DEPARTMENT OF ENVIRONMENTAL STUDIES
SCHOOL OF LIFE SCIENCES
DR. BHIMRAO AMBEDKAR UNIVERSITY, AGRA

MINUTES

The minutes of the meeting of the Academic Committee of Department of Environmental Studies held in the Department of Environmental Studies of the Dr. Bhimrao Ambedkar University, Agra on 02nd June 2022 at 04:00 PM. The following members were present:

1. Prof. Sant Prakash, DEI, Deemed university, Agra
2. Dr. Hemant Kumar Kulshrestha, Department of Chemistry, St. John's College, Agra
3. Dr. Geeta Maheshwari, Agra College, Agra
4. Prof. Bhupendra Swarup Sharma, Head & Dean, Dr. Bhimrao Ambedkar University, Agra

1. The Academic Committee considered and approved of Revised Ordinances of the M.Sc. Environmental Science. (In Faculty of Life Science) course based on Choice Based Credit System (CBCS) as per NEP 2020. (Appendix – 1)

2. The Academic Committee considered and approved the Revised Syllabus of M.Sc. Environmental Science (In Faculty of Life Science) based on Choice Based Credit System (CBCS) as per NEP 2020. (To be implemented from the academic session 2022-2023). (Appendix – 2)

3. The Academic Committee considered and approved the Syllabus for Minor Subject for Post Graduate (M.Sc.) Courses for other Faculty, based on Choice Based Credit System (CBCS) as per NEP 2020. (To be implemented from the academic session 2022-2023. (Appendix – 3)

4. The Academic Committee considered and approved of Ordinances of Post Graduate Diploma in Research (PGDR) in Environmental Science (in Faculty of Life Science) course based on Choice Based Credit System (CBCS) as per NEP 2020. (Appendix – 4)

5. The Academic Committee considered and approved the Syllabus of Post Graduate Diploma in Research (PGDR) in Environmental Science (in Faculty of Life Science) based on Choice Based Credit System (CBCS) as per NEP 2020. (To be implemented from the academic session 2022-2023). (Appendix – 5

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6. The Academic Committee considered and approved the fee structure of Post Graduate Diploma in Research (PGDR) in Environmental Science (in Faculty of Life Science) based on Choice Based Credit System (CBCS) as per NEP 2020 (To be implemented from the academic session 2022-2023. Tuition fees 25000/- per semester and other fees (examination, enrollment, sports and cultural activities etc.) as per University norms.

Prof. Sant Prakash,
DEI, Deemed University, Agra

Dr. Hemant Kumar Kulshrestha,
Department of Chemistry,
St. John's College, Agra

02/06/22

Dr. Geeta Maheshwari,
Agra College, Agra

Prof. Bhupendra Swarup Sharma
Head & Dean,
Dr. Bhimrao Ambedkar University, Agra

Registrar
Dr. B.R.A. University, Agra

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DEPARTMENT OF ENVIRONMENTAL STUDIES
SCHOOL OF LIFE SCIENCES
DR. BHIMRAO AMBEDKAR UNIVERSITY, AGRA

MINUTES

The minutes of the meeting of the Academic Committee of Department of Environmental Studies held in the Department of Environmental Studies of the Dr. Bhimrao Ambedkar University, Agra on 21st May 2022 at 04:00 PM. The following members were present:

1. Prof. Sant Prakash, DEI, Deemed university, Agra
2. Dr. Hemant Kumar, Department of Chemistry, St. John's College, Agra
3. Dr. Geeta Maheshwari, Agra College, Agra
4. Prof. Bhupendra Swarup Sharma, Head & Dean, Dr. Bhimrao Ambedkar University, Agra

1. The Academic Committee considered and approved of Ordinances of the B.Sc. (In Faculty of Life Science) course based on Choice Based Credit System (CBCS) as per NEP 2020. (Appendix – 1)

2. The Academic Committee considered and approved the Syllabus of Environmental Science Subject for B.Sc. (In Faculty of Life Science) based on Choice Based Credit System (CBCS) as per NEP 2020. (To be implemented from the academic session 2022-2023). (Appendix – 2)

3. The Academic Committee considered and approved the Subject Combinations (Three) for B.Sc. (In Faculty of Life Science) as per NEP 2020. (To be implemented from the academic session 2022-2023). (Appendix – 1)

4. The Academic Committee considered and approved the B.Sc. Syllabus of Minor/elective Subject for other Faculty based on Choice Based Credit System (CBCS) as per NEP 2020. (To be implemented from the academic session 2022-2023) (Appendix – 3)

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5. The Academic Committee considered and approved the Syllabus for Co- curricular courses of B.Sc. (In Faculty of Life Science) based on Choice Based Credit System (CBCS) as per NEP 2020. (To be implemented from the academic session 2022-2023. (Appendix – 4)

6. The Academic Committee considered and approved the Syllabus for Vocational courses of B.Sc. (In Faculty of Life Science) based on Choice Based Credit System (CBCS) as per NEP 2020. (To be implemented from the academic session 2022-2023. (Appendix – 5)

7. The Academic Committee authorized the Dean, Faculty of Life Science to prepare the syllabus of vocational courses other than approved in item no. 6 for B.Sc. (In Faculty of Life Science)from the available list of vocational courses approved by the University (Appendix-6)

8. The Academic Committee considered and approved the fee structure of B.Sc. (In Faculty of Life Science) based on Choice Based Credit System (CBCS) as per NEP 2020 (To be implemented from the academic session 2022-2023. Tuition fees 10000/- per semester (20000/- per year) and other fees (examination, enrollment, sports and cultural activities etc.) as per University norms.

Prof. Sant Prakash, 21/5/22
DEI, Deemed University, Agra

Virtually Present
Dr. Hemant Kumar, *
Department of Chemistry,
St. John's College, Agra

21/05/22
Dr. Geeta Maheshwari,
Agra College, Agra

21/5/22
Prof. Bhupendra Swarup Sharma
Head & Dean,
Dr. Bhimrao Ambedkar University, Agra

*Dr. Hemant Kumar Recommendation attached herewith separately.

Registrar
Dr. B.R.A. University, Agra

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DR. BHIMRAO AMBEDKAR UNIVERSITY, AGRA

FACULTY OF LIFE SCIENCE

DEPARTMENT OF ENVIRONMENTAL STUDIES

MASTER OF SCIENCE (M.Sc.) IN ENVIRONMENTAL SCIENCE

(IN FACULTY OF LIFE SCIENCE)

(Based on Choice Based Credit System)

(AS PER NEP, 2020)

REVISED ORDINANCES

1. The title of the M.Sc. course shall be M.Sc. Environmental Science (In Faculty of Life Science). The Course shall be conducted by the Department of Environmental Studies (Dr. Bhimrao Ambedkar University), Agra.

2. The M.Sc. Environmental Science (In Faculty of Life Science) course shall be of two years (divided into four Semesters) programme and based on Choice Based Credit System (CBCS). The first year of M.Sc. shall be known as M.Sc. 1st year having I and II semesters. Similarly, second year of this course shall be called M. Sc. 2nd year having III and IV semesters. Each semester shall consist of minimum 90 working days.

3. B.Sc. Research (in Faculty of Life Science) will be awarded if student exit the programme after completing M.Sc. first year (I and II semester) of M.Sc. Environmental Science (in Faculty of Life Science) programme and earned total 52 credits. The I and II semesters of the First year of the M.Sc. Environmental Science (in Faculty of Life Science) Programme will be known as VII and VIII semesters of the B.Sc. Research (in Faculty of Life Science).

4. The M.Sc. Environmental Science (in Faculty of Life Science) programme is spread over four semesters. The total marks assigned for this programme shall be 2500 marks and the credits earn will be of 100 credit points and comprises of three different components viz: I) Teaching - Theory II) Lab Work and (III) Industrial/Summer Training/ Survey/ Research Project

Distribution of credits for M. Sc. Environmental Science (In Faculty of Life Science) Programme is:

Total Credits for M. Sc. Degree Programme = 100 credits

I) Teaching - Theory = 68 credits

II) Lab work = 16 credits

III) Industrial/Summer Training/ Survey/ Research Project = 16 credits

Distribution of credits for teaching (Total 68 credits)

i) Major/Core courses (16x4) = 64 credits

ii) Minor courses = 04 credits

Distribution of credits for Lab work and Project (Total 32 credits)

i) Lab work = 16 credits

ii) Industrial/Summer Training/ Survey/ Research Project = 16 credits

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5. A. Program Duration and Credit Requirements:

a. M.Sc. Environmental Science (In Faculty of Life Science) degree programme shall be of four semesters (2 years) M. Sc. Environmental Science (in Faculty of Life Science). The M.Sc. Environmental Science (in Faculty of Life Science) programme will be based on Choice Based Credit System (CBCS). Each semester shall consist of minimum 90 working days.

b. These will be consecutive academic years.

