DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,AURANGABAD

CIRCULAR NO.SU/Sci./M.Sc.Env./56/2023

It is hereby inform to all concerned that, the syllabus prepared by the Ad-hoc Board in Environmental Science and recommended by the Dean, Faculty of Science & Technology the Hon'ble Vice-Chancellor has accepted the **Revised Syllabus of M.Sc. Environmental Science IVth semester for affiliated Colleges and University Department** in his emergency powers under section 12(7) of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council as appended herewith.

This shall be effective from the Academic Year 2022-23 and onwards.

All concerned are requested to note the contents of this circular and bring notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO. SU/SCI/2023/19144-51
Date:- 19.01.2023.

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Deputy Registrar,
Academic Section.

Copy forwarded with compliments to :-

1] **The Principal of all concerned affiliated Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,
2] **Head of the Department, Department of Environmental Science,**
Dr.Babasaheb Ambedkar Marathwada University, Aurangabad.
3] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

1] The Director, Board of Examinations & Evaluation,Dr.BAMU,A'bad.
2] The Section Officer,[M.Sc.Unit] Examination Branch,Dr.BAMU,A'bad.
3] The Programmer [Computer Unit-1] Examinations, Dr.BAMU,A'bad.
4] The Programmer [Computer Unit-2] Examinations, Dr.BAMU,A'bad.
5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.BAMU,A'bad.
6] The Public Relation Officer, Dr.BAMU,A'bad.
7] The Record Keeper, Dr.BAMU,A'bad.

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Jd*19.01.2023/-

DR. BABASABEB AMBEDKAR MARATHWADA UNIVERSITY
AURANGABAD- 431004 (M.S)

Department of Environmental Science

Structure and Curriculum

For

M.Sc. IInd year Environmental Science
of
College and University Department
(Choice Based Credit System)
With
OBE Pattern

(Effective from the Academic year2021-23)

9/01/23

Dean
Faculty of Science & Technology
Dr. Babasaheb Ambedkar Marathwada
University, Aurangabad

BOS chairman

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.

Course Structure

M.Sc. (Environmental Science) in Choice Based Credit System

From Academic Year 2022-2023

106 credits against 2650 marks.

	M.Sc. II year (Semester- III)				
Course	**Course Code**	**Paper Titles**	**Hrs/ week**	**Credits**	**Marks**
CC	ENV-501	Solid Waste Management	04	04	100
CC	ENV-502	Ecological Footprint & Carbon Sequestration	04	04	100
CC	ENV-503	Advance Technology & CDM	04	04	100
EC	ENV-521	Mooc's Course from SWAYAM Platform	04	04	100
SC	ENV-522	Global Environmental Crises &Climate Change	04	04	100
LC	ENV-541	Lab Course- IX	04	02	50
LC	ENV-542	Lab Course- X	04	02	50
LC	ENV-543	Lab Course- XI	04	02	50
LC	ENV-544	Lab Course- XII	04	02	50
Total Credits for Semester – III = 28 (Theory:20 ;Lab:08) (With One Elective Course)					
	M.Sc. II Year (Semester-IV)				
Course	**Course Code**	**Paper Titles**	**Hrs/ week**	**Credits**	**Marks**
CC	ENV-504	RS & GIS Application in Environment	04	04	100
CC	ENV-505	EIA & Environmental Auditing	04	04	100
CC	ENV-506	Sustainable Urban & Rural Developmental Planning	04	04	100
EC	ENV-523	Mooc's Course from SWAYAM Platform	04	04	100
LC	ENV-545	Lab Course -XIII	04	02	50
LC	ENV-546	Lab Course-XIV	04	02	50
LC	ENV-547	Project + Internship + Field visit / Tour + Review Writing + Research Proposal writing,	08	04	100
Total Credits for Semester – IV : 24 (Theory:16 ;Lab:08) (With One Elective Course)					

COM: Common
CC: Core Course
LC: Lab Course
SC: Service Course
RM: Research Methodology
EC: Elective Course
ELC: Elective Lab Course
FC: Foundation Course

Dean
Faculty of Science & Technology
Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

BOS chairman

Introduction:

The course of M.Sc. Environmental Science is designed as per the present needs of industrial and professional consultancy services, development of administrative, management and academic skills and at par with NET/SET syllabi. The content of syllabus is modified and reframed from time to time considering the need of time and demand from industries to incorporate recent developments and new trends in the subject. Apart from the academic curricula the students are assigned field visits, excursions, and industrial visits and special in-plant training in industries. The students are encouraged for research through the projects as a part of partial fulfillment of the M.Sc. course. The students are also given exposure to seminars, short-term trainings and guests lecture by eminent environmentalist. The course promotes the interest in the students to enrich their knowledge and involvement in the environmental protection.

Eligibility conditions:

Those who have completed B.Sc. with Environmental Science, Botany, Zoology, Physics, Chemistry, Microbiology, Biochemistry, Bio-Technology, Earth Science etc., B.E. Civil Engineering, B.Sc. Agriculture and Foreignsic Science, shall be held eligible for the admission to M.Sc. in Environmental Science.

The weightage of 1% will be given to the candidates who offered Environmental Science as one of the optional subjects at the B.Sc. level for seeking the admission to the M.Sc. Environmental Science.

Admission / Promotion Process:

In response to the advertisement for registration, interested students will have to register themselves. Admission will be done on the basis of merit in their degree score or Common Entrance Test (CET) and performance of students at their qualifying graduate level examination. The weightage of 1% will be given to the candidates who offered Environmental Science as one of the optional subjects at the B.Sc. level for seeking the admission to the M.Sc. Environmental Science. Once the student is admitted he / she will be promoted to the 2^{d} year (3rd semester) if he / she qualify all courses lst semester and 50 % of theory courses of IInd semester. Students will have to register themselves for every consecutive semester. Dropout students will be allowed to register for respective semester as and when the concerned courses are offered by the course implementing institute/ department, however he / she should not exceed more than twice the duration of the course from the date of first registration. The admission of the concern student will be automatically cancelled if he / she fail to complete the M. Sc. degree within a period of maximum four years / eight semesters.

Course structure:

The M.Sc. Course is of two years period with 106 Credits of 2650 marks. The course is divided in to four semesters. In first semester there will be 28 credits with 700 marks. Second semester is of 26 credits with 650 marks, Third semester is of 28 credits with 700 marks and fourth semester is of 24 credits with 600 marks. Paper No ENV- 522 of 4 Credits of 100 marks from IIIrd semester will be a **Service Course** which can be opt by the students from other department / institutions.

During the two years study course students has to earn the total credits from the following manner.

1.	**Core Courses**	**:- 44 credits**
2.	**Elective Courses**	**:- 16 credits**
3.	**Foundation Course**	**:- 04 credits**
4.	**Service Course**	**:- 04 credits**
5.	**Lab Courses**	**:- 24 credits**
6.	**Elective Lab Course**	**:- 08 credits**
7.	**RM Courses**	**:- 04 credits**
8.	**COM Course**	**:- 02 credits**
	Total Credits	**:- 106 credits**

Above credits includes the credits for Research Methodology /Research Project /in-plant training etc. in the following manner ,04 credits-RMC and 3 credits for Project dissertation, In-plant training and field work etc, with a total of 7credits devoted for research orient activities.

