AND WILDLIFE ECOLOGY      M.M. 50**

- Unit-I**      Forest types, Organization and productivity: Major types and composition of forests of India, structural organization of forest ecosystems, Primary production in different ecosystems and methods of measurement of primary production.  
**Social forestry:** Objectives, scope and necessity, agroforestry, Extension forestry, eucalyptus dilemma, people's participation, Roles on NGOs.
- Unit-II**      **Silvicultural practices:** Silvicultural principles, different silvicultural practices, impact of deforestation and shifting cultivation on forest ecosystems.  
**Forest management:** Objectives and principles, techniques, sustainable yield relation, biodiversity and Forest.
- Unit-III**      Values of wild life. Wildlife census methods (waterhole survey, point count and line transect methods, pug marks count method, King's census method), Components of wildlife habitat (Cover, Food, Water and Space), Common flora and fauna of India.
- Unit-IV**      Indian wildlife (Introduction, distribution of wildlife in ecological subdivision of India), IUCN Categories, National Parks, Wildlife Sanctuaries, Biosphere Reserves and Zoos in India, Gene pool. Habit, Habitat and breeding biology of few mammals (*viz.* Elephant, Tiger) and birds (*viz.* Weaver bird, Oriental Magpie Robin).  
Wildlife protection: Ecological basis of wild life conservation and management, case studies on crocodile farming, sea turtle conservation and project tiger, wild life and range management, management of Fire, .Role of NGO's in wildlife and forest conservation, Agenda-21.
- UNIT – V**      Reasons for wildlife depletion (Habitat destruction, Commercial wildlife exploitation, Overgrazing etc.) Eco-tourism management, Measurement for wildlife conservation (Policies and programmes), Special projects for endangered species (Project tiger, Gir lion Sanctuary Project, Crocodile breeding project, Project Hangul), International trade of wildlife, Animal cruelty: causes and prevention.

---

**Note:** Each theory paper shall consist of ten questions. Two questions will be set up from each unit. Candidate will have to attempt five questions in all selecting one question from each unit. The duration of each theory paper will be of three hours. The duration of practical will be of 6-8 hours depending on the nature of exercises, spread over 1 or 2 days as may be required, according to the type of problems/questions to be solved.

**ENS- 105: NATURAL DISASTERS**

**MM 50**

**Unit-I Introduction to Hazards**

Hazard Classification – Natural hazards and Technological hazards, Effects of hazards, Vulnerability and susceptibility of hazards, Assessing hazards and risks, Hazard prediction and warning, Role of different individuals, Natural Service functions of natural hazards. A brief introduction to biological hazards- Forest fires, Biological warfare, Anthrax.

**Unit-II Earthquakes**

Earthquakes - Types and Distribution of earthquakes, Prediction and control of earthquakes, Tsunami - Hazards associated with tsunamis, Tsunami prediction and warning systems,

**Unit-III Volcanoes**

Volcanoes-Distribution of volcanoes, eruption processes, Kinds of volcanic eruptions, Factors controlling volcanic eruptions, Products of volcanic eruptions, Hazards associated with volcanoes.

**Unit-IV Floods and Landslides**

Different kinds of floods, Factors leading to floods, Factors affecting floods, Floods and their associated hazards, Flood control measures, Prediction of floods.

Factors causing landslides, Different kinds of mass movements, Factors that affect mass movement, prediction of mass movement, Landslides and their effects, Precursor events before the occurrence of landslides, Prevention and mitigation of mass movements.

**Unit- V Weather related Hazards**

Effects of cyclones, genesis of a cyclone, Behaviour 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, lightening, Service functions of thunderstorms and lightening.

Factors leading to drought, drought consequences, strategies for drought mitigation, Desertification – Factors causing desertification, famine, El Nino and their effects.

---

**Note:** Each theory paper shall consist of ten questions. Two questions will be set up from each unit. Candidate will have to attempt five questions in all selecting one question from each unit. The duration of each theory paper will be of three hours. The duration of practical will be of 6-8 hours depending on the nature of exercises, spread over 1 or 2 days as may be required, according to the type of problems/questions to be solved.

**M.Sc. (Environmental Sc.)  
SEMESTER-II**

**ENS-201 ENVIRONMENTAL CHEMISTRY**

**M.M. 50**

**Unit I** Fundamentals of Environmental Chemistry: Stiochiometry, Gibb's energy, chemical potential, chemical equilibria, acid base reactions, solubility product, solubility of gases in water.