B. **Distribution and Requirements of Credits for M. Sc. Environmental Science** (in Faculty of Life Science) **Programme is:**

a. **M. Sc. 1st year (I and II semester) / B. Sc. Research (VII and VIII Semester) will be of 52 credits.**

I. Teaching of 01 Major Course (4 Theory in course) in each semester (I&II Semester) = 16 + 16 credits = 32 credits

II. Teaching of 01 Minor Course Theory (II semester) = 4 credits

III. Practical work of 01 Major Course in each semester (I & II Semester) = 4 + 4 credits = 08 credits

IV. Industrial/Summer Training/ Survey/ Research Project in a year (I & II semester) = 8 credits

B. Sc. Research (in Faculty of Life Science) will be awarded if student exit M. Sc. first year but after completing all 2 semesters (1st year) of M. Sc. **Environmental Science** (in Faculty of Life Science) programme and earned total 52 credit.

b. **M. Sc. 2nd year (III and IV Semester) will be of 48 credits.**

I. Teaching of 01 Major Course (4 Theory in course) in each semester (III&IV Semester) = 16 + 16 credits = 32 credits

II. Practical work of 01 Major Course in each semester (III&IV Semester) = 4 + 4 credits = 08 credits

III. Industrial/Summer Training/ Survey/ Research Project in a year (III and IV semester) = 8 credits

M. Sc. Environmental Science (in Faculty of Life Science) will be awarded after completing all 4 semesters (2 years) comprising total 100 credits.

6. A. Teaching (68 Credits)

Teaching is a major component of the M.Sc.Environmental Science (In Faculty of Life Science) programme. It shares 68 credits out of total 100. The remaining two components i.e. Lab work and Industrial/Summer Training/ Survey/ Research Project share remaining 32 credits. Various courses offered under M.Sc. Environmental Science (In Faculty of Life Science) programme are categorized as: A) Core courses B) Elective course. Altogether there are 13 Core courses and 03 Elective courses. All core courses are offered in I, II, III and IV semesters and all Elective Courses will be offered in III and IV semester of the M.Sc. Environmental

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Science (In Faculty of Life Science) programme. All Core Courses and Elective courses are of 4 credits each and compulsory for all the students and cover all specialized papers.

In III semester there is 02 Elective Courses, out of which students will have to choose any 01 Elective courses to obtain 4 credits

In IV semester there is a running list of 04 Elective Courses, out of which students will have to choose any 02 Elective courses to obtain 8 credits.

One compulsory Minor course is of 4 credits will be chosen by student from other faculty in 1st year (II semester) of M.Sc. Environmental Science (In Faculty of Life Science) Programme.

B. Lab work and Industrial/ Summer Training/ Survey/ Research Project (32 credits)

a) Lab work (16 credits)

The lab work component is spread over all four semesters and is called as practical to be completed in I,II,III and IV semesters respectively. Under Lab Work sets of experiments specially designed for M.Sc. Environmental Science (In Faculty of Life Science) students by faculty members of the department are carried out in M. Sc. laboratory.

b) Industrial/Summer Training/ Survey/ Research Project (16 credits)

The Industrial/Summer Training/ Survey/ Research Project component is spread over all four semesters and is called as Research Project to be completed upto the end of II semester and IV semester respectively. Each student will work for M. Sc. Industrial/Summer Training/ Survey/ Research Project under the supervision of formally assigned supervisor in the Department. Assigning of supervisor will be based on academic interest shown by the student in area of research specialization of the concerned faculty member followed by the consent given by the faculty member to supervise the project work of that particular student. Student shall complete the process of academic interaction to obtain teachers consent to supervise his/her project work by the beginning of I and III semester. The work on research project will start in First/third semester under the supervision of concerned faculty member in his /her lab or from other institution govt./ private sector (industries/consultancies/laboratory/ NGO) in the form summer training(4-6 weeks) and will be completed by second/fourth semester with writing and submission of dissertation. Students will have to present their work and defend it in an open viva-voce in the presence of internal and external examiner in the end of the 1st year and 2nd year respectively.

7. There shall be four theory papers, One Lab Work/ Practical examination and Industrial/Summer Training/ Survey/ Research Project in each semester.

8. Each Semester shall have Four Theory Papers (Examination) of 75 marks each and Four Periodical Tests/ Continuous Internal Examination (CIE) of 25 marks

each (one class test of 10 marks, One seminar of 10 marks and Viva- voce of 5 marks) in each course (Total marks of each theory paper 100 (4 credits) including Periodical Tests/CIE). One Practical examination of 100 marks (4 credits) in each semester and Industrial/Summer Training/ Survey/ Research Project of 200 marks (8 credits) in together in I & II semester and III & IV semester respectively.

Continuous Internal Evaluation (CIE) shall be based on one class test of 10 marks, One seminar of 10 marks and Viva- voce of 5 marks as decided by the concerned teacher/HOD).

One minor course of other faculty shall have one theory paper of 75 marks and periodical test/CIE of 25 marks only in II semester.

M. Sc. 1st year (I and II semester) / B. Sc. Research (VII and VIII Semester) will be of 1300 Marks.

a. Teaching of 01 Major Course (4 Theory in course) in each semester (I & II Semester) = 400 + 400 = 800 Marks

I. Teaching of 01 Minor Course Theory (II semester) = 100 Marks

II. Practical work of 01 Major Course in each semester (I & II Semester) = 100 + 100 = 200 Marks

III. Industrial/Summer Training/ Survey/ Research Project in each semester (I & II Semester) = 200 Marks

Total Marks of M.Sc. 1st year (I & II semester) / B.Sc. Research 4th year (VII & VIII Semester) = 1300 marks

M. Sc. 2nd year (III and IV Semester) will be of 1200 Marks.

I. Teaching of 01 Major Course (4 Theory in course) in each semester (III & IV Semester) = 400 + 400 = 800 Marks

II. Practical work of 01 Major Courses in each semester (III & IV Semester) = 100 + 100 = 200 Marks

III. 01 Industrial/Summer Training/ Survey/ Research Project III & IV Semester) = 200 Marks

Total Marks of M.Sc. 2nd year (III and IV Semester) = 1200 marks

M. Sc. Environmental Science (in Faculty of Life Science) will be awarded after completing all 4 semesters (2 years) comprising total 2500 Marks.

9. At the end of each Semester there shall be End Semester/Term Examination of three hours duration for each course and practical examination of six hours, based on prescribed courses taught during the Semester.

10. Prior to the commencement of each End Semester/ Term Examination there shall be preparation leave for not less than 7 days and not more than 10 days.

11. The theory examiners of the End Semester/Term Examination shall be 50% internal and 50% external.

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12. The practical and Research Project examination at the end of each Semester/year shall be conducted by a Board of two examiners (one external and one internal examiner).

13. The paper setters/examiners- external as well as internal shall be appointed by the Vice- Chancellor on the recommendation of the Head of the Department.

14. To start with not more than 20 students shall be admitted in the First Semester. No admission in any other Semester will be allowed.

15. The minimum qualification for admission to the Master's course (M.Sc.) in Environmental Science (In Faculty of Life Science) shall be:

a. Bachelor's degree (Three Year) with atleast II division with Chemistry/ Zoology/ Botany/ Forestry/Mathematics/Physics/Environmental Science as one of the subjects.

or

(b) Bachelor's degree (Three Year) with at least II division in any one of the following:
Biotechnology, Microbiology, Biomedical Science, Biochemistry, Life Science, Biophysics, Forestry, Environmental Science, Geology and Home Science will also eligible.

or

(c) B.Sc. (Honours School) (Three Year) with at least II division in any one of the following:Environmental Science, Biotechnology, Biochemistry, Biophysics, Microbiology, Zoology, Botany, Physics, Forestry, Geology, Home Science and Chemistry will also be eligible.

or

(d) B.E/ B. Tech. degree in any one Environmental Engineering, Biotechnology Engineering, Civil Engineering and Fire Engineering with 50% marks in aggregate will also be eligible.

16. The admission of the candidate shall be on the basis of academic record, admission test and interview.

17. The admission test shall be based on objective type questions of B.Sc. standard. The test may be 2-3 hours depending upon the number of questions.

b. The test shall be followed by the interview to be conducted by the Department faculty members.

c. All the above examination shall be given equal weightage. The admission test shall be of 40 marks and the interview of 10 marks. The marks obtained from High School to B.Sc. taken in equal percentage shall be normalized to 50%.

