

**, Commerce, and Science College, Ahmednagar  
(Autonomous)  
(Affiliated to Savitribai Phule Pune University, Pune)**



**National Education Policy (NEP)  
Choice Based Credit System (CBCS)**

**Programme Skeleton and Syllabus of  
M.Sc. Environmental Science**

**Implemented from**

**Academic Year 2023-24**

**9.2 Distribution of credits**

Type of Courses	Total Credits	Credits/ Semester
Discipline-Specific Core Courses (DSC)	54	14 /12
Discipline Specific Elective Courses (DSE)	16	04
Research Methodology (RM)	04	Semester I only
On-Job Training/ Internship (OJT/I	04	Semester II only
Project (PR)	10	Semesters III and IV only
Total	88	22

**9.3 Master of Science (M.Sc.) Course Distribution**

Class	Semester	Subjects	Courses	DSC		DSE		RM/OJT/ Internship etc.		Project *	Total Credits
				T	P	T	P	T	P		
M. Sc. I	I	01	09	03	03	01	01	01*		00	22
M. Sc. I	II	01	09	03	03	01	01	00	01	00	22
M. Sc. II	III	01	07	02	02	01	01	00	00	01	22
M. Sc. II	IV	01	07	02	02	01	01	00	00	01	22

\* RM: Theory and Practical credits in RM paper shall be decided by the Department. The final marks/grade point shall be calculated by considering theory and practical marks.

**9.4 Master of Science (M. Sc.) Credit Distribution**

Class	Semester	Subjects	Courses	DSC		DSE		RM/OJT/ Internshi p etc.		Project *	Total Credits
				T	P	T	P	T	P		
M. Sc. I	I	01	09	08	06	02	02	04*		00	22

M. Sc. I	II	01	09	08	06	02	02	00	04	00	22
Exit Option: PG Diploma											
M. Sc. II	III	01	07	08	06	02	02	00	00	04	22
M. Sc. II	IV	01	07	08	04	02	02	00	00	06	22
				<b>32</b>	<b>20</b>	<b>08</b>	<b>08</b>	<b>02</b>	<b>06</b>	<b>12</b>	<b>88</b>

### 9.5 Master of Science (M. Sc.) Distribution of Courses

Class	Semester	Course and their credits in the bracket			
		DSC	DSE	RM/OJT/ Internship etc.	Project *
M. Sc. I	I	DSC -01 (03)	DSE -01 (02)	RM-01(04)	NA
M. Sc. I	I	DSC -02 (03)	DSE -02 (02)		
M. Sc. I	I	DSC -03 (02)			
M. Sc. I	I	DSC -04 (02)			
M. Sc. I	I	DSC -05 (02)			
M. Sc. I	I	DSC -06 (02)			
M. Sc. I	II	DSC -07 (03)	DSE -03 (02)	OJT-01 (04)	NA
M. Sc. I	II	DSC -08 (03)	DSE -04 (02)		
M. Sc. I	II	DSC -09 (02)			
M. Sc. I	II	DSC -10 (02)			
M. Sc. I	II	DSC -11 (02)			
M. Sc. I	II	DSC -12 (02)			
M. Sc. II	III	DSC -13 (04)	DSE -05 (02)	NA	PR-01(04)
M. Sc. II	III	DSC -14 (04)	DSE -06 (02)		
M. Sc. II	III	DSC -15 (03)			

M. Sc. II	III	DSC -16 (03)			
M. Sc. II	IV	DSC -17 (04)	DSE -05 (02)	NA	PR-02(06)
M. Sc. II	IV	DSC -18(04)	DSE -06 (02)		
M. Sc. II	IV	DSC -19 (02)			
M. Sc. II	IV	DSC -20 (02)			

### Programme Framework (Courses and Credits): M. Sc. Environmental Science

Sr. No.	Year	Semester	Level	Course Type	Course Code	Title	Credits
1.	I	I	6.0	DSC-01	MS-EN111T	Environmental Biology & Biodiversity	03
2.	I	I	6.0	DSC-02	MS-EN112T	Environmental Chemistry	03
3.	I	I	6.0	DSC-03	MS-EN113T	Environmental Geosciences	02
4.	I	I	6.0	DSC-04	MS-EN114P	Practical based on EN111	02
5.	I	I	6.0	DSC-05	MS-EN115P	Practical based on EN112	02
6.	I	I	6.0	DSC-06	MS-EN116P	Practical based on EN113	02
7.	I	I	6.0	DSE-01	MS-EN117T	Atmospheric Science	02
8.	I	I	6.0	DSE-02	MS-EN118P	Practical based on EN117	02
9.	I	I	6.0	RM-01	MS-EN119T/P	Environmental Instrumentation	04
10.	I	II	6.0	DSC-07	MS-EN121T	Water & Soil Pollution: Management and Mitigation	03
11.	I	II	6.0	DSC-08	MS-EN122T	Air, Noise and Radiation Pollution:	03