**Unit II** Air: Chemical composition of Air: Chemical speciation. Particles, ions and radicals in the atmosphere. Natural and anthropogenic sources of pollution. Primary and Secondary pollutants. Transport and diffusion of pollutants. Gas laws governing the behaviour of pollutants in the atmosphere. Oxygen and ozone chemistry. Chemistry of air pollutants Photochemical smog. Methods of monitoring and control of air pollution- SO<sub>2</sub>, NO<sub>x</sub>, CO, SPM. Effects of pollutants on human beings, plants, animals, materials and on climate., Air quality Standards.

**Unit III** Water: Chemistry of water, Types, sources and consequences of water pollution, Physico-chemical and bacteriological sampling and analysis of water quality. Water quality standards. Concept of DO, BOD, COD, sedimentation, coagulation, filtration, Redox potential.

**Unit IV** Soil Chemistry: Inorganic and organic components of soil. Nitrogen pathways and NPK in soils. Weathering of rocks, rock forming minerals, Soil /normal forming factors, Soil properties, Chemical and mineralogical properties of soils. Physico-chemical and bacteriological sampling and analysis of soil quality.

**Unit V** Noise: Sources of Noise pollution, measurement of noise and indices, effect of meteorological parameters on noise propagation. Noise exposure levels and standards. Noise control and abatement measures. Impact of Noise on human health.

Radioactive pollution, Thermal pollution. Marine pollution, Acid rain, Green house effect

---

**Note:** Each theory paper shall consist of ten questions. Two questions will be set up from each unit. Candidate will have to attempt five questions in all selecting one question from each unit. The duration of each theory paper will be of three hours. The duration of practical will be of 6-8 hours depending on the nature of exercises, spread over 1 or 2 days as may be required, according to the type of problems/questions to be solved.



ENS-202

BIostatistics, Instrumentation and Computer Application

M.M. 50

**Unit I:** Basic elements and tools of statistical analysis: Probability, Sampling, Measurement and distribution of attributes; Distribution – Normal, Poisson and Binomial; Arithmetic, Geometric and Harmonic Means; moments; tests of hypothesis and significance, t and  $\chi^2$  tests.

**Unit II:** Physics of Dielectrophoresis and its environmental applications, Basics of NMR instrumentations, significance of relaxation time, Raman effect and experimental measurement, Raman Spectroscopy, LASER based techniques, LIDAR based methods and techniques, SODAR Radiofrequency measurement and techniques.

**Unit III:** Principal of analytical methods: Titrimetry, Gravimetry, Colourimetry, Spectrophotometry (atomic absorption spectrophotometry, X-ray fluorescence, X-ray diffraction, flame photometry) , Gas chromatography, , GLC, HPLC, Electrophoresis, Gel filtration.

**Unit IV:** Bio-sensors: Radioactive techniques and scintillation counter, Microscopy (Compound, Phase contrast, fluorescent, electron microscope). pH meter, refractometer, Nephelometer , biochips, Smoke meter. Samplers- types methods of sample preservation.

**Unit V:** Introduction and history of Computer. Computer Basics, Communication technology and Information superhighway. IT tools, MS Windows and MS Office (MS word, MS Power point and MS Excel) Application of Computer in Environmental Modeling and forecasting.

---

**Note:** Each theory paper shall consist of ten questions. Two questions will be set up from each unit. Candidate will have to attempt five questions in all selecting one question from each unit. The duration of each theory paper will be of three hours. The duration of practical will be of 6-8 hours depending on the nature of exercises, spread over 1 or 2 days as may be required, according to the type of problems/questions to be solved.

**ENS-203 ENVIRONMENTAL METEOROLOGY AND REMOTE SENSING M.M. 50**

- Unit I** Earths as a planet- Motion of the earth, seasons, law of Black body radiation solar constant, Albedo. Mean heat balance of the earth atmosphere system. General Circulation.
- Unit II** Atmospheric structure and composition, Temperature and pressure, humidity. Dry adiabatic and saturated adiabatic lapse rates. Stability of the atmosphere. Inversions. Local winds. Clouds- Their formation and classification. Artificial modification of Clouds.
- Unit III** Climatology - Climatic control. Elements and factors of climate and their interaction. Oceanic and Continental influence, Influence on environment. Climatic Change.
- Unit IV** Basic Concepts of Remote Sensing, Physics of Remote Sensing; electromagnetic spectrum, terminologies, Principles of Radiation: radiation Transfer. Spectral reflectance of vegetation, soil and water. Interpretation principles and techniques.
- Unit V** Thermal and microwave sensing: basic concepts, Profiles: SAR, SLAR- operation, Characteristics of RADAR signals, earth surface characteristics influencing RADAR returns. Interpretation of microwave Data. Application of remote sensing, G.P.S. and G.I.S.