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18. Admission in the course will be finalized by the Dean/Head of the Department/Admission Committee of the Faculty of Life Science.

19. In case of misbehavior, indiscipline, the student may be expelled from the Department or given some other punishment recommended by the faculty members of the Department / Proctor of the University and the decision of the unfair means committee of the university is final in the case of cheating and using unfair means by the student in any examination. All cases of expulsion shall be referred to the Vice-Chancellor for final approval.

20. Each student shall pay tution, examination and other fees as per semester/annual and as per University Orders.

21. **(a).** Each theory paper of the Course shall contain not more than 8 questions spread uniformly over the entire syllabus. The students shall have to answer only four questions in three hours, which shall be the duration of the question paper. If the 4 Units are there in the syllabus one question will be compulsory form each unit.

(b). A student must get at least 35% marks in each theory paper (Minimum 26 Marks out of 75 Marks) and periodical tests/CIE (Minimum 9 Marks out of 25 Marks) separately in each Semester for being eligible for promotion to the next Semester. Further, he/she must get at least 35% marks in the practical examination (Minimum 35 Marks out of 100 Marks) and Research Project (70 Marks out of 200 Marks), separately. To pass the course the candidate should secure at least 35% marks in the aggregate.

22. A student who fails or want to improve in theory paper/(s) or Periodical tests/CIE shall be given only one chance to reappear in that paper along with the next following batch. The chance to reappear shall be given only in not more than two courses in one Semester. The candidate shall, however be promoted to the next Semester. No separate examination will be conducted for such candidate.

23. If a candidate fails to appear in practical examination, a special practical examination can be conducted for the candidate on the deposition of fees as prescribed by the university as a special practical examination fees.

24. A student may appear as an Ex-student in the term/semester examination provided that :-

(a) He /She has completed all the semester examination, test and seminars but failed in aggregate of all the semester examination.

(b) He /She has attended 50% of lectures, practical, appeared in tests and seminars and he/she has submitted the Medical Certificate an application on the first day of the term/semester examination or prior to this.

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25. If a candidate has secured 60% or more marks in the aggregate in all the four semester he/she will be placed in I division. If he/she secured 50% or more but less than 60% will be placed in II division. If he/she secured less than 50% marks will be placed in III division. If a candidate has secured 75% or more marks in the aggregate of all the four Semester examination it counted together, it shall be mentioned in his Degree that he has passed M.Sc. Examination with Distinction.

26. Every candidate will be required to have 75% attendance of the prescribed number of periods in each paper. Teaching/ Library Reading shall be of one-hour duration and will be counted as one attendance. Practical of 2-3 hours will also be counted as one attendance.

    Exemption in the prescribed number of attendance may be granted by the Vice-Chancellor on the recommendation of the Head of the Department in case of following circumstances:

    The student should be a sportsman or sportswoman who have participated in games up to the level of National/ Inter-University/ Camps/ Tournaments and Youth Welfare Activities.

    In spite of exemptions clarified above it will be compulsory for a candidate that he/she has attended at least 60% Prescribed number of periods.

27. **Course Structure**

    The course structure and course outlines of M. Sc. Environmental Science (in Faculty of Life Science) programme shall be as per the respective regulations recommended by the respective Academic Committee/ Board of Studies of the Department and ratified by the competent authority.

28. **Minor Course:**

    a. The student will have to study one minor course of other faculty in II semester
    b. Minor course (other faculty) shall be allotted by Department based on availability of seats at the beginning of the semester and fill in the Examination form.
    c. Student will have to opt for a minor course of other faculty offered by Department, from the subjects available at the Institutes/departments of the Khandari Campus, Dr. Bhimrao Ambedkar University Agra. Classes and examinations for minor course shall be run simultaneously with their major courses/subjects.
    d. The student will have the freedom to choose a similar course of equal credits from MOOCs, SWAYAM portal of UGC/Ministry of education in place of a Minor Course offered in the semester as specified by the Department. The total credits required for that course could be earned in Minor Course from this mode and those credits have to be added by the University in their SGPA/ CGPA on the submission of certificate.

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e. Student may complete minor course from SWAYAM, MOOCS etc. by recognized Central or state government body, or UGC, or University during the period of II semester of M.Sc. Environmental Science Programme it will be considered as one Minor paper of four credits. His marks/grades will be awarded according to the decision of Equivalence committee of Faculty of Life Science on the submission of the certificate.

29. **Exit option and award of B.Sc. Research (in Faculty of Life Science)**

a. In case the student wishes to leave after completion of one year of M. Sc. Environmental Science (in Faculty of Life Science) programme, He/she shall be eligible for award of B.Sc. Research in Faculty, provided the student fulfils the following conditions:

i. Has pursued the prescribed courses of study and has earned 52 credits as prescribed under the relevant regulations within an academic year.

ii. Obtained a minimum CGPA of 4.0

iii. Paid all the dues of the University.

iv. No disciplinary proceedings are pending against him/her.

v. Any other condition, as notified by the competent authority of the University.

30. Students holding a B.Sc. Research (In Faculty of Life Science) can apply for lateral entry (with same subject) into the second year of M. Sc. Environmental Science (in Faculty of Life Science) Programme against the vacant seats through the laid down admission process for the purpose as notified by the University.

31. Those Students who reappear in any course/s in any semester or re-register for a semester shall have to pay the prescribed fee (Tution, Examination and Other fees).

32. Challenge evaluation shall be permitted as per rules/orders of the University.

33. The Conversion of SGPA/CGPA to equivalent marks shall be as per University Norms.

34. **Interpretation clause**

In case of any issue of interpretation arising during the course of implementation of these Ordinances or in case of any unforeseen circumstance, decision of the Vice Chancellor shall be final.

35. Anything, not covered under the Ordinance (*vide supra*) shall be decided by the Academic Committee of the Department without prejudice to the powers of The Academic Council, Executive Council, The Admission Committee, and The Examination Committee of The University. The Academic Committee shall be responsible for courses, syllabus of M. Sc. Environmental Science (in Faculty of Life Science) or any other degree.

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REVISED

COURSES AND SYLLABI

OF

M.Sc. ENVIRONMENTAL SCIENCE
FACULTY OF LIFE SCIENCE

Based on Choice Based Credit System (CBCS)

Under NEP-2020

2022

DEPARTMENT OF ENVIRONMENTAL STUDIES
SCHOOL OF LIFE SCIENCES
DR. BHIMRAO AMBEDKAR UNIVERSITY
AGRA-282 002

REVISED COURSES AND SYLLABI
OF
M.Sc. ENVIRONMENTAL SCIENCE
Faculty of Life Science
BASED ON CHOICE BASED CREDIT SYSTEM (CBCS)
Department of Environmental Studies,
Dr. Bhimrao Ambedkar University, Agra
UNDER NEP-2020

Courses	M. Sc. Environmental Science I semester	Marks		Total	Credit
	Course Title	CIE	End Semester Examination	100	
EnvSc-C101	Ecology and Sustainable Development	25	75	100	4
EnvSc-C102	Environmental Pollution	25	75	100	4
EnvSc-C103	Energy and Environmental Policy	25	75	100	4
EnvSc-C104	Biodiversity and Conservation	25	75	100	4
EnvSc -C105	Practical		100	100	4
	Industrial training/Survey/Research Project				
	Total			500	20
Courses	**M. Sc. Environmental Science II semester**	**Marks**		**Total**	**Credit**
	Course Title	**CIE**	**End Semester Examination**		
EnvSc-C201	Environmental Chemistry	25	75	100	4
EnvSc-C202	Earth Processes and Soil Sciences	25	75	100	4
EnvSc-C203	Environmental Techniques	25	75	100	4
EnvSc-C204	Environmental Engineering	25	75	100	4
EnvSc-C205	Practical		100	100	4
EnvSc-C206	**Industrial training/Survey/Research Project**		200	**200**	**8**
	Minor (Other Faculty)	25	75	**100**	**4**
	Total			**800**	**32**
Courses	**M. Sc. Environmental Science III semester**	**Marks**		**Total**	**Credit**
	Course Title	**CIE**	**End Semester Examination**		
EnvSc-C301	Water resources and Marine Environment	25	75	100	4
EnvSc-C302	Solid and Hazardous Waste Management	25	75	100	4
EnvSc-C303	Environmental Bio-statistics and Modelling	25	75	100	4
EnvSc -E304	Meteorology: Tools And Techniques	25	75	100	4
EnvSc -E305	Atmosphere And Global Climate Change				
EnvSc-C306	Practical		100	100	4
	Industrial training/Survey/Research Project				
	Total			500	20
Courses	**M. Sc. Environmental Science IV semester**	**Marks**		**Total**	**Credit**
	Course Title	**CIE**	**End Semester Examination**		
EnvSc-C401	Environmental Impact and Risk Assessment	25	75	100	4
EnvSc-C402	Environmental Biotechnology and Toxicology	25	75	100	4
EnvSc –E403	Environmental Biotechnology	25	75	100	4
EnvSc –E404	Environmental Instrumentation				
EnvSc –E405	Ecotoxicology And Environmental Health	25	75	100	4
EnvSc –E406	Environmental Hazards				
EnvSc-C407	Practical		100	100	4
EnvSc-C408	**Industrial training/Survey/Research Project**		200	200	8
	Total			**700**	**28**
	Total Marks and Credits			**2500**	**100**

Note; The I and II semesters of the First year of the M.Sc. Environmental Science (in Faculty of Life Science) Programme will be known as VII and VIII semesters of the B.Sc. Research (in Faculty of Life Science).