Courses:

1. **Core Course (C.C) :** Core course is a course that a student admitted to a particular P.G. Program must successfully complete to receive the degree. Normally no theory course shall have more than four credits.
2. **Elective Course (E.C) :** Elective course means an optional course from the basic subject or specialization.
3. **Foundation Course (F.C):** It includes fundamentals of environment, necessary to the students offering the course from other disciplines.
4. **Service Course (S.C)**: Service course will be offered in IIIrd semester. Students must complete a service course for securing M.Sc. degree to acquire 4 credits.
5. **Lab Course (L.C) :**It includes all laboratory assignments related to theory courses.
6. **Elective Lab Course (E L C)** :It includes all laboratory assignments related to elective theory courses.
7. **Research Methodology (RM):** This course includes research related components to understand basics in the research and develop the research skill.
8. **Common Course (COM) :** This course is introduced to learn the Great Constitution of India.
9. **Bridge Course in Environmental Science**: This course is designed to provide some important concept's introduction as the base to science graduates, who have not studied the environmental science subject at graduate level. This course is being implemented at the beginning of M.Sc. Environmental Science 1st semester and will be used for **identification** of slow and fast learner student.

- Each course shall include lectures/ tutorials/laboratory or field work/seminar/practical training/assignments /mid-term and term end examination/paper/report writing or review of literature and any other innovative practices to meet effective teaching and learning needs.

- The result of examination conducted of 'Bridge Course in Environmental Science' will be used to identify the slow and fast learner students, which is an integral part of OBE pattern.

- The student will have to register the service course of his interest after the start of IIIrd semester in the concerned department on official registration form and is to be completed in this semester.

- No service course will be offered unless a minimum of 10 students are registered.

Choice Based Credit System (CBCS):

The choice-based credit system has been adopted by this department. This provides flexibility to make the system more responsive to the changing needs of our students, the professionals and society. It gives greater freedom to students to determine their own pace of study. The credit-based system also facilitates the transfer of credits.

- Students will have to earn 106 credits for the award of M.Sc. (Environmental Science) degree.
- Out of 106 credits, students will have to earn the credits from Core courses with 44 credits, foundation course worth 04 credits, elective courses worth 16 credits, laboratory courses worth 32 credits (24 credits for core Lab course and 8 credits for Elective Lab course), research methodology 4 credits, service course 04 credits and 02 credits from the compulsory course 'Constitution of India'.

Credit-to- contact hour Mapping:

One contact hour per week is assigned 01 credit for theory and 0.5 credits for laboratory courses/ research project. Thus a 04 - credit theory course corresponds to 04 contact hours per week and same analogy will be applicable for laboratory courses / research project, containing 04 contact hours per week for 02 credits practical course. Overall, one credit equal to 15 hours for theory and 30 hours for practical.

Note:

- Tutorial, assignments and seminar presentation are integral components of all theory courses. Tutorials consist of conceptual / questions based on the respective theory courses in the semester covering all units of paper.
- Each course / paper should be taught about 56 contact hours in one semester.
- Teaching duration for LAB COURSES from first to fourth semesters should be of 04 hours per week per batch.

Attendance:

Students must have 75 % of attendance in each core, foundation, elective, laboratory and research project course for appearing examination otherwise he / she will not be strictly allowed for appearing the examination of each course. However, students having 65 % attendance with medical certificate may request Head of the Department for the condonation of attendance.

Pattern:

The 80:20 patterns for external and internal assessment will be implemented with continuous assessment and there shall be combined passing for external and internal assessment.

Results Grievances

Grievances related to assessment in examination will be resolved as per the provisions of university rules and regulations.

Evaluation Methods:

The assessment will be based on 80:20 ratios for external and internal pattern. In the continuous internal assessment (CIA) and semester end examination (SEE), there is combined passing.

Continuous Internal Assessment (CIA):

- For the theory paper of 100 marks: The Continuous Internal Assessment (CIA) of the students, containing 20 marks for two midterm tests (10 marks per test), 10 marks for two tutorials (05 marks per tutorial), 10 marks for one seminar (08 marks for giving seminar and 02 marks for submission of hard copy of seminar) and 10 marks for attendance and overall performance of the students. The marks secured out of 50 will be scale down to 20 as internal marks secured out of 20.
- For theory paper of 50 marks: The Continuous Internal Assessment (CIA) containing 20 marks for two midterm tests (10 marks per test), 10 marks for two tutorial (05 marks per tutorial), 10 marks for one seminar (08 marks for giving seminar and 02 marks for submission of hard copy of seminar) and 10 marks for attendance and overall performance of the student. The marks secured out of 50 will be scale down to 10 as internal marks secured out of 10.
- The first midterm exam will be taken after completion of 40 percent syllabus and second midterm exam will be taken after completion of 80 percent syllabus. The continuous internal assessment will be done by concern teacher, who is teaching that paper. The obtained score in Continuous Internal Assessment (CIA) will be considered as internal score.
- There will be 10 marks for Continuous Internal Assessment (CIA) of lab course / practical paper of 50 marks, containing 10 marks for one practical test, 10 marks for record book submission, 10 marks field work / assignments / viva on practical's and 10 marks for attendance, discipline & overall performance of student. The marks secured out of 40 will be scale down to 10 as internal marks secured out of 10.
- There will be combined passing for internal and external examination. The students have to earn minimum 40% marks for passing.

Semester End Examination (SEE):

- The semester end theory and practical examination will be conducted after completion teaching. The total marks shall be 100 for 4 credit theory courses, 50 marks for 02 credits theory course and 50 marks for 02 credits lab course / practical course. The semester end exam of 80 marks will be taken for 04 credits theory course and 40 marks for 02 credits theory course along with 40 marks lab course of 02 credits.
- Semester end examination (SEE) time table will be declared as per the university annual calendar. The paper setting and assessment of theory courses, laboratory courses and project dissertation will be done by external / appointed examiners.

A. Structure for theory course for Internal Assessment.

i) Theory paper of 100 marks

Test-I	Test-II	Two Tutorials/ Assignments	One Seminar	Attendance, Discipline & Overall performance etc.	Total Marks secured out of	Marks scale down to 20 as internal score
10 Marks	10 Marks	10 Marks	10 Marks	10 Marks	50 Marks	

ii) Theory paper of 50 marks

Test-I	Test-II	Two Tutorials/ Assignments	One Seminar	Attendance, Discipline & Overall performance etc.	Total Marks secured out of	Marks scale down to 10 as internal score
10 Marks	10 Marks	10 Marks	10 Marks	10 Marks	50 Marks	

B. Structure for lab course for Internal Assessment.

Practical Test-I	Record Book	Field work / Assignments / Viva	Attendance, Discipline & Overall performance etc	Total Marks secured out of	Marks scale down to 10 as internal score
10 Marks	10 Marks	10 Marks	10 Marks	40 Marks	

The theory and practical examinations will be held at the end of each semester. There will be combined passing for continuous internal assessment marks and for semester end examination assed by external / appointed examiner center wise after getting at least minimum 40 % marks in each paper.