---

**Note:** Each theory paper shall consist of ten questions. Two questions will be set up from each unit. Candidate will have to attempt five questions in all selecting one question from each unit. The duration of each theory paper will be of three hours. The duration of practical will be of 6-8 hours depending on the nature of exercises, spread over 1 or 2 days as may be required, according to the type of problems/questions to be solved.

ENS-204 ENVIRONMENTAL MICROBIOLOGY

M.M. 50

**Unit-I**

**General Microbiology:** Microbial diversity, General classification, Microbial colonization, Biological interactions of microbes with plants and animals.

**Unit-II**

**Aquatic Microbiology:** Microbes in aquatic systems, measuring activity of microbes in water, Pathogens in water, Water health standards, Algal Blooms, bio-films.

**Unit-III**

**Soil microbiology:** Microbes in soils and their role, microbial interactions, mineralization and immobilization of nutrients in soil, Microbial degradation of cellulose, lignin Microbe mediated C, N and S transformations mycorrhiza and their environmental significance.

**Unit-IV**

**Biodegradation microbiology:** Interaction of biological, chemical and environmental factors in Biodegradation processes. Bioremediation processes; Definition and classification including *in situ* and *ex situ* types.

**Unit-V**

**Applied Environmental Microbiology:** Biodegradation of pesticides and hydrocarbons, Sewage sludge treatment using microbes, microbial fermentations, biohydrometallurgy and microbial recovery of oil. Use of bacteria ,fungi and algae in biosorption , Biomineralization and bioleaching.

---

**Note:** Each theory paper shall consist of ten questions. Two questions will be set up from each unit. Candidate will have to attempt five questions in all selecting one question from each unit. The duration of each theory paper will be of three hours. The duration of practical will be of 6-8 hours depending on the nature of exercises, spread over 1 or 2 days as may be required, according to the type of problems/questions to be solved.

ENS-205

ENVIRONMENTAL ENGINEERING

M.M. 50

**Unit I.** General principles and application of chemical engineering- Heat transfer – Different methods- Heat exchangers-Evaporators – Basic principles of radiation – handling of toxic and hazardous materials.

**Unit II.** Mass transfer: Ideal mixtures, Raoult and Henry's laws, X-Y diagrams- the distillation columns, reflux ratio, ideal plate, estimation of the number of ideal plates by McCabe Thiele method.

**Unit III.** The packed column, various types of packing, Requisite properties of packing, Channeling and flooding- Introduction of liquid-liquid extraction.

Solid- liquid separation: filtration, Filtration equipments (details) Centrifuges, Sedimentation continuous thickener solid- gas separation- Cyclone, electrostatic precipitators, bag filters and scrubbers.

**Unit VI.** Introduction to chemical process industries, Concepts of Unit operations and unit processes. the flow chart , Simplified flow chart with description for the following.

Sulphuric acid, caustic soda, metal refining, Insecticides, petroleum refining, paper and pulp organics with emphasis on local plants and sources of pollutants.

**Unit V.** Elements of Hydraulics- principles of fluids- basic equation for flow through pipes and open channels- Discharge and velocity equation.

Water purification process in natural and engineered systems. Water supply – design and layout of water distribution systems.

Process analysis, design and layout of industrial and municipal waste water systems.

---

**Note:** Each theory paper shall consist of ten questions. Two questions will be set up from each unit. Candidate will have to attempt five questions in all selecting one question from each unit. The duration of each theory paper will be of three hours. The duration of practical will be of 6-8 hours depending on the nature of exercises, spread over 1 or 2 days as may be required, according to the type of problems/questions to be solved.

**M.Sc. (Environmental Sc.)  
SEMESTER-III**

## ENS-301 ENVIRONMENTAL BIOTECHNOLOGY

M.M. 50

**Unit-I** Basic Techniques in genetic engineering: Restriction endonucleases, Restriction analysis, Southern blotting and hybridization, Gene identification and isolation; Genomic library, Use of reverse- transcriptase, c DNA library construction and screening.

**Unit-II** Introduction of cloned genes into new hosts using plasmid and phage vector systems, Chemical synthesis of DNA, DNA ligation, Transformation and screening of transformations, Expression of genes in new host.