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FIRST SEMESTER
Core Course
Code-EnvSc-C102
ENVIRONMENTAL POLLUTION

Topics	Teaching Hours
UNIT-I	
1) Chemistry of water-Types, sources and consequences of water pollution. 2) Types and characteristics of domestic, industrial and agricultural wastes and their effects on water bodies, animal and human beings. 3) Water quality parameters, Physiochemical and bacteriological sampling. 4) Water quality standards (Drinking Water).	15
UNIT-II	
1) Atmosphere and its fraction; gas laws governing the behavior of pollutants in atmosphere. 2) Natural and Anthropogenic sources of atmospheric pollutants, their effects on animal, human, vegetation and materials and their reaction in the atmosphere. 3) Transport and dispersal of pollutants, effects of meteorological and topographical factors. 4) Sampling of gaseous and particulate matter, their analysis and air quality standards.	15
UNIT-III	
1) Basic properties of sound waves plane and spherical waves, sound pressure and intensity levels, decibel, effects of meteorological parameters on sound propagation measurement and analysis of sound. 2) A weighted sound level, equivalent sound level (leq.) Noise pollution level (NPL), Sound exposure level (SEL), Traffic sound index (TNI), Day night level. 3) Source of noise, noise control and abatement measures, sound absorption coefficient. 4) Hazards of noise pollution, effects on physiological, circulatory, respiratory, muscular, hearing loss and threshold shifts and noise standards.	15
UNIT-IV	
1) Physico-chemical and bacteriological sampling as analysis of soil quality. 2) Sources of soil pollution, Industrial waste effluents and heavy metals, their interactions with soil components. 3) Soil micro-organisms and their function, degradation of different insecticides/fungicides and weedicides in soil. 4) Different kind of synthetic fertilizers (NP & K) and their interactions with different components of soil.	15

Suggested Readings: Leslie collier, Balows Albert and Sussman Max, Topley and Wilson's Microbiology and Microbial infections. Oxford University Press.
Murray J.F. and Nadel. J.A., 2000, Text book of respiratory medicine, 3 rd Edn.,
W.B. Saunders & Co. Park. J.E. and Park. K., 1994, Text book of preventive and social medicine, Banarsi Das & Bhanot, Jabalpur.
A.C. Stern, Air Pollution vol. 1 – 7.
Anjaneyulu. Y, 2004, Introduction to Environmental Science. B. S. Publications.
D. Daniel Chiras, 2001, Environmental Science, 6 th Ed., Jones and Bartlett Publishers.

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FIRST SEMESTER
Core Course
Code-EnvSc-C103
ENERGY AND ENVIRONMENTAL POLICY

	Topics	Teaching Hours
	UNIT-I	
1)	Sun as source of energy: Earth and Sun relationship, nature and its radiation and heat budget of earth.	15
2)	Conventional and non-conventional energy resources: Fossil fuel, coal, oil and natural gas, hydroelectric power, tidal, wind and geothermal energy.	
3)	Biomass, solar collectors, photovoltaic and solar ponds.	
4)	Natural energy resources: soil, water, land wood etc.	
	UNIT-II	
1)	Resources of energy and their impacts on environment.	15
2)	Minerals Resources-Types, their characteristics and uses.	
3)	Nature of nuclear energy, history of nuclear energy development, Nuclear Reactors	
4)	Nuclear Fusion, Breeder Reactors, Nuclear Fission, Nuclear Fuel Cycle.	
	UNIT-III	
1)	Energy consumption criteria in different parts of world and conservation of energy.	15
2)	Concept of environmental ethics.	
3)	Energy and Sustainable development of environment,	
4]	Strategic analysis of India-multi-dimensional energy crisis.	
	UNIT-IV	
1)	Agenda-21 and government policy for natural resources and environment.	15
2)	Land use policy for India, urban planning for India.	
3)	Environmental education and awareness: formal and non-formal education.	
4)	Role of UNESCO and Non-governmental organizations in environmental conservation.	

Suggested Readings: Craig. J.R., Vaughan. D.J., Skinner. B.J., 1996, Resources of the Earth: origin, use, and environmental impact, 2 nd Ed. Prentice Hall, New Jersey. Klee. G.A, 1991, Conservation of natural resources.. Prentice Hall Publ. Co., New Jersey.

Owen. O.S, Chiras. D.D, Reganold. J.P, 1998, Natural resource conservation – management for sustainable future, 7 th Ed., Prentice Hall.

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FIRST SEMESTER
Core Course
Code-EnvSc-C104
BIODIVERSITY AND CONSERVATION

Topics	Teaching Hours
UNIT-I	
1) Concept: organic evolution through geological time scales. 2) Introduction to biodiversity and it's types. 3) Levels and gradients of biodiversity. 4) Ecosystem biodiversity – Biomes, Mangroves, coral reefs, wetlands.	15
UNIT-II	
1) Terrestrial diversity. 2) Threats to biodiversity: Disturbance and pollution, Introduction of exoctic species, Extinction of species. 3) Human interventions and biodiversity loss: Global environmental change, land and water use changes. 4) RED data book and related documentations.	15
UNIT-III	
1) Methods of biodiversity conservation – In situ conservation (Biosphere Reserve, National Parks, Wildlife Sanctuaries, Scared Groves). 2) Ex situ conservation (Botanical garden, Zoological garden, Gene Bank pollen, seed and seedling banks tissue culture and DNA bank. 3) IUCN categorized – endangered, threatened, vulnerable species. 4) International organization realted to biodiversity conservation (Traffic, REED, REED +).	15
UNIT-IV	
1) Benefits of conservation. 2) Conservation projects. 3) History of conservation movements. 4) Biodiversity Hotspots and it's criteria.	15

Suggested Readings: Daily, G.C., Ed., 1997, Nature's Services: Societal Dependence on Natural Ecosystems. Island Press, Washington, D.C.

Dobson, A.P., 1996, Conservation and Biodiversity. Scientific American Library, New York, NY.

Gaston, K J. and J.I. Spicer, 1998, Biodiversity: An Introduction. Blackwell Science, London, UK.

Groom bridge, B., and M. Jenkins, 2000, Global Biodiversity: Earth's Living Resources in the 21 st Century. World Conservation Press, Cambridge, UK.

IUCN, 2004, Red list of threatened species. A global species assessment. IUCN, Gland, Switzerland

Loreau, M., and P. Inchausti, 2002, Biodiversity and Ecosystem functioning: Synthesis and Perspectives. Oxford University Press, Oxford, UK.

Primack, R.B., 2002, Essentials of Conservation Biology, 3 rd Edn., Sinauer Associates, Sunderland, Ma. USA

Wilson, Edward O., 1993, Diversity of Life. Harvard University Press, Cambridge, MA.