Every student will have to complete 106 credits to obtain the Masters degree in Environmental Science having practicals / laboratory work / field work / demonstration work etc., of which 102 credits should be from their respective subject and four (04) credits from service courses

Pattern of semester end question paper will be as below:

- The semester end examination of theory course of 4 credit will have two parts A and B with (20+60 = 80 Marks). Part A will be consisting of 10 questions having 1 mark each (multiple choice questions) , 05 questions of fill in the blanks / answer in single sentence for 05 marks and 05 marks for five match the pairs / true or false as compulsory short answer questions of total 20 marks and it should cover entire course curriculum. Part **A** will consist 20 Marks. Part **B** will consist 7 questions of which students will have to attempt any five questions each of 12 marks. The time duration of the paper will be 03 hours.
- The semester end examination of theory course of 2 credit will have two parts A and B with (10+ 30 = 40 Marks). Part A will be consisting of 05 questions having 1 mark each (multiple choice questions), 02 questions of fill in the blanks / answer in single sentence and 03 marks for 03 match the pairs / true or false as compulsory question of total 10 marks and it should cover entire course curriculum. Part A will consist 10 Marks. Part B will carry 5 questions of which students will have to attempt any three questions each of 10 marks. The time duration of the paper will be 02 hours.

  (Note: -Number of sub questions (with allotment of marks) in a question may be decided by the examiner.)
- Semester end practical examination (for laboratory courses) will be of 40 marks each and of 4 hours duration. Student must perform at least three experiments from each lab course containing one major and two minor experiments. The major question of 12 marks and minor Question 10 marks and 04 marks for viva-voce exam and 04 marks for record book. The final practical examination will be conducted at the end of each semester along with the theory examination.
- Semester end examination for project dissertation will be carried out in the respective semester. The content, presentation, interaction and submission will be considered during project dissertation assessment.

  (**Note**: The project dissertation will be a part of lab course from fourth semester and it will be allotted at the beginning of first semester and assessed in fourth semester.)

- The students will have to complete one month In-plant training in Industry / Institution/NGO/ Laboratories / Municipal Corporation / Forest department / Pollution Board etc.
  (**Note** : Student will be deputed in summer vacation for in-plant training after IInd Semester Examination and student will have to submit in-plant training completion report with certificate to the department and it will be assess in final practical examination.)

- At the end of each semester the result will be forwarded to the Director of Examination Board by CAP chairman.

Earning Credits:

At the end of every semester, a letter grade will be awarded in each course for which a student had registered. A student's performance will be measured by the number of credits that he/she earned by the weighted Grade Point Average (GPA). The SGPA (Semester Grade Point Average) will be awarded after completion of respective semester and the CGPA (Cumulative Grade Point Average) will be awarded at the end of the 4th semester.

Grading System:

The grading reflects a student-own proficiency in the course. A ten-point rating scale shall be used for the evaluation of the performance of the students to provide letter grade for each course and overall grade for the Master Programme. Grade points are based on the total number of marks obtained by him// her in at heads of the examination of the course. The grade points and their equivalent range of marks are shown in Table-I.

Table – I : Ten point grade and grade description

Marks Obtained (%)	Grade Point	Letter Grade	Description
90-100	9.00- 10	O	Outstanding
80-89	8.00-8.90	A^{++}	Exceptional
70-79	7.00-7.90	A^{+}	Excellent
60-69	6.00-6.90	A	Very Good
55-59	5.50-5.90	B^{+}	Good
50-54	5.00-5.40	B	Fair
45-49	4.50-4.90	C^{++}	Average (Above)
41-44	4.1-4.49	C	Average
40	4.0	P	Pass
< 40	0.0	F	Fail (Unsatisfactory
	0.0	AB	Absent

- Non appearance in any examination / assessment shall be treated as the students have secured zero marks in that subject examination / assessment.
- Minimum P grade (4.00 grade points) shall be the limit to clear / pass the course / subject. A student with F grade will be considered as 'failed" in the concerned course and he / she have to clear the course by appearing in the next successive semester examinations.
- Every student shall be awarded grade points out of maximum 10 points in each subject (based on 10 point scale). Based on the grade points obtained in each subject, Semester Grade Point Average (SGPA) and then Cumulative Grade Point Average (CGPA) shall be computed. Results will be announced at the end of each semester and CGPA will be given on the completion of M. Sc. programme.

Computation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average)

Grade in each subject / course will be calculated based on the summation of marks obtained in internal and semester end examination.

The computation of SGPA and CGPA will be as below

- Semester Grade Point Average (SGPA) is the weighted average points obtained by the students in a semester and will be computed as follows.

$$\text{SGPA} = \frac{\textit{Sum (Course Credit X Number of Grade Points in concern Course Gained by the Student)}}{\textit{Sum (Course Credit)}}$$

The SGPA will be mentioned on the mark sheet at the end of every semester.

- The Cumulative Grade Point Average (CGPA) will be used to describe the overall performance of a student in all semester of the course and will be computed as under.

$$\text{CGPA} = \frac{\textit{Sum (All four Semester SGPA)}}{\textit{Total Number of Semester}}$$

The SGPA and CGPA shall be rounded off to the second place of decimal.

Grade Card:

Results will be passed through the Departmental Committee / Principal and the grade card (containing the grades obtained by the student along with SGPA) will be issued by the university after completion of every semester.

The grade card will be consisting of following details.

- Title of the courses along with code opted by the student.
- Credits associated with the course.
- Grades and grade points secured by the student.
- Total credits earned by the student in a particular semester.
- Total credits earned by the students till that semester.
- SGPA of the student.
- CGPA of the student (at the end of the 4th semester).

Cumulative Grade Card

The grade card sheet showing details grades secured by the student in each subject in all semester along with overall CGPA will be issued by the University at the end of 4th semester.

Semester – III

CC (Env-501 :- Solid Waste Management)

(Theory Core Course with 04 credits)

Course Objectives

Students will be able to know

1. Current Scenario of MSW, Model's for appropriate waste collection.
2. Management & Handling Rules of MSW.
3. Identification of Hazardous Waste sources & Characteristics.
4. Designing & Operation facilities for Hazardous waste.
5. Bio-Medical Handling & Management Rule's 2008

Teaching Scheme			**Evaluation Scheme**		
Lectures	:-	4 hr/week			
Tutorials	:-	1 hr/ week	Continuous Internal Assessment by Teacher	:-	20 Marks
Test	:-	1 hr/week	Sem-End Examination	:-	80 Marks
Total Credit	:-	04	**Total Marks**	**:-**	**100 Marks**

Unit I- General Introduction:

Introduction to MSW, Sources and types of solid waste, On-site and Off-site disposal options, Protective measures, Problems associated with system, Design of appropriate waste management system.

Unit II- Treatment Methods for sewage sludge:

Introduction, Identification factors in selecting the best system, Sludge treatment and disposal processes, Chemical stabilization, Incineration, Heath Furnace system, Composting, Sludge disposal regulation.

Unit III- Integrated Solid Waste Management:

Approaches to integrated waste management, Assessment of Solid Waste Management (SWM), Policies, Laws and Acts, Financing mechanism, Stake holder's participation, and Case studies towards sustainable waste management.

Unit- IV- Managing Risk and Hazards:

Development of risk and hazardous management systems, Hazards and risk analysis methods, Hazardous waste incineration – trends and prospects, Hazard management in chemical industry, Policy issues and problems in hazardous management.

Unit-V- Life Cycle Analysis:

Life cycle analysis of material recycling, Paper recycling, Glas recycling, Plastic recycling, E-Waste management, , Environmental Management Plan.(EMP).

Unite- VI- Landfilling Methods and Operations:

Introduction, Landfilling methods and operations, Landfill designs, Leachates release and migration, Types of bioreactors, Landfill leachates treatment by electrochemical oxidation, Combined landfill gas and leachate extraction system.