**Unit-III** Gene transfer methods in bacteria and plants, Polymerize chain reaction, DNA sequencing methods, Hybridoma Technology, ELISA .

**Unit-IV** Applications of natural and genetically engineered micro-organisms from extreme environment: like thermophiles, alkalophiles; acidophiles, and halophiles in waste treatment of different industries. Production of enzymes like cellulase, proteases amylases; alcohol and acetic acid production,

**Unit-V** Biofertilizer technology: Rhizom culture, Blue-green algae culture, *Azolla* culture and *Micorrihizae* culture. Benefits and significance of biofertilizers in agriculture. Petroleum pollutant biodegradation.

---

**Note:** Each theory paper shall consist of ten questions. Two questions will be set up from each unit. Candidate will have to attempt five questions in all selecting one question from each unit. The duration of each theory paper will be of three hours. The duration of practical will be of 6-8 hours depending on the nature of exercises, spread over 1 or 2 days as may be required, according to the type of problems/questions to be solved.

**ENS-302 ENVIRONMENTAL MANAGEMENT AND IMPACT ASSESSMENT M.M. 50**

- Unit I** Environmental Management, Concept of Environmental management, Aspects & approaches to Environmental Management, Ecological Basis of Environmental Management, Agro-climatic Regional Planning, Risk Assessment : Basic components of a hazard control system, Techniques of risk assessment, Emergency control & disaster planning
- Unit II** Environmental Impact Assessment: Introduction, concept and aims, impact statement, methods and processes, mitigation measures. Prediction and assessment of impacts on air, water and noise. EIA Guidelines 1994, notification of Govt. of India.
- Unit III** Public participation in Environmental decision making. Environmental Economics, Economics of pollution control, Cost Benefit Analysis. Economics and Environment  
Economic growth, Gross National product and the quality of life: Sustainable-earth economy, Discount factor  
Environmental Ethics: Ethics and moral, Throw-away society ethics, Sustainable-Earth Society ethics, Ethical guidelines.
- Unit IV** Prediction and assessment of impacts on the biological, cultural and socio- economic environments, Introduction and basic concepts.. Environmental Impact Assessment of major developmental projects – industries, mining, thermal power plants, atomic power stations, transport (rail, road highway), tourism (including hotels, beach, resorts)
- Unit V** Environmental Audit – introduction, concepts, steps, methodology. EIA of different xenobiotics (chemical, fertilizer, heavy metals)

---

**Note:** Each theory paper shall consist of ten questions. Two questions will be set up from each unit. Candidate will have to attempt five questions in all selecting one question from each unit. The duration of each theory paper will be of three hours. The duration of practical will be of 6-8 hours depending on the nature of exercises, spread over 1 or 2 days as may be required, according to the type of problems/questions to be solved.



**ENS-303 ENVIRONMENTAL POLLUTION MANAGEMENT**

**M.M.50**

**Unit-I**

**Waste water management:** Primary treatment methods – screening, grit removal, primary sedimentation, secondary treatment methods, Activated sludge process, trickling filters, rotating biological contactors, oxidation ponds and lagoons. Advance waste water treatment-removal of nutrients and solids. Waste water reuse and sludge disposal, MINAS

**Unit-II**

**Air Pollution control:** 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.

**Unit-III**

**Noise Pollution Control:** Absorbing materials, barrier materials, damping materials, acoustical enclosures, Reactive silencers and filters; Active noise control methods.

**Unit-IV**

**Solid wastes:** Sources, chemical composition and classification of solid wastes, Solid waste management options: Sanitary Landfill, Recycling, Composting, Incineration, Energy recovery options from organic wastes. Hospital waste management; Fly ash management, Municipal Solid Waste (Management and Handling) Rules, 2000;

**Unit-V**

**Hazardous Waste Management:** Classification of Hazardous wastes; Physico-chemical properties of hazardous waste needed in management, Hazardous waste control and treatment, Different methods of disposal and management of hazardous wastes, Hazardous Waste (Management and Handling) Rules (1989) and (2000) Amendments.

---

**Note:** Each theory paper shall consist of ten questions. Two questions will be set up from each unit. Candidate will have to attempt five questions in all selecting one question from each unit. The duration of each theory paper will be of three hours. The duration of practical will be of 6-8 hours depending on the nature of exercises, spread over 1 or 2 days as may be required, according to the type of problems/questions to be solved.