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SECOND SEMESTER
Core Course
Code-EnvSc-C201
ENVIRONMENTAL CHEMISTRY

Topics	Teaching Hours
UNIT-I	
1) Fundamentals of Environmental Chemistry: Stochiometry, Gibb's energy, chemical potential, chemical equilibria. 2) Acid base reactions, solubility product, solubility of gases in water. 3) The carbonate system, unsaturated and saturated hydrocarbons, radionuclide's. 4) Energy fundamentals: First and Second law of Thermodynamics.	15
UNIT-II	
1) Chemical composition of air: Classification of elements, chemical speciation, particles, ions and radicals in the atmosphere. 2) Chemical processes for formation of inorganic and organic particulate matter, photochemical reactions in the atmosphere. 3) Oxygen and ozone chemistry: Ozone production, ozone destruction and its effects. 4) Photochemical smog, formation of peroxyacetyl nitrates (PAN) and its effects.	15
UNIT-III	
1) Water chemistry: Chemistry of water, concept of DO, BOD, COD, sedimentation, coagulation, filtration, redox potential. 2) Soil chemistry: Inorganic and organic components of soil, Nitrogen pathways and NPK in soils. 3) Elemental Cycles and their environmental significance (nitrogen cycle, Sulphur cycle, carbon cycle and oxygen cycle) 4) Acid rain: Formation of acid rain and its effects on artifacts,Toxic chemicals in the environment- (water) : Pesticides in water, biochemical aspects of arsenic, cadmium, lead, mercury,	15
UNIT-IV	
1) Toxic chemicals in the environment- (Air): carbon monoxide, ozone, pesticides, insecticides, MIC in the air. 2) Greenhouse gases and their effects, Global warming, Causes and Consequences of Global Climate Change. Role of ocean and forest as carbon sink. 3) Indoor air pollution: indoor/outdoor relationships, personal air pollution exposure, Indoor air quality problems, Prevention and control measures. 4) Vehicular Pollution: Automobile emissions, effects, prevention and control of Vehicular pollution, brief description of Euro I, Euro II, Euro III & Euro IV norms for automobiles and urban air quality.	15

Suggested Readings: Manahan. Stanely E, 2000, 7 th Edn., Environmental Chemistry, Lewis Publishers.
Stumm, W.; Morgan, J. J., 1996, Aquatic Chemistry: Chemical Equilibria and Rates in Natural Waters; Wiley Interscience: New York,.
Wayne, R. P., 2000, Chemistry of Atmospheres: An Introduction to the Chemistry of the Atmospheres of Earth, the Planets, and their Satellites (3rd Ed.), Oxford University Press
Williams Ian, 2001, Environmental Chemistry –a modular approach, Willey John & Sons
Williams. R.J.P and Frausto da. J.J.R, 1996, The Natural Selection of the Chemical Elements, Oxford University Press, Oxford, UK /New York, NY
Willard & Others, 1988, Instrumental Methods of Analysis, Wadsworth.

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Signature Not Verified
RAJEEV KUMAR
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SECOND SEMESTER

Core Course

Code-EnvSc-C202

EARTH PROCESSES AND SOIL SCIENCES

Topics	Teaching Hours
UNIT-I	
1) Primary formation of core, mantle and crust. 2) Magma generation, Formation of igneous rock and sedimentary rock. 3) Glaciers and glaciations: Types of glaciers, surface profile of glaciers, Glaciers and glaciations: Types of glaciers, surface profile of glaciers. 4) Weathering of rocks, Erosion, transportation and deposition of earth's materials by running water, wind and glaciers	15
UNIT-II	
1) Concept of Geological hazards. 2) Study of Floods, landslides, earthquake, volcanism, drought and cyclones. 3) Prediction and perception of hazards and disaster management. 4) Sea floor spreading and mountain building, rock deformation, evolution of continents.	15
UNIT-III	
1) Soil genesis: formation and soil profile development. 2) Classification of soil, chemical and mineralogical composition of soil. 3) Soil organic matter and their sources, composition, microbial decomposition of organic matter. 4) Humus formation: nature and properties of humus, clay-humus complex and significance.	15
UNIT-IV	
1) Soil colloidal system, soil acidity and alkalinity salinity, nature, formation and control. 2) Major soil nutrients and elements, hygroscopic nature of soil, capillary and gravitational forms of soil water. 3) Soil air composition and gaseous exchange between atmosphere and soil air. 4) Soil temperature and loss of heat and thermal conductivity.	15

Suggested Readings: Keller. Edward A, 1996, Introduction to Environmental Geology, Prentice Hall, Upper Saddle River, New Jersey

Kesler, S. F. 1994, Mineral resources, economics and the environment. Upper Saddle River, NJ: Prentice Hall.

Owen., Oliver S, Chiras. Daniel D, Reganold. John P., 2002, Natural Resource Conservation, 7th Ed., Prentice Hall, Upper Saddle River, New Jersey

Skinner, Brian J., Porter, Stephen C., 1995, The Dynamic Earth: An Introduction to Physical Geology, Casebook, 3rd Edition (Paperback), John Wiley, New York

Skinner, B. J., and Porter, S. C., 1995, The Blue Planet, An Introduction to Earth System Science, John Wiley & Sons, Inc.

Slaymake, Olav, (Editor), 2000, Geomorphology, Human Activity and Global Environmental Change. John Wiley, New York.

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SECOND SEMESTER

Core Course

Code-EnvSc-C203

ENVIRONMENTAL TECHNIQUES

Topics	Teaching Hours
UNIT-I	
Air Quality Monitoring and Sampling Methods 1) Sulphur di Oxide 2) Oxide of Nitrogen 3) Suspended Particulate Matter 4) RSPM - PM10 and PM2.5	15
UNIT-II	
Water Quality Sampling and Analysis Methods 1) Turbidity, Total Solids 2) DO, BOD,COD 3) Sodium, Potassium, 4) Arsenic, Cadmium, 5) Zinc ,Chromium, 6) Copper, Iron. 7) Biological Analysis : Qualitative and quantitative methods for planktons, MPN incoliforms.	15
UNIT-III	
Biochemical Methods 1) Serum Total Protein, Serum Albumin, 2) Serum Globulin, Albumin-Globulin Ratio, 3) Cholesterol, HDL-Cholesterol, 4) Alkaline Phosphatase, 5) Acid Phosphatase, 6) SGPT, SGOT.	15
UNIT-IV	
Methods of Exposure of Toxicants 1) Dose-Response and Dose-Effect Relationship; 2) Statistical Concept of LC50AndLD50; 3) Bioassays.	15

Suggested Readings: American Public Health Association (APHA), 1998 Standard Methods for the Examination of water and waste water 20th edition

Thimmaiah, S.K., 1999 Standard Methods of Biochemical Analysis, Kalyani Publisher

Abbasi S.A. 1998 Water Quality Sampling and Analysis, Discovery Publishing House, New Delhi

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SECOND SEMESTER
Core Course
Code-EnvSc-C204
ENVIRONMENTAL ENGINNERING

Topics	Teaching Hours
UNIT-I	
1) Elimination and minimization of air pollution emission. 2) Selection criteria of a control system. 3) Air pollution Control Equipments: Cyclone Collector, Filteration and Electrostatic Precipitators. 4) Air pollution Control Equipments: Scrubbing, Adsorption.	15
UNIT-II	
1) Waste water treatment by aeration, coagulation and flocculation, sedimentation and filteration. 2) Aerobic and anaerobic process of waste water treatment. 3) Waste water treatment process – Primary, Secondary and Tertiary treatment. 4) Sludge treatment and disposal.	15
UNIT-III	
1) Solid waste collection and transportation. 2) Solid waste processing and recovery. 3) Disposal Technique – Landfilling method, it's basic aspect and types and Incineration. 4) Energy recovery methods of solid waste disposal: Gasification, Pyrolysis, Plasma pyrolysis.	15
UNIT-IV	
1) Hazardous waste treatment strategies. 2) Treatment of biomedical waste by incineration, Microwave, Autoclave, Hydroclave. 3) Disposal of plastic waste and treatment and disposal of metal sharps. 4) Nuclear waste disposal technique.	15

Suggested Readings: Henry Glya, J. and Heinke, 2004, Gary W. Environmental Science and Engineering. Pearson low priced edition.

Kiely, G., 1998, Environmental Engineering, Irwin McGraw Hill, Boston.

Masters, M.G., 1998, 2nd Edition, Introduction to Environmental Engineering and Science, Prentice Hall, London.

Peavy, H.S., Rowe, D.R. and George, T., 1987, Environmental Engineering, McGraw Hill, New York.

Vesilind, P.A., 1997, Introduction to Environmental Engineering. PWS publishing, Boston.