Current development in the subject.

Course Outcome

Students should be able to:

1. Discuss current scenario of MSW, models for appropriate waste collection.
2. Apply management and handling rule of MSW
3. Differentiates of hazardous waste sources and characteristics
4. Create designing and operation facilities for hazardous waste
5. Evaluate biomedical handling and management rule 2008

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12. Gilbert Masters, "An Introduction of Environmental Engineering", McGraw-Hill Publishers.
13. Dr. P.K Behra , Dr. S.K. Sahu and M.S. Shivarama, "Encyclopedia of Hazardous Waste Management", Dominate Publishers and Distributers.

Semester – III

CC (Env-502: - Ecological Foot Prints & Carbon Sequestration)

(Theory Core Course with 04 credits)

Course Objectives

Students will be able to know

1. Concepts of Ecological Footprint, Carbon capturing for sustainable future.
2. Carbon Emission and Global issues and remedial measures.
3. Types of carbon sequestration, Carbon sequestration as green house mitigation policy.
4. Pattern of energy use, carbon credit, trading and tax.

Teaching Scheme			**Evaluation Scheme**		
Lectures	:-	4 hr/week			
Tutorials	:-	1 hr/ week	Continuous Internal Assessment by Teacher	:-	20 Marks
Test	:-	1 hr/week	Sem-End Examination	:-	80 Marks
Total Credit	:-	04	**Total Marks**	**:-**	**100 Marks**

Unit I: Carbon footprints and Sustainability:

Concept of ecological footprints, origin of ecological footprints, ecological footprint and policy development, ecological foot print and sustainability indicators, Environmental ethics, consumerism and carbon emission trends, comparison of rural and urban consumerism, sources of carbon emission, carbon footprints and ecological stability India's ecological footprint, concept of sustainable human society, carbon capturing for sustainable future.

Unit II: Carbon emission and Global Issues:

Nature of environmental problems, intensity, general causes, and impacts of global, regional and local environmental problems, population explosion and carbon emission trends, carbon emission and global warming, carbon emission and climate change, ozone layer depletion, acid rain, loss of biodiversity, environmental degradation, pollution of air, water and soil, mitigation and remedial measures.

Unit III: Carbon Sequestrations:

Carbon sequestration concept, introduction, types of carbon sequestration, terrestrial carbon sequestration, geological sequestration, ocean sequestration, National Energy Technology Laboratory (NETL), Concept of carbon sequestration in plants, animals and soil, carbon sequestration in food chain, food web, carbon storage in plant and soil, carbon sequestration as greenhouse mitigation policy, role of trees, vegetation and forest in carbon sequestration, monitoring and measurement of wood and soil carbon.

Unit IV: Carbon credits:

Pattern of energy use, energy technologies and environmental impacts, need of carbon trading, Concept and theme of Kyoto protocol, role of international agencies, obligation on nations for carbon emission reduction, Kyoto declaration, Economics of carbon sequestration, legal and institutional issues, carbon credit evaluation mechanics, carbon credit-trading and tax.

Unit V: Energy Conservation and Carbon Trading:

Domestic energy needs, social energy utilization pattern, energy use and carbon emission in industrial and commercial sectors, energy utilization pattern of global, national and local levels, methods for the conservation of energy, Concept of carbon trading, Carbon marketing potential, carbon credits and agriculture, Scope of carbon trading in India.

Current development in the subject.

Course Outcome

Students should be able to:

1. Identify the concepts of ecological footprint
2. Interpret carbon capturing for sustainable future
3. Apply carbon sequestration as green house mitigation policy
4. Create own consultancies

References

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2. http://www.carbonfootprint.com
3. http://www.footprintnetwork.org/en/index.php/GFN/page/carbon_footprint
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5. Arnaud Brohé, Nick Eyre and Nicholas Howarth Carbon Markets An International Business Guide,
6. Brian J McPherson; E T Sundquist, 2009. A book on Carbon sequestration and its role in global carbon cycle, Washington, DC: American Geophysical Union ; published under the aegis of the AGU Books Board.
7. http://envfor.nic.in/cc/cdm/publications.htm
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11. Rai, G.D. Non-renewable Energy Resources, Khanna Pub., New Delhi.

Semester – III

CC (Env-503 : - Advance Technologies and CDM)

(Theory Core Course with 04 credits)

Course Objectives

Students will be able to know

1. Concepts of Advance Technologies, AOP, VOC etc.
2. Nanotechnology as a tool for sustainability, Nano particle Characterization.
3. Concept of CDM, issues related to clean development mechanism.
4. National CDM, technology and Climate Change.

Teaching Scheme

Lectures	:-	4 hr/week
Tutorials	:-	1 hr/ week
Test	:-	1 hr/week
Total Credit	:-	04

Evaluation Scheme

Continuous Internal Assessment by Teacher	:-	20 Marks
Sem-End Examination	:-	80 Marks
Total Marks	**:-**	**100 Marks**

Unit I: Introduction to Advance Technologies:

Characterization of effluent, Introduction of AOP(Advance Oxidation Processes), Fundamental of AOP for waste water treatment, UV/0_3 processes, ozonation, fenton processes, Ultrasound processes, application of AOP for VOC reduction and odor treatment, Sonochemistry, photochemistry, photochemical processes for water and waste water treatment,

Unit II: Environmental Nanotechnology

Background of nanotechnology, partial size an surface area, converging science and technology, nanotechnology as a tool for sustainability, health, safety at environmental issues ; Characterization of nano materials, AFM , STM,SEM,TEM,XRD,ESCA,IR and raman UV-DSR of nano materials for structural and chemical nature.

Unit III: Clean Energy Technology

Renewable energy projects and Clean Development Mechanism, biomass energy based systems, Clean Development Mechanism benefits , first small scale project registered in India , challenges of Clean Development Mechanism, reclamation of oil polluted soil, metal pollutant recovery from polluted soil.

Unit IV: Clean Development Mechanism

Clean Development Mechanism concept, Introduction, Need of Clean Development Mechanism , Zero pollution and discharge, history of Clean Development Mechanism , Issues related to Clean Development Mechanism, basic principles and functions of Clean Development Mechanism, present status and proposal of development of Clean Development Mechanism.

Unit V : Clean Development Mechanism and climate change

CDM Gold Standards', Organization of CDM, Green house gases emissions, carbon sequestration under Clean Development Mechanism, Clean Development Mechanism and carbon trading in India, trading and project based mechanism, developing a national Clean Development Mechanism strategy. Clean Development Technology and climate change

Current development in the subject.