**ENS-304 ENVIRONMENTAL GEOSCIENCES**

**M.M. 50**

**Unit I** Environmental Geosciences- Fundamental concepts.

The earth systems and biosphere: Conservation of matter in various geospheres- lithosphere, hydrosphere, atmosphere and biosphere. Energy budget of the earth. Earth's thermal environment and seasons. General relationship between landscape, biome and climate. Climates in India, Indian Monsoon, El Nino, Droughts, tropical cyclones and western disturbances.

**Unit II** Earth's processes and geological hazards: earth processes: Concept of residence, times and rates of natural cycles. Catastrophic geological hazards. study of floods, landslides, earthquakes. Volcanism and avalanche. Prediction and perception of the hazards and adjustments to hazardous activities.

**Unit III** Introduction : Composition of ocean water. Horizontal and vertical distribution of temperature in ocean, source of organic salinity in oceans and its controlling factors. Sources and types of marine deposits, their classification and distribution.

**Unit IV** Land use planning: The land use plan. Soil surveys in relation to land use planning. Methods of site selection and evolution.

**Unit V** Environmental Geochemistry: Concepts of Major, Trace and rare earth elements (REE). Classification of trace elements, mobility of trace elements. Trace elements and health. Possible effects of imbalance of some trace elements. Diseases induced by human use of land.

---

**Note:** Each theory paper shall consist of ten questions. Two questions will be set up from each unit. Candidate will have to attempt five questions in all selecting one question from each unit. The duration of each theory paper will be of three hours. The duration of practical will be of 6-8 hours depending on the nature of exercises, spread over 1 or 2 days as may be required, according to the type of problems/questions to be solved.

<b>ENS-305</b>	<b>GENERAL ENVIRONMENTAL ASPECTS</b>	<b>M.M. 50</b>
<b>UNIT – I</b>	Evolution, Origin of life and Speciation, Human ecology and human settlement, Scheme of labeling of eco-friendly products (Ecomark), Environmental Education and Awareness.	
<b>UNIT – II</b>	Convention on Conservation of Antarctic marine (1980) and mineral living resources, Treaty on principles governing the activities of state in the exploration and use of outer space (1967). The citizens convention on biodiversity/biological (1992), International convention on the high seas and fishing and living resources (1958) and Intervention of oil pollution casualties (1969).	
<b>UNIT – III</b>	Environment issues in India <i>viz.</i> Narmada dam, Tehri dam, <i>Chipko</i> movement, <i>Beej Bachao Andolan</i> , Green revolution, Silent valley movement, <i>Urja gram</i> , CNG implementation in Delhi. Formation and reclamation of wastelands, User, Alkaline and Saline soil, Hazardous wastes, Epidemiological issues: Goiter, Fluoriasis and Arsenic poisoning, Desertification and its control.	
<b>UNIT – IV</b>	Environmental priorities in India, Sustainable development: concept, objectives and principles. Challenges for sustainable development: Social, Political and Economic considerations, Role of individual and community in Sustainable development. Urban and rural planning, utilization of fly ash, waste disposal, Recycling and power generation, Resettlement and rehabilitation process.	
<b>UNIT – V</b>	Wetlands conservation, Water crisis and rainwater harvesting, Water conservation, Coastal management, Climate of India and Indian Monsoon, Tropical cyclones, Coral reef conservation.	

---

**Note:** Each theory paper shall consist of ten questions. Two questions will be set up from each unit. Candidate will have to attempt five questions in all selecting one question from each unit. The duration of each theory paper will be of three hours. The duration of practical will be of 6-8 hours depending on the nature of exercises, spread over 1 or 2 days as may be required, according to the type of problems/questions to be solved.

**M.Sc. (Environmental Sc.)  
SEMESTER-IV**

**ENS-401 ENVIRONMENTAL POLICIES AND LAWS M.M. 50**

**Unit I** Environment protection- Issues and Problems, International and national efforts for environment protection. National Environmental Policy of India. (PSAP,1992; NCSPSED,1992 ). Provision of Constitution of India regarding Environment (Article 48, 51A and 253).

**Unit II** The Water (Preventions and Control of Pollution) Act, 1974; The Water Rules,1975; Air (Prevention and Control of Pollution) Act, 1981; The Air Rules,1982 ; Environmental Protection Act, 1986; Forest Conservation Act,1980; Indian Forest Act (revised), 1982; Wildlife (Protection) Act, 1972 and their amendments; Noise Pollution Rules,2000; Motor Vehicle Act, 1988.