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THIRD SEMESTER

Core Course

Code-EnvSc-C301

WATER RESOURCES AND MARINE ENVIRONMENT

Topics	Teaching Hours
UNIT-I	
1) Ground Water: Origin, types, importance, occurrence, reservoirs, basins and movement. Hydrologic cycle and its balance. Hydrologic properties of rocks: porosity, permeability, specific yield, specific retention, hydraulic conductivity, transmissivity, storage coefficient. 2) Darcy's law and experiment. 3) Well hydraulics: Confined, semi-confined and unconfined aquifer. Time variations of levels, fluctuations due to evapotranspiration, urbanization, Meteorological phenomena and land subsidence. 4) Ground water quality, measurement of water quality, Ground water contamination and pollutants: Problem of arsenic and fluoride.	15
UNIT-II	
1) Surface water; Atmospheric aspects of the hydrologic cycle: weather and climate, evaporation, evaporation and transpiration, Evapotranspiration. 2) Precipitation and run off: Conditions for precipitation occurrence, forms of precipitation, average basin precipitation, rainfall and run off. 3) Stream flow: Measurement of stream flow, Interaction of surface water and ground water. 4) Rainwater harvesting, eutrophication restoration of Indian lakes and wetland conservation, National Water policy	15
UNIT-III	
1) Origin and composition of sea water. 2) Physical properties of marine water: temperature, density, optics, currents, wave generation, thermo-haline turbidity currents (gravity), gyres. 3) Chemical properties of marine water: Salinity and its determination and distribution, causes of salinity variations. 4) Dissolved gases and carbonate chemistry of ocean water, residence time, biochemical reactions and their distributions.	15
UNIT-IV	
1) Biological Oceanography: Division of the marine environment benthic, pelagic, bathyal, littoral, ocean water as biological environment. 2) Ocean pollution by toxic wastes and its effect. 3) Geological and Geophysical Oceanography: History of ocean basin, geophysical and geological processes, ocean basin rocks and sediments. 4) Beach and beach processes, littoral sediment transport, coastal erosion- causes and protection, resources of ocean, renewable and non-renewable.	15

Suggested Readings: Aggarwal, A., 1991, Floods, Floodplains and Environmental Myths. Centre for Science and Environment, New Delhi.
Audrew D. Ward and Stanley Trimble, 2004, 2 nd Ed., Environmental Hydrology, Lewis Publishers.
Karanth, K.R.C., 1988, Ground Water: Exploration, Assessment and Development. Tata-Mcgraw Hill, New Delhi.
Mahajan, G., 1989, Evaluation and Development of Groundwater. Ashish Publishing House, New Delhi.
Rao, K.L., 1982, India's water wealth. Orient Longman, Delhi.
Subramaniam V., 2002, Text Book of Environmental Science, Narosa Publishing House, Delhi.
Timothy, Davie, 2003, Fundamentals of Hydrology. Rowledge, Taylor and Francis Group, U.K.
Todd, D.K., 2004, Groundwater Hydrology, John Wiley & Sons Inc.
Vijay P. Singh, 1995, Environmental Hydrology. Kluwer Academic Publications, The Netherlands.
Wright. R.T and Nebel. B.J., 2002, Environmental Science: toward a sustainable future, Prentice Hall India Ltd, 8 th Edition.

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THIRD SEMESTER
Core Course
Code-EnvSc-C302
SOLID AND HAZARDOUS WASTE MANAGEMENT

Topics	Teaching Hours
UNIT-I	
1) Definition and Classification Hazardous waste, ignitability, corrosivity, reactivity, toxicity, radioactivity. 2) Hazardous waste : Sources, effects, storage and handling. 3) Management of Hazardous wastes: Pollution, prevention, waste minimization, recycling of wastes, land disposal. 4) Risk assessment: Carcinogens, dose response assessment, risk exposure assessment.	15
UNIT-II	
1) Radioactive pollution, biological effects of ionizing radiation. 2) Radiation exposure, radiation protection, radioactive waste. 3) E- waste & it's effect and Plastic waste and It's effect. 4) Fly ash and its utilization.	15
UNIT-III	
1) Solid Waste : Definition, Source and types 2) Generation and Effects of soild waste. 3) Physical and chemical composition of solid waste. 4) General characterization and classification of solid waste	15
UNIT-IV	
1) Different methods of solid waste management. 2) Recycling of solid waste material. 3) Environmental concern of landfilling of municipal soild waste. 4) Biomedical Waste: Definition, Sources of generation, categories, colour coding system for segregation, transportation specifications.	15

Suggested Readings:

Henry Glya, J. and Heinke, 2004, Gary W. Environmental Science and Engineering. Pearson low priced edition.
Kiely, G., 1998, Environmental Engineering, Irwin McGraw Hill, Boston.

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THIRD SEMESTER
Core Course
Code-EnvSc-C303
ENVIRONMENTAL BIOSTATISTICS AND MODELLING

Topics	Teaching Hours
UNIT-I	
1) Sampling techniques and data representation 2) Measures of central tendency 3) Measures of dispersion. 4) Distribution.	15
UNIT-II	
1) Probability and Chi-square test. 2) Correlation and linear regression. 3) Tests of significance. 4) Experimental design and analysis of variance.	15
UNIT-III	
1) Computer fundamentals and operating system-function/need of operating system 2) Permanent storage of data, number systems, decimal to binary and vice-versa, binary coded decimal numbers. 3) Low and high level languages. 4) Basic concept of algorithms and flow charting.	15
UNIT-IV	
1) Programming in 'C' and C++ : Introductory concepts. 2) Word Processing: MS- word, Excel and their application. 3) Internet : History, Application, Service provider, computer and ethics-hacking, viruses, abuses. 4) Application of computers in Environmental Science.	15

Suggested Readings: Gallager R., 1996, Discrete Stochastic Processes, Kluwer Academic Publishers. Grant, W.E., Pederson, E.K. and Sendra, L.M., 1997, Ecology and Natural Resource Management: Systems Analysis and Simulation, John Wiley, New York.

Jorgensen, S.E. Miller, F., (Ed.), 2000, Hand Book of Ecosystem Theories and Management, Section-I and 11.4 of Section II. CRC press, Florida.

Recknagal, F., (Ed.), 2003, Ecological Informatics, chapters I, II, III and IV. Springer, Germany.

Wainwright, John (Editor), Mulligan, Mark (Editor), 2004, Environmental Modelling: Finding Simplicity in Complexity. John Wiley, New York

Zannetti, P., 1990, Air pollution modeling, theories computational methods and available softwares. Van Nostrand Rheinhold, New York.

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THIRD SEMESTER
Elective Course
Code-EnvSc-E304
METEOROLOGY: TOOLS AND TECHNIQUES

Topics	Teaching Hours
UNIT-I	
1) Meteorological Parameters: Pressure, Atmospheric Pressure belts, temperature, wind and wind roses humidity, precipitation and radiation. Atmospheric stability, inversions, mixing heights. 2) Scales of Meteorology. 3) Dew, Fog, Frost, Haze, Clouds: Cloud development and classification of Clouds. Cloud Bursting and its consequences 4) Air masses and Fronts.	15
UNIT-II	
1) World Climates: Elements of climate, Climatic controls, Classification of climate, Preliminary concept of climate change. 2) Indian climate, seasons in India. Spatial and temporal patterns of climatic parameters in India, Weather Forecasting. 3) Elements of Agro climatology. and EL Nino, Southern Oscillations. 4) Human and animal bio-climatology.	15
UNIT-III	
1) Basic Principle, instrumentation and application of spectroscopy, colorimetry and Flame photometer. 2) Spectroscopy: Basic principle, instrumentation and applications of atomic absorption and emission spectroscopy. 3) Chromatography: Principle, types and application of Gas Chromatography, Gas-liquid chromatography and HPLC. 4) Centrifugation: Basic Principle, Types and instrumentation and application.	15
UNIT-IV	
1) Nephlometer: Principles and Applications. 2) High Volume Sampler, Respirable Dust Sampler, Fine Particulate Sampler: Principle, instrumentation and applications. 3) Titrimetry and Gravimetry. 4) X- ray diffraction.	15

Suggested Readings: Barry, R. G., 2003. Atmosphere, weather and climate. Routledge Press, UK
Critchfield, Howard J., 1998, General climatology, Prentice Hall India Pvt. Ltd., New Delhi,
C. Donald Ahrens, Meteorology Toady Seventh edition .