Course Outcome

Students should be able to:

1. Define the advanced technologies and CDM
2. summarizes nanotechnology for optimization of treatment plant
3. apply CDM mechanism as a strategy plan
4. create own consultancies

References

1. Clean development mechanism (CDM) and carbon trading in India – Jitendra Kumar singh.
2. Bio-energy and CDM – B.Schlamadinger, J. Jurgens jaoanneum research, Elisabathstasse.
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4. CDM gold standards – Wikipedia,free encyclopedia.mnt
5. CDM & wind energy-Dec 2009 WWE A-charles-de-Gautlestr 553113 bonn Germany
6. GHeG omissions trading and project based mechani – preceding-organization for economic co-operation and development, concerted action on tradable emissions permits.
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12. Rao M.N. and Rao H.V.N. 1989, Air Pollution, Tata McGraw-Hill Pub. Co.Ltd., New Delhi.
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14. Pandey G.N. and Carney G.C., 2002, Environmental Engineering, Tata McGraw-Hill Pub. Co., New Delhi.
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20. Raju B.S.N., 1997, Fundamentals of Air Pollution, Oxford & IBH Pub. Co.Pvt.Ltd., New Delhi.
21. Rao M.N. and Rao H.V.N. 1989, Air Pollution, Tata McGraw-Hill Pub. Co.Ltd., New Delhi.
22. Rao C.S., 1991, Environmental Pollution Control Engineering, Willey Eastern Ltd., New Delhi.
23. Pandey G.N. and Carney G.C., 2002, Environmental Engineering, Tata McGraw-Hill Pub. Co., New Delhi.
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26. Sinha R. K., Sinha A. K., Saxena V. S., A book on Waste Management INA, Shri Publishers, Jaipur (2000).
27. Environmental applications of nanomaterials-synthesis, Sorbents and sensors, edited by Glen E Fryxell and Guozhong Cao, Workdscibooks, UK
28. Environmental nanotechnology, Mark wisener, Jeo, Yues Bolteru,2007, McGraw Hill.
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Semester – III

EC (Env-521 :- Mooc's Courses)

(Theory Core Course with 04 credits)

Course Objectives

Students will be able to know

1. Students will be able to know the present status of plastic waste as a pollutant and how to mitigate its problem.
2. The students will be able to understand that, how the modeling can be used to study the environmental problems.
3. The students will gain the knowledge about energy, economics and policies.

The students has to earn 04 credits from the following list of Mooc's Courses on SWAYAM platform by Online mode and should secure certificate from the concern organization. The evaluation processes will be followed as per university rules.

List:

1. Business Environment - I I S Jaipur (04 Credits)
2. Communication Skills Modes and Knowledge Dissemination - N I TT I & R, Chandighad (03 Credits)
3. Business and Sustainable Development, - I I T Bombay, Mumbai (01 Credit)
4. Environmental Studies, - Devi Ahilaya University, Indore (04 Credits)
5. Plastic Waste Management , I I T Kharagpur (02 Credits)
6. Energy Economics and policies, - I I T Mandi (02 Credits)

Semester – III

LC: ENV 541: Lab Course – IX

(Based on CC Env. 501)

Lab Course	:-	4 hr/week	**Evaluation Scheme**		
Assignment / field work/ outreach activities	:-	2 hr/week	Continuous Internal Assessment by Teacher	:-	10 Marks
			Sem-End Examination	:-	40 Marks
Total Credit	:-	02	**Total Marks**	:-	50 Marks

1. Determination pH & electrical conductance of municipal solid waste.
2. Determination of total water soluble solids of municipal solid waste.
3. Determination of moisture content of municipal solid waste.
4. Determination of loss on ignition of municipal solid waste.
5. Determination of organic carbon from municipal solid waste.
6. Determination of total Kjeldahl nitrogen from municipal solid waste.
7. Determination of total phosphorous in municipal solid waste.
8. Determination of potassium of municipal solid waste.
9. To study the percentage composition of degradable and non degradable material from solid waste.
10. To study the percentage of potential recycling material from municipal solid waste.
11. To study the conventional signs and symbols used in hazardous waste study.
12. Geological investigation and identification of landfill sites for solid waste management.
13. To study the leachable calcium and magnesium content from vermin-compost prepared from municipal solid waste.
14. Developing appropriate microbial consortium for land applied effluents. (Bioremediation)

Semester – III

LC: ENV 542: Lab Course – X

(Based on CC Env. 502)

Lab Course	:-	4 hr/week	**Evaluation Scheme**		
Assignment / field work/ outreach activities	:-	2 hr/week	Continuous Internal Assessment by Teacher	:-	**10 Marks**
			Sem-End Examination	:-	**40 Marks**
Total Credit	:-	**02**	**Total Marks**	:-	**50 Marks**

1. To study the total carbon content present in plant biomass.
2. To study the calorific value of plant biomass by titrometric method/ bomb calorimetric method.
3. Study of carbon footprint of product.
4. Determination of rate of carbon fixation in aquatic ecosystem by phytoplankton.
5. Immobilization of cultured bacterial sample.
6. Measurement of carbon content from various soil samples by ignition method.
7. Determination of various parameters from prepared compost and comparison with standards.
8. Determination of air pollution index.
9. Determination of soil pollution index.
10. Determination of urban infrastructure index.
11. Determination of water quality index.
12. Determination of Environmental pollution index (EPI).
13. Determination of life quality index.
14. Determination of Comprehensive environmental pollution index (CEPI).

Semester – III

LC: ENV 543: Lab Course – XI

(Based on CC Env. 503)

Lab Course	:-	4 hr/week	**Evaluation Scheme**		
Assignment / field work/ outreach activities	:-	2 hr/week	Continuous Internal Assessment by Teacher	:-	**10 Marks**
			Sem-End Examination	:-	**40 Marks**
Total Credit	:-	**02**	**Total Marks**	:-	**50 Marks**

1. To determine moisture from stack emission gases.
2. To determine the density of stack emission gases.
3. Designing a manual for stack monitoring system.
4. To study trouble shooting mechanism may be encountered in the use of stack sampler.
5. Evaluation of atmospheric pollutants in working environment of industry as a field study.
6. To prepare a flow chart treatability study of industrial effluents.
7. To demonstrate treatability of various industrial effluents.
8. Application of nano particles for pollution abatement.
9. Synthesis of nano particles using plant resources.
10. Application of enzyme in process development.
11. Process modification in Clean Development Mechanism.
12. Removal of heavy metal from waste water by using aquatic plants.
13. Removal of COD from waste water by using root zone technology.
14. Determination of carbon monoxide and hydrocarbons from automobile exhaust.
15. Biological adsorption atmospheric dust particles or other pollutants.

Semester – III

LC: ENV 544 : Lab Course – XII

(Based on environmental components)

Lab Course	:-	4 hr/week			**Evaluation Scheme**
Assignment / field work/ outreach activities	:-	2 hr/week	Continuous Internal Assessment by Teacher	:-	**10 Marks**
			Sem-End Examination	:-	**40 Marks**
Total Credit	:-	**02**	**Total Marks**	:-	**50 Marks**

1. Determination of water soluble aluminum compounds as Alumina (Al2O3) from alum by using gravimetric method.
2. Determination of water soluble aluminum compounds as Alumina (Al2O3) from alum by using volumetric method.
3. Determination of different adsorbing capacity of different activated carbon prepared from different plant materials.
4. Determination of stability of bleaching powder.
5. Determination of silicates from caustic soda.
6. Determination of chlorides from caustic soda.
7. Determination of sulphates from caustic soda.
8. Determination of bulk density of filter sand.
9. Determination of percentage of oxides and hydroxides in lime.
10. Determination of active functional groups of activated carbon by using FTIR spectroscopy.
11. Determination of iodine number of activated carbon.
12. Determination of ozone by using spectrophotometric method.
13. Analysis of chloroflouro carbons and chlorinated hydrocarbons by Gas chromatography.
14. Determination of metal pollutants (As, Cr, Fe, Pb, Mn, etc.) from provided sample.
15. Determination of pesticide residue in given sample by TLC / GLC method.