**Unit III** Regulation for management of Hazardous Substances

Hazardous Waste (management and Handling) Rules, 1989; Manufacture, Use, Import, Export & Storage of Hazardous Microorganisms & Genetically Engineered cells Rules, 1989; Hazardous Chemicals (Manufacture, storage & Import) Rules, 1989; Public Liability Insurance Act, 1991; National Environmental Tribunal Act, 1995; Biomedical Waste Rules, 1998.

**Unit IV** Public Interest Litigations (Cases filed & Movement in India) Scheme of labeling of Environment friendly products (Eco-Mark). National and International Organizations dealing with environmental issues. Famous Environmental Conventions

**Unit V** Case studies to be taken up: M.C. Mehta Vs Union of India: Ganga pollution case of Tanneries, AIR-1988 SC 1037 (1987), M.C. Mehta Vs Union of India, Ganga Pollution (Municipalities), AIR 1988 SC 1115 (1988), R.L. and E. Kendra Dehradun Vs State of U.P. (Dehradun quarrying case, AIR 1985 SC 652 and Banwari Sewa Ashram Vs State of U.P. AIR, 1987, SC 374.

---

**Note:** Each theory paper shall consist of ten questions. Two questions will be set up from each unit. Candidate will have to attempt five questions in all selecting one question from each unit. The duration of each theory paper will be of three hours. The duration of practical will be of 6-8 hours depending on the nature of exercises, spread over 1 or 2 days as may be required, according to the type of problems/questions to be solved.

**ENS-402 Credit Seminar**

**ENS-403: ENVIRONMENTAL HEALTH AND TOXICOLOGY M.M.50**

**Unit-I**

**Pollution and human health:** Trace element deficiency and disorders, occupational health hazards, biogeochemical factors in environmental health, epidemiological issues- goiter, fluorosis, arsenic poisoning.

**Unit-II**

**Transmissible diseases:** Symptoms, epidemiology and control of vector borne diseases- amoebiasis, trypanosomiasis, filariasis, leishmaniasis, schistosomiasis, life cycle of Plasmodium, control of Malaria, tuberculosis and AIDS. Waterborne diseases: Jaundice & diarrhea.

**Unit-III**

**Principles of toxicology:** Toxic chemicals in the environment and their effects, heavy metals, Pesticides. Mode of entry of toxic substances, biotransformation of xenobiotics, detoxification, indices of toxicology.

**Unit-IV**

**Genetic Toxicology:** Carcinogenesis; Carcinogens, chemical carcinogenicity, mechanism of carcinogenicity, Oncogenes and tumour suppressor genes. Environmental carcinogenicity testing.

**Unit V**

**Mutagenicity:** Mutagens, Environmental mutagen testing- Bacterial mutagenesis assays, gene mutation chromosome damage assays, DNA damage and repair assays.

---

**Note:** Each theory paper shall consist of ten questions. Two questions will be set up from each unit. Candidate will have to attempt five questions in all selecting one question from each unit. The duration of each theory paper will be of three hours. The duration of practical will be of 6-8 hours depending on the nature of exercises, spread over 1 or 2 days as may be required, according to the type of problems/questions to be solved.

**ENS-404: ENVIRONMENTAL MODELING**

**M.M.50**

**Unit-I**

Role of modeling in environmental sciences, model classification deterministic models, stochastic models, steady state models, dynamic models.

**Unit-II**

Different stages involved in model building. Methods for the formulation of dynamic balance equations-mass balance procedures, energy balancing, simple microbial growth kinetics, Monod equation.

**Unit-III**

Simulation examples- Streeter-Phelps Oxygen Sag Model, Lotka-Volterra Predator Prey Model. Gaussian Plume Model.

**Unit- IV**

Energy Balancing, Microbial Growth Kinetics- Exponential Growth Model, Logistic Growth Model, Monod Equation, Two Species Population Growth Model of Competition.

**Unit-V**

GIS-Principle, Scope, Methodology and role in environmental modeling and management

---

**Note:** Each theory paper shall consist of ten questions. Two questions will be set up from each unit. Candidate will have to attempt five questions in all selecting one question from each unit. The duration of each theory paper will be of three hours. The duration of practical will be of 6-8 hours depending on the nature of exercises, spread over 1 or 2 days as may be required, according to the type of problems/questions to be solved.



**Department of Environmental Sciences**  
**Central University of Haryana**  
**Jant-Pali, Mahendergarh**  
**Website: [www.cuharyana.org](http://www.cuharyana.org)**