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THIRD SEMESTER
Elective Course
Code-EnvSc-E305
ATMOSPHERE AND GLOBAL CLIMATE CHANGE

Topics	Teaching Hours
UNIT-I	
1) Earth systems: Atmosphere, hydrosphere, lithosphere, biosphere and their linkage. 2) Earth's geological history and development and evolution of atmosphere. 3) Fractions of atmosphere. 4) Atmospheric composition.	15
UNIT-II	
1) Ocean: general circulation pattern, air- sea interaction. 2) Wind, Stability and turbulence. 3) EL Nino, Southern Oscillations. 4) Energy Balance of atmosphere.	15
UNIT-III	
1) Natural Climate Change: Records of climate change (Glacial cycle, Ocean sediments, corals, tree rings). 2) Causes and Consequences of Global Climate Change. 3) Role of ocean and forest as carbon sink. 4) Ozone depletion - Stratospheric ozone shield.	15
UNIT-IV	
1) Impact of climate change on human, ecosystem, species distribution, spread of diseases. 2) Extinction risk of temperate- sensitive species. 3) UV effects on human, animal and plants. 4) Policy for climate change: Kyoto, carbon trading, carbon sequestration, carbon footprint, carbon credit and clean development mechanism.	15

Suggested Readings: Barry, R. G., 2003. Atmosphere, weather and climate. Routledge Press, UK

Critchfield, Howard J., 1998, General climatology, Prentice Hall India Pvt. Ltd., New Delhi.

Firor, J., and J. E. Jacobsen, 2002. The crowded greenhouse: population, climate change and creating a sustainable world. Yale University Press.

Glantz, M. H., 2003. Climate Affairs: a primer. Island Press.

Harvey D., 2000, Climate and Global Climate Change, Prentice Hall.

Kump, L. R., Kasting, J.F., and Carne, R. G., 2004. The Earth System. 3 rd Ed. Prentice-Hall

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FOURTH SEMESTER
Core Course
Code-EnvSc-C401
ENVIRONMENTAL IMPACT AND RISK ASSESSMENT

Topics	Teaching Hours
UNIT-I	
1) Principles and procedures: Nature and purpose of environmental impact assessment (EIA), Worldwide spread of EIA. 2) Environmental impact assessment process, Screening, Scoping and Terms of Refrences (TOR) 3) Impact assessment methodologies. 4) Baseline information, Generalized approaches to impact analysis and prediction	15
UNIT-II	
1) Identification of impacts, mitigation measures and comparison of alternatives. 2) Environmental impact assessment evaluation of proposed action 3) Environmental management plan and Environmental Impact statements 4) Procedure for reviewing, environmental impact analysis and statement.	15
UNIT-III	
1) Case study: River valley projects, thermal Power Plants, mining projects. 2) EIA guidelines 1994, notification of Government of India. 3) Guidelines of environmental monitoring audits. 4) Applications of geographic information system (G.I.S.) in environmental management.	15
UNIT-IV	
1) Risk assessment-Hazard analysis, hazards identification, vulnerability analysis, risk analysis. 2) Risk assessment and comparisons-risk and uncertainty, risks of new technologies, comparison of risks, contrasting risks. 3) Risk consequences : Impacts of serious accidents, uncertainty costs, signal incidents and risk probabilities : Human factors, organizational factors and external social factors. 4) Remote sensing : Principle and applications of remote sensing in environmental science.	15

Suggested Readings: Glasson J., Therivel R., Chadwick. A., 1994, Introduction to environmental impact assessment- Principles and procedures, process, Practice and prospects. Research Press, Delhi.
Morris. P. & Therivel. R., 2001, Methods of environmental impact assessment, 2 nd Ed. Spon Press, New York, With a chapter on GIS and EIA by A.R. Bachiller & G. Wood, p. 381-401. Petts Judith, 1999, Handbook of environmental impact assessment. Vol. 1, Blackwell Science.

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FOURTH SEMESTER
Core Course
Code-EnvSc-C402
ENVIRONMENTAL MANAGEMENT AND LAWS

Topics	Teaching Hours
UNIT-I	
1) Environmental management: fundamentals and goals, standards, monitoring, Environmental auditing, types and general methodology of audit. 2) Modeling, And Environmental Management Systems, public participation for environmental management. 3) Environmental management and economics: greening of economics, evaluating the environment and natural resources, cost benefit analysis, green taxes, green funding, 4) Debt, structural adjustment and environment, trade and environmental management.	15
UNIT-II	
1) International Standardization Organization (ISO),EMS Certification, ISO 14000 Series, and. ISO-14001 requirements, Difference Between ISO 14000 and ISO14001 Environmental Policy, and Relationship between ISO-9001 and ISO-14001. 2) Environmental protection: Issues and problems, national and international conventions: Stockholm conference 1972, Earth Summit 1992. Montreal Protocol 1987. 3) Policy for climate change: kyoto, carbon trading, carbon sequestration, carbon footprint, carbon credit and clean development mechanism. Provision of Constitution of India regarding environment [Article 48 A and 51-A(g)]. 4) Municipal Solid Wastes (Management and Handling) Rules, 2000. Hazardous waste management and handling rules, 1989.Biomedical Waste (Management And Handling) Rules,1998 and amendment 2016.	15
UNIT-III	
1) The Environmental (Protection) Act, 1986 and rules 1986. 2) Air (Prevention and Control of Pollution) Act, 1981 as amended by 1987 and rule 1982. 3) The Water (Prevention and Control of Pollution) Act, 1974 as amended upto 1988 and rules 1975. 4) The Wildlife Protection Act 1972, amendment bill 1991.	15
UNIT-IV	
1) The Indian Forest Act , 1927 and Forest conservation Act, 1980. 2) The Public Liability Insurance Act, 1991 and rules 1991. 3) Scheme of labelling of environmental friendly products (Ecomark). 4) Motor Vehicle Act, 1988 and Vehicular exhaust emission standards, 1990.	15

Suggested Readings: Bell Stuart & Mc Gillvray Donal, 2001, Environmental Law, Universal Law Publishing Co., Diwan Shyam and Rosencranz Armin, 2002, Environmental Law and Policy. Hughes David, 1992, Environmental Law, Butterworths.

Jariwala C.M., 2004, Environmental Justice, APH Publishing Corporation, N. Delhi Leelakrishnan. P, 2004, Environmental Law Case Book , Lexis Nexis, Butterworths Mohanty. S. K., 2004, Environment and Pollution Law, Universal Law Publishing Co. Pvt. Ltd.

Singh Gurdip, 2004, Environmental Law in India, Mcmillan & Co.

Singh Gurdip, 2003, International Environmental Law, Macmillan

Shastri. S. C., 2005, Environmental Law, Eastern Book Company.

FOURTH SEMESTER
Elective Course
Code-EnvSc-E403
ENVIRONMENTAL BIOTECHNOLOGY

Topics	Teaching Hours
UNIT-I	
1) Natural environmental of microorganisms, The terrestrial environment, aquatic and extreme environment. 2) General characters and basic classification of microorganisms. 3) Structure and growth of microorganisms as related to the environment. 4) Major groups of microorganisms.	15
UNIT-II	
1) Biotechnology for pollution abatement. 2) Use of microorganism in waste treatment and waste management. 3) Bioremediation: Remediation of degraded ecosystem. 4) Role of microorganisms in degradation of pesticides, chemicals, petroleum products and plastics.	15
UNIT-III	
1) Vermiculture technology. 2) Biofertilizer technology. 3) Role of microorganism in alcohol and acetic acid production, fermentation technology. 4) Composting and Biomethanation.	15
UNIT-IV	
1) Biotoxicity assays to evaluate Effectiveness of Bt spores against pest and beneficial insects. 2) Biological indicators and biosensors. 3) Bioenergy and biofuels. 4) Biopesticides and biofertilizers	15

Suggested Readings: Gardner, Simmonds, Snustad, 1991, Principles of Genetics. John Wiley, Eighth Edition. Mohapatra. P. K., 2006, Text Book of Environmental Biotechnology. I K International. Olguin, E., Sanchez, G. and Hernandez, E., 1999, Environmental biotechnology and cleaner bioprocesses, Taylor & Francis, London. Rittman, B. E., and McCarty, P. L., 2001, Environmental Biotechnology. Principles and applications. McGraw-Hill, New York.
Scragg, A. H., 2005, Environmental Biotechnology. Oxford University of Press. Wainwright, M., 1999, An introduction to environmental biotechnology. Springer Verlag, New York.