Semester – III

SC (Env-522:- Global Environmental Crises & Climate Change)

(Theory Core Course with 04 credits)

Course Objectives

Students will be able to know

1. Concepts of climate change, Strategies of green house warming.
2. Global Environmental problem, developmental priorities in India.
3. Environmental movements and controversies, Reclamation of Alkaline and saline soil.
4. Natural Hazards & Man made hazards, Control Measures.

Teaching Scheme

Lectures	:-	4 hr/week
Tutorials	:-	1 hr/ week
Test	:-	1 hr/week
Total Credit	:-	04

Evaluation Scheme

Continuous Internal Assessment by Teacher	:-	20 Marks
Sem-End Examination	:-	80 Marks
Total Marks	**:-**	**100 Marks**

Unit – I: Climate Change:-

Climate change- introduction, concept and phenomenon; Climate change and its impact on agriculture, its impact on agricultural biodiversity, climate change and emerging of new kinds of diseases and epidemics; Human health problems , climate change and its impact on hydrological cycle - rainfall, icefall, surface water resources; Climate change and oceanic environment; IPCC reports ; Energy policies in Asia in light of climate change; Strategies to handle green house warming - Chine's stand; Reply of Malaysia to Global Climate change; India's action plan on climate change.

Unit – II: Global and local environmental issues:

Global environmental problems- global warming concept and considerations; green house emission rate; ozone layer depletion; Cycles of global environment change; Scientific evidences of greenhouse effect or to global warming ; Effect of Global warming : atmospheric gases and their impacts on ionosphere, Meteorology and dispersion of atmospheric gases, Green house effects current status, polar ice caps and snow melting due to temperature fluctuation, Health and hygiene considerations due to global warming; Global warming and other related environmental problems with respect to aquaculture,

Unit – III : Environmental and developmental priorities in India :

Developmental priorities in India, Pre independence and post independence development, Industrialization, Green revolution, Urbanization, developmental priorities vs. environmental priorities, resource depletion and degradation due to improper priorities such as water, soil, forest etc in India.

Unit – IV : Global environmental Movements and controversies:

Environmental movements - Environmental movements and peoples responses; Green peace, world watch Institute, wetland international etc. Indian environmental movements and initiatives Chipko, Apico, Narmada Bachoao Andolan, Save western Ghats, Environmental Controversies : social political and economic issues in the controversies, Narmada Project, Almatti dam, Sarda Sarovar project, Tehri dam, Koyna dam, MIC gas tragedy, Chernobyl tragedy, Mahtura Refinery case, Silent valley, Rehabilitation and settlement issues, government policies and social awareness for the protection of environment. Reclamation of alkaline and saline soils, Interstate river water disputes.

Unit – V : Natural Man made Hazards: :

Flooding, Nature and frequency of flooding, Impacts of flood hazard; urbanization and flooding; flood mitigation methods; land slide – causes and consequences; human land use and landslides; prevention and control of land sliding, Coastal hazards; tropical elegance and tsunamis; coastal erosion; sea level changes and its impact on coastal areas. Earthquakes; causes, intensity and magnitude of earthquakes; causes; geographic distribution of earthquake zones, seismic waves, travel time and location of epicenter; natures of destruction; ground subsidence; protection from earthquake hazards; volcanism; nature and causes of volcanism, volcanism and climate. Social and economic impact of natural disasters; Manmade Hazards :- Industrial accidents; causes and effects of hazardous waste, chemical waste and their disposal and control, oil spills-causes, impacts and control, manmade hazards; forest fire, industrial fires and control; environmental degradation due to wars.

Current development in the subject

Course Outcome

Students should be able to:

1. Locate global environmental issues
2. Compare climatic change effects on natural environmental components
3. Correlate developmental priorities in India
4. Evaluate controversial issue s and its mitigations

References

1. Coastal Zone Management by Dr. Ramakrishnan Korakandy.
2. Environment Security and Tourism Development in South Asia by V.C. Pandey
3. Environment and its Global Implications by Gopal Bhargava.
4. Indian Vistas of Environment by Chittabrata Palit and Mahua Sarkar.
5. The Immanent Disaster A vision on Climate change by Sampooran Singh
6. Natural Resources of Himalaya by K.S.Gupta/
7. Fly Ash Amendment and plant Growth by Dr. S.M. Mohan
8. Environmental Education by Archana Tomar
9. Disaster management by S.Narayan
10. Biodiversity and Ecosystem Conservation by Ashish Dutta
11. Corporate governance for sustainable environment by Ramesh Chandra and Ritu Aneja
12. Global warming and climate changes transparency and accountability edt by Gopal Bhargava.
13. Energy and environment in india by K.C.Gupta

Semester – IV

CC (Env-504:- RS & GIS Application in Environment)

(Theory Core Course with 04 credits)

Course Objectives

Students will be able to know

1. Types of Aerial Photography, Photo Interpretation & Mapping of Objects.
2. Scope of Remote Sensing & there Application.
3. Scope of GIS, Advance's in GIS & the application of GPS.
4. Applications of RS & GIS for soil erosion, flood Mapping, wildlife, grassland status.
5. Wildlife conservation & Management, urban planning & GIS in Disaster Management.

Teaching Scheme

Lectures	:-	4 hr/week
Tutorials	:-	1 hr/ week
Test	:-	1 hr/week
Total Credit	:-	04

Evaluation Scheme

Continuous Internal Assessment by Teacher	:-	20 Marks
Sem-End Examination	:-	80 Marks
Total Marks	**:-**	**100 Marks**

Unit-I: Aerial Photography and Photogrammetry:

Sensory organ eye and camera, Working principle of camera, Camera types, cameras used in aerial photography, Aerial photography- history of aerial photography, Platforms used in aerial photography, Methods of aerial photography, Types of Aerial photographs (vertical & oblique photographs), Geometry of aerial photographs, Scale of aerial photographs; Stereoscopic vision , Stereoscopes, stereoscopic photographs, Parallax bar, Photogrammetry – Photo interpretation, mapping of objects from aerial photographs.

Unit-II: Remote Sensing:

Introduction and scope of remote sensing, Stages in remote sensing, Fundamental principle of remote sensing- Electromagnetic spectrum, Transmission, Absorption, Reflection, atmospheric scattering, emissivity, Radiant energy and its interaction with matter and earth surface and atmosphere, spectral signature, Platforms in remote sensing, Active and passive remote sensing, Remote sensing sensors.

Unit-III: Satellite Remote Sensing:

Polar and geostationary satellites, Meteorological satellites and non-meteorological remote sensing satellites, Landsat, Spot, IRS, ERS, JERS, Quickbird; Sensors-Pushbrooom and Whiskbroom types, Data reception, Archiving and distribution of data, Radar and LIDAR as Active Remote Sensing Systems, Working of Radar, Satellite images, Radar Images.

Unit-IV: Geographic Information System (GIS):

Definition, Scope of Geographic Information System, Capabilities and advances of GIS, Use of GIS in spatial and temporal analysis, Components of GIS system , GIS software's ; Digital Image processing- Image structure, Raster and Vector data types, Image enhancement and rectification, Band combination, Geo referencing the data, Image classification, image interpretation. Geographical Positioning System, Applications of GPS.

Unit-V: Application of RS and GIS:

Application of RS& GIS - in Environmental Systems , soil erosion study, flood mapping and flood damage study, Agricultural study, Natural resources study such as Water, soil, wildlife, Grassland, minerals & Metals etc. ;Use of RS &GIS in Environmental Audit. Use of RS&GIS in Environmental Management study- in soil Conservation and Management, in Water Shade Management, in forest conservation & management, in wildlife conservation and management, in Urban Planning. Use of RS and GIS in Disaster management

Current development in the subject.