02/06/22

FOURTH SEMESTER
Elective Course
Code-EnvSc-E404
ENVIRONMENTAL INSTRUMENTATION

Topics	Teaching Hours
UNIT-I	
Spectroscopy 1) Emission spectroscopy. 2) Atomic absorption spectroscopy 3) Flame photometry 4) Circular Dichronism Spectroscopy	15
UNIT-II	
Centrifugations 1) Principle 2) Types of centrifuges 3) Types of centrifugation 4) Ultra-centrifugation **Air Monitoring Sampler** 5) High Volume Sampler 6) Respirable Dust Sampler 7) Fine Particulate Sampler 8) Gravimetry and titrimetry	15
UNIT-III	
Chromatography 1) Paper chromatography, TLC 2) Column chromatography 3) GLC 4) HPLC	15
UNIT-IV	
1) pH meter 2) Photometry 3) Spectrophotometry 4) Nephalometry 5) Conductivity meter	15

Suggested Readings: Chatwal, Gurdeep R., Sham, Anand, K. 2016 Instrumental method of chemical analysis, Himalaya Publishing Comapany.
Chatwal, Gurdeep R, Sham, Anand, K 2016 Spectroscopy Himalaya Publishing Comapany

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FOURTH SEMESTER
Elective Course
Code-EnvSc-E405
ECOTOXICOLOY AND ENVIRONMENTAL HEALTH

Topics	Teaching Hours
UNIT-I	
1) Principles in toxicology, aquatic and animal toxicity tests. 2) Statistical concept of LD50 and LC50. 3) Dose response and Dose effect relationship, Dose response curve. 4) Biological, chemical and ecological factors that influence toxicity.	15
UNIT-II	
1) Major classes of environmental pollutants – Heavy Metals, Gases, Pesticides and Fertilizers. 2) Biotransformation and it's processes. 3) Bioaccumulation and Biomagnification. 4) Toxicants effects – Cellular, Organismic, Population and Ecosystem level.	15
UNIT-III	
1) Biochemical teratogenicity and it's effect. 2) Carcinogenicity of environmental pollutants. 3) Environmental toxins and human health. 4) Microbial toxins.	15
UNIT-IV	
1) Water borne diseases, air borne diseases. 2) Vector transmitted diseases. 3) Food – borne diseases. 4) Occupational Health.	15

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.

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.

02/6/22 02/06/22

FOURTH SEMESTER
Elective Course
Code-EnvSc-E406
ENVIRONMENTAL HAZARDS

Topics	Teaching Hours
UNIT-I	
1) Concept of geological hazards – continental drift theory. 2) Plate – tectonic theory. 3) Distinction between natural hazards and anthropogenic hazards. 4) Prediction and perception of hazards.	15
UNIT-II	
1) Geological Hazard :Earthquake, Earthquake destruction and prediction 2) Geological Hazard :Volcanism, Volcanic activity, Igneous activity and Material Extruded during eruption 3) Geological Hazard : Mass – movement, Landslide and its prediction 4) Geological Hazard: Tsunami. And its consequences, Mitigation measures and early warning	15
UNIT-III	
1) Hydrological Hazard: Floods and its types, River topography ,causes and its prediction 2) Hydrological Hazard: Drought and its types 3) Hydrological Hazard: Tropical Cyclones and Anticyclone, Hurricanes, Tornedo 4) Atmospheric climatic hazards.	15
UNIT-IV	
1) Technological hazards: Bhopal, Three Mile Island and Chernobyl disasters. 2) Biophysical Hazard – frost, Epidemics. 3) Cloud Bursting and its consequences 4) Disaster management.	15

Suggested Readings: Bell. F.G, E & FN Spon, 1999, Geological Hazards: Their Assessment, Avoidance and Mitigation, e Books der ULB Darmstadt.

Burton. I, Kates. R.W and White. G.F, 1993, Environment as Hazard Guilford Press. Casale. R and Margottini. C. (Ed.), Springer, 2004, Natural Disasters and Sustainable Development

Hewitt. K., 1997, Regions of risk, Longman Press.

Henrry J.G. and Heinke , G.W., 2004, Environmental Science and engineering, Pearson education, Delhi, India.

Keller. Edward A, 1996, Introduction to Environmental Geology, Prentice Hall, Upper Saddle River, New Jersey

Smith Keith, 2001, Environmental Hazards: Assessing Risk and Reducing Disaster, Routledge.

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APPENDIX - C

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DEPARTMENT OF ENVIRONMENTAL STUDIES

Minor Course

For Students of Other Faculties

ENVIRONMENTAL POLLUTION

Topics	Teaching Hours
UNIT-I	
1) Chemistry of water-Types, sources and consequences of water pollution. 2) Types and characteristics of domestic, industrial and agricultural wastes and their effects on water bodies, animal and human beings. 3) Water quality parameters, Physiochemical and bacteriological sampling. 4) Water quality standards (Drinking Water).	15
UNIT-II	
1) Atmosphere and its fraction; gas laws governing the behavior of pollutants in atmosphere. 2) Natural and Anthropogenic sources of atmospheric pollutants, their effects on animal, human, vegetation and materials and their reaction in the atmosphere. 3) Transport and dispersal of pollutants, effects of meteorological and topographical factors. 4) Sampling of gaseous and particulate matter, their analysis and air quality standards.	15
UNIT-III	
1) Basic properties of sound waves plane and spherical waves, sound pressure and intensity levels, decibel, effects of meteorological parameters on sound propagation measurement and analysis of sound. 2) A weighted sound level, equivalent sound level (leq.) Noise pollution level (NPL), Sound exposure level (SEL), Traffic sound index (TNI), Day night level. 3) Source of noise, noise control and abatement measures, and sound absorption coefficient. 4) Hazards of noise pollution, effects on physiological, circulatory, respiratory, muscular, hearing loss and threshold shifts and noise standards.	15
UNIT-IV	
1) Physico-chemical and bacteriological sampling as analysis of soil quality. 2) Sources of soil pollution, Industrial waste effluents and heavy metals, their interactions with soil components. 3) Soil micro-organisms and their function, degradation of different insecticides/fungicides and weedicides in soil. 4) Different kind of synthetic fertilizers (NP & K) and their interactions with different components of soil.	15

Suggested Readings: Leslie collier, Balows Albert and Sussman Max, Topley and Wilson's Microbiology and Microbial infections. Oxford University Press.

Murray J.F. and Nadel. J.A., 2000, Text book of respiratory medicine, 3 rd Edn.,

W.B. Saunders & Co. Park. J.E. and Park. K., 1994, Text book of preventive and social medicine, Banarsi Das & Bhanot, Jabalpur.

A.C. Stern, Air Pollution vol. 1 – 7.

Anjaneyulu. Y, 2004, Introduction to Environmental Science. B. S. Publications.

D. Daniel Chiras, 2001, Environmental Science, 6 th Ed., Jones and Bartlett Publishers.

02/06/22 02/06/22

Number of students undertaking field project or research projects or internships
Programme Name: M.Sc. ENVIRONMENTAL SCIENCE

Programme name	Name of the students	
M.Sc. ENVIRONMENTAL SCIENCE	DIVYA ISRANI	Research Project
M.Sc. ENVIRONMENTAL SCIENCE	MEHREEN IFATIKHAR	Research Project
M.Sc. ENVIRONMENTAL SCIENCE	RASHMI BAGHEL	Research Project
M.Sc. ENVIRONMENTAL SCIENCE	RUBY SHARMA	Research Project
M.Sc. ENVIRONMENTAL SCIENCE	SHYAM PRATAP SINGH CHAUHAN	Research Project
M.Sc. ENVIRONMENTAL SCIENCE	ZAHOOR AHMED MALIK	Research Project
M.Sc. Environmental Science	SRISHTI CHAHAR	Research Project
M.Sc. Environmental Science	BHAVANA PANDEY	Research Project
M.Sc. Environmental Science	NIKITA KHANDELWAL	Research Project
M.Sc. Environmental Science	SONAM VARSHNEY	Research Project
M.Sc. Environmental Science	NISHA KASANA	Research Project
M.Sc. Environmental Science	DIVYA BHALLA	Research Project
M.Sc. Environmental Science	DESHRAJ	Research Project
M.Sc. Environmental Science	SHREEANSHEE SHARMA	Research Project
M.Sc. Environmental Science	MAHAK	Research Project
M.Sc. Environmental Science	JAY PRAKASH SINGH	Research Project
M.Sc. Environmental Science	AMBUJ PATEL	Research Project
M.Sc. Environmental Science	PRIYA SONI	Research Project
M.Sc. Environmental Science	PRIYANSHU SIKARWAR	Research Project
M.Sc. Environmental Science	DIVYA BAGHEL	Research Project
M.Sc. Environmental Science	ANJALI KUMARI	Research Project
M.Sc. Environmental Science	PRAGYA SHARMA	Research Project
M.Sc. Environmental Science	YASHIKA SHARMA	Research Project
M.Sc. Environmental Science	NIHARIKA SHARMA	Research Project
M.Sc. Environmental Science	SHIVANI YADAV	Research Project

Signature Not Verified
RAJEEV KUMAR
Digitally Signed By Registrar