Course Outcome

Students should be able to:

1. Define and discuss the concepts and components of aerial photographs
2. Summarize the principle and procedure of remote sensing
3. Identify and use the different types of satellite images and aerial photographs
4. Illustrate the use of GIS software for extraction of information and interpretation
5. Demonstrate the use of RS and GIS in environmental study and management

References

1. Remote Sensing and Image Interpretation:-Tomas M.Lillesand and Ralph W.Keifer john Wiley and sons Inc. New Yark.
2. Introduction to Remote sensing:-James B. Campbell, Tylor and Franeis Ltd.Londan.
3. Fundamentals of GISN:-Michael N.Demers..
4. Remote Sensing application in applied geosciences:-Sumitra Mukherjee, Milton Book Company.
5. Environmental Geography:-H.M Saxena, Milton Book Company.
6. Principles of Photogeology:-Singh.
7. Principles of Remote Sensing:-Currain.
8. Fundamentals of Photogeology:-S.N.Pandey.
9. PC Software made simple:-Taxali.
10. Illustrated lotus 1-2-3:-by Muller.
11. Principles of Remote Sensing:-A.N.Gatel and S.Singh, Scientific Publishers (India). Jodhpur (1999Edition).
12. Remote Sensing for Environment and Forest Management:-A.Mehrotra and R.K.Suri. Indus Publishing Co.New.Dehli(1994 Edition)
13. Remote sensing for large wildfires:-E.Chuvieco, Springer, New York (1999 Edition).
14. Remote Sensing in Geoscience:-Tripathi N.K.
15. Remote sensing and GIS for site characterization;-Application and standard:-Singhroy, Technip Books International New Delhi.
16. Environmental Remote Sensing:-Saumirta Mukherjee.

Semester – IV

CC (Env-505:- EIA & Environmental Auditing)

(Theory Core Course with 04 credits)

Course Objectives

Students will be able to know

1. Scope & Objectives of EIA, Skip Relation of EIA to Sustainable Development.
2. Various Components of EIA, Impact Interpretation & Analysis.
3. EIA Notification 2006 & Amendment, Public Participation in EIA.
4. Scope & Objectives of Environmental Audit, Submission of Environmental Audit Report to MoEFCC.

Teaching Scheme

Lectures	:-	4 hr/week
Tutorials	:-	1 hr/ week
Test	:-	1 hr/week
Total Credit	:-	04

Evaluation Scheme

Continuous Internal Assessment by Teacher	:-	20 Marks
Sem-End Examination	:-	80 Marks
Total Marks	**:-**	**100 Marks**

Unit I: Introduction:

Concept of EIA, Scope and Objectives of EIA, Nexus between development and environment, origin and development of EIA. Measurement of impact-physical, social, economical, natural; concept of significant effect; short term versus long term effect; skip relation of EIA to sustainable development.

Unit II : EIA

Screening process, TOR, data collection, protocol for evaluation of impacts, pollution load calculation, methods of impact analysis: - Impact identification prediction, evaluation monitoring and mitigation measures, Public participation in environmental decision making, Assessment of various categories of EIA-rapid, comprehensive, regional and strategic EIA. Various components of EIA, Impact interpretation, various impact analysis methods-checklist, overly, matrix, and Adhoc methods.

Unit III: Assessment of Impact

Overview of EIA notification,2006 and amendments, Evaluation of proposed actions and determination of impact importance, Development of value functions and scoping of EIA methodologies, preparation and writing of EIA/EIS, Review of procedure, practices and guidelines for EIA in India. Role of EIS in EIA –Baseline study, risk assessment, risk management, mitigation measures and comparison of alternatives Impact analysis with respect to air and water quality, noise, energy, vegetation and wild life and social and economic issues, Public participation in EIA.

Unit IV: Case Studies of EIA

EMP for a particular sector like, urbanization, mining, industrial [cement, Pharmaceutical, distillery etc].Thermal power plants, hydropower, Road and highway projects etc.

Unit V : Environmental Audit

Introduction ; Scope , Applicability and Objectives of Environmental Audit; Notification and Guidelines for Environmental Audit; Procedure of Environmental auditing (Water, Raw Materials and Energy balance; Hazardous waste Audit, Safety Audit); Designing and implementation of audit tools; pre audit activities; on site activities; post audit activities; Environmental statement; benefits of environmental audit; EA scenario in India – submission of Environmental Audit report in MOEF format – form VB; Environmental performance evaluation;

Current development in the subject.

Course Outcome

Students should be able to:

1. Define scope and objectives of EIA , nexus between development and environment, skip relation of EIA to sustainable development
2. Identify social, economical and environmental impact for human welfare
3. Evaluate EIA notification 2006 and amendments, public participation in EIA
4. Assess screening process in EIA, TOR, protocols for evaluation of impacts and impact analysis.
5. Explain environmental audits, hazardous waste audit and safety audit

References

1. Environmental Impact Assessment: A. Eillpin.
2. Environmental Impact Assessment and Management: H. Kumar (1998).
3. Environmental Impact Assessment of Tehri Dam: V. Govardhan.
4. Practical guide to Environmental Impact Assessment: Belly Bowers and Marriott (1977).
5. Environmental Impact Assessment: A. K. Shrivastava APH Publication 2003.
6. Law of Intellectual Property: Dr. S. R. Mysani Asia Law House (2nd Edition) Law Book Sellers, Publishers and Distributors Hyderabad.
7. Environmental Impact Assessment, L. W. Canter, McGraw Hill publication, New Delhi.
8. Proceedings Indo-US workshop on environment impact analysis and assessment (1980) NEERI, Nagpur.
9. Environment & Social impact assessment, Vlcany, F., Bronsetin DA (1995), John Wiley & Sons, New York.
10. EIA – A Biography. B. D. Clark, B. D. Bissel, P. Watheam.
11. Second world congress on engineering and environment 1985, Institution of engineers.

Semester – IV

CC (Env-506 :- Sustainable Urban & Rural Developmental Planning)

(Theory Core Course with 04 credits)

Course Objectives

Students will be able to know

1. Concept of sustainable development.
2. Concept of sustainable urban development and its applications.
3. Concept of rural development and its importance.
4. The understanding of urban and rural problems and mitigation by planning it for sustainable development.

Teaching Scheme

Lectures	:-	4 hr/week
Tutorials	:-	1 hr/ week
Test	:-	1 hr/week
Total Credit	:-	04

Evaluation Scheme

Continuous Internal Assessment by Teacher	:-	20 Marks
Sem-End Examination	:-	80 Marks
Total Marks	:-	**100 Marks**

Unit I: Sustainable Rural development: Concept and theory, Planning the rural –urban interface under sustainable principle, Sustainable rural development in India: Issues and challenges, Sustainable rural development initiatives taken by Government of India, Rural developmental strategies, Sustainable rural technologies: Food processing, watershed management, , organic farming, rural tourism, ICT in rural technology, IOT in agriculture. Rural development- Planning for rural development.- components of planning, village level planning, block and district level planning,

Unit II: Urban development:

Urbanization- causes and impacts, strategic approach to urban development, sustainable urban development and planning, Good governance , the strategic approach in support of development, Urban themes and sectoral issues, strategies for regional urban planning,

Urban Transportation and planning : Urban Transportation problems & Externalities- Congestion, Safety, Emissions, etc.; Transport planning; Implementation hierarchical levels of Urban Transport Planning: Master plans, detailed development plans; Planning and design of sustainable urban mobility.

Unite III: Urban Services: Different type of municipal services, Role of stakeholders in Urban services and finance, Public private partnerships, Integrated municipal solid waste management and plan preparation for urban areas; Decentralized waste management, Municipal solid waste management- Operation and maintenance; Solid Waste generation and minimization; Waste forecasting; Waste collection in urban areas- Equipment, vehicles; Waste disposal from urban areas- Landfill siting criteria, Landfill area calculation, Landfill Types, Landfill Design, Landfill phasing.

Unite IV: Municipal health services: Public health challenges, Health facilities, Stakeholders, Improving healthcare access for the urban poor, Community based healthcare programs, Epidemic and pandemic control, Governments health programs

Other urban services and activities: Street sweeping, Cleaning of surface drains; Street lighting services, Fire services, Urban forestry, environment and ecology, Provision of parks, gardens and playground, burial grounds and cremation facilities;

open space management, urban forest / vegetation management, utility management in urban areas; Sustainable urban Development- principle of sustainable urban development, urban growth management town planning.

Unit V: Advanced waste management technologies: Waste to energy, Bio-methanation, Refuse derived fuel, Evaluation of alternative technologies, Plastic waste and Hazardous waste management; wealth from waste etc.

References / Books

1. Hutchinson, B.G., Principles of Urban Transport Systems Planning, McGraw Hill, London, 1974.
2. Khisty, C. Jotin and Lall, B. Kent., Transportation Engineering and Planning, 3rd Edition, Pearson India, 2001
3. Papacostas, C. S., and Prevedouros, P. D., Transportation Engineering and Planning. 3rd Edition, Prentice - Hall of India Pvt. Ltd., 2002.
4. Garber N.J., and Hoel L.A., Traffic and Highway Engineering, 4th Edition, Cengage Learning, 2009
5. Kadiyali, L.R., Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi, 2013
6. Municipal solid waste management manual Part I & II. CPHEEO, India

7 What a Waste: Solid Waste Management in Asia, The International Bank for Reconstruction and Development/The World Bank

8.Agriculture and Rural Development 2011: Rural Development in European Union A stastical and Information Report 2011

1. Sustainable Rural Development : A regional Perspective, 2009; A Annual Report on Monitoring
2. Introduction to Sustainable Rural Development: Key Concepts and Theoretical Foundation 2012. Russain State Agrarian University, Russia.

Semester – IV

EC (Env-523: - Mooc's Course on SWAYAM platform)

(Theory Core Course with 04 credits)

Course Objectives

1. To learn about the basic /advanced components of environmental science.
2. Acquire the skill in the field of environmental science.
3. Acquisition of knowledge by online mode.

The students has to earn 04 credits from the following list of Mooc's Courses on SWAYAM platform by Online mode and should secure certificate from the concern organization.
The evaluation processes will be followed as per university rules.

List of Courses:

1. Ecology and Environmental Ethics: Problems and Perspectives; Amrita Viswa Vidyapeeth (04 Credits)
2. Environmental Communication; University of Calicut. (04 credits)
3. Environmental Law; National Law University, New Delhi (04 credits)
4. Resources and Environment; Maharaja College, University of Mysore, Mysore (04 Credits)
5. Water Resources and Watershed Management; Osmania University, Hyderabad. (04 credits)

Semester – IV

LC: ENV 545: Lab Course – XIII
(Based on theory papers)

Lab Course	:-	4 hr/week	**Evaluation Scheme**		
Assignment / field work/ outreach activities	:-	2 hr/week	Continuous Internal Assessment by Teacher	:-	**10 Marks**
			Sem-End Examination	:-	**40 Marks**
Total Credit	:-	**02**	**Total Marks**	:-	**50 Marks**

1. Marginal information of toposheet and indexing of toposheet.
2. To study the conventional signs and symbols from toposheet
3. Interpretation of toposheet for specific objects.
4. To study the principle and application of: a)Pocket Stereoscopes, b) Mirror stereoscope, c) Parallax Bar.
5. Stereoscopic vision test by using pocket stereoscope.
6. Determination of scale of aerial photograph and satellite image.
7. Identification of features on vertical aerial photograph.
8. Orientation of sterio- model under mirror stereoscope and detection of objects from steriopairs
9. Land use and land cover study / mapping of objects from aerial photograph..
10. Determination of coordinates of selected points / area by using GPS for confirmation of objects from satellite image /toposheet(ground trouthing).
11. Browsing of toposheet /satellite image in GIS software and georeferencing.
12. Digital image processing- stacking of image, image rectification / image enhancement , image display in RGB .
13. Image interpretation- unsupervised and supervised classification.
14. To study the land use and land cover visually by using satellite images and google image.
15. Preparation of shape file of an area and display information in point line and polygon form.

Semester – IV

LC: ENV 546: Lab Course – XIV
(Based on theory papers)

Lab Course	:-	4 hr/week	**Evaluation Scheme**		
Assignment / field work/ outreach activities	:-	2 hr/week	Continuous Internal Assessment by Teacher	:-	**10 Marks**
			Sem-End Examination	:-	**40 Marks**
Total Credit	:-	**02**	**Total Marks**	:-	**50 Marks**

1. Environmental audit protocol and audit process of any two industries.
2. Standard operational procedure (SOP) for Environmental Impact Assessment.
3. Preparation of TOR (Turn of Reference) for EIA in any two industries
4. Study of environmental parameters during pre-audit, onsite audit and post audit activities in EIA.
5. Preparation of checklist for the environmental impact assessment for construction project or any other developmental activity.
6. To study the environmental impact of any one developmental activity by using network method.
7. Estimation of water requirement for industry using thumb rule
8. Estimation of sewage treatment plant capacity by thumb rule
9. To study the water quality of river or water bodies to discharge its water in river by thumb rule.
10. To study the required contents in EIA report along with public hearing with respect to EIA notification 2006.
11. Estimation of stack height on the basis of particulate matter using thumb rule.
12. To calculate raw water requirement for a power plant by thumb rule.
13. To study the life cycle assessment technique for the assessment of environmental impacts associated with all the stages of products life from cradle to grave.
14. Preparation of EMP statement for any one development activities.
15. Preparation of SIA report for tourism project / activities.

Semester – IV

LC: ENV 547: Project + Internship + Field visit / Tour + Review writing + Research Proposal writing

Lab Course	:-	8 hr/week	**Evaluation Scheme**		
Project work / field work/ project writing etc.	:-	2 hr/week	Continuous Internal Assessment by Teacher	:-	**20 Marks**
			Sem-End Examination	:-	**80 Marks**
Total Credit	:-	**04**	**Total Marks**	:-	**100 Marks**

1.	Project work / dissertation	40 marks
2.	Internship / in plant training report	20 Marks
3.	Visit / Tour report	10 Marks
4.	Review writing	10 Marks
5.	Research Project Proposal writing	20 Marks

Note:

I. **The project internship is to be performed during summer vacation after completion of First year.**

II. **Allotment of project work should be before the commencement of third semester.**

III. **The field visits / tours to be arranged during third semester tenure only.**

31/01/23

Dean
Faculty of Science & Technology
Dr. Babasaheb Ambedkar Marathwada
University, Aurangabad

BOS chairman