						Management and Mitigation	
12.	I	II	6.0	DSC-09	MS-EN123T	Environmental Law, Ethics and Policy	02
13.	I	II	6.0	DSC-10	MS-EN124P	Practical based on EN121	02
14.	I	II	6.0	DSC-11	MS-EN125P	Practical based on EN122	02
15.	I	II	6.0	DSC-12	MS-EN126P	Practical based on EN123	02
16.	I	II	6.0	DSE-05	MS-EN127T	Forestry and Habitat Management	02
17.	I	II	6.0	DSE-06	MS-EN128P	Practical based on EN127	02
18.	I	II	6.0	OJT-01	MS-EN129P	In Plant Training and Report	04
19.	II	III	6.5	DSC-13	MS-EN131T	EIA & Environmental Audit	04
20.	II	III	6.5	DSC-14	MS-EN132T	Remote Sensing & GIS	04
21.	II	III	6.5	DSC-15	MS-EN133P	Practical based on DSC-01	03
22.	II	III	6.5	DSC-16	MS-EN134P	Practical based on DSC-02	03
23.	II	III	6.5	DSE-05	MS-EN135T	Environmental Biotechnology -I	02
24.	II	III	6.5	DSE-06	MS-EN136P	Practical based on DSE-01	02
25.	II	III	6.5	PR-01	MS-EN137P	Project report and Scientific Writing	04
26.	II	IV	6.5	DSC-17	MS-EN141T	Solid & Hazardous Waste Management	04
27.	II	IV	6.5	DSC-18	MS-EN142T	Environmental Toxicology and Health	04

<b>28.</b>	II	IV	6.5	DSC-19	MS-EN143P	Practical based on EN141	02
<b>29.</b>	II	IV	6.5	DSC-20	MS-EN144P	Practical based on EN142	02
<b>30.</b>	II	IV	6.5	DSE-07	MS-EN145T	Restoration Ecology and Watershed Management	02
<b>31.</b>	II	IV	6.5	DSE-08	MS-EN146P	Practical based on EN145	02
<b>32.</b>	II	IV	6.5	PR-02	MS-EN147P	Dissertation	06

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's  
New Arts, Commerce and Science College, Ahmednagar  
(Autonomous)

**Board of Studies in Environmental Science**

Sr. No.	Name	Designation
1.	Dr. Satish Kulkarni	<b>Chairman</b>
2.	Prof.Dr. N.R.Bandella	<b>Academic Council Nominee</b>
3.	Dr. Nilesh Wagh	<b>Academic Council Nominee</b>
4.	Dr. Deepali Nimbalkar	<b>Vice-Chancellor Nominee</b>
5.	Dr. D. D.Ahire	<b>Member</b>
6.	Dr. A.P.Pandit	<b>Member</b>
7.	Prof.Dr. D.C. Meshram	<b>Member (co-opt)</b>
8.	Dr. Ashish V. Mane	<b>Member (co-opt)</b>
9.	Mr. Kaliprasad Ningurkar	<b>Alumni</b>
10.	Dr. Prakash Mundhe	<b>Industry Expert</b>

**Prologue/ Introduction of the programme:**

M.Sc. in Environmental Science happens to be a 4-semester course spread across 2 years and is mostly full time. Candidates enrolled in the course have the option of specializing in many different areas such as Ecology, Engineering, Chemistry and, Biology Conservation. After completing this course, the postgraduates usually engage in research with respect to the protection of natural resources and the discovery of new resources, management and control of waste (domestic and industrial) and even opt for environmental conservationist or engineer, etc. This a newly emerging domain in the science field especially in the wake of greater awareness about environmental issues in today's technologically driven world. To understand the unique adjustments and modifications in the environment and its effect on organism's especially agricultural species, this dimension of scientific study has gained momentum of late. This field has

become a prominent part of biology and biomedical research.

The course plans to address the developing requirement for skilled experts in the public eye for applying best administration rehearses attracted from different orders to make inventive answers for a maintainable future. M.Sc. Environmental Science program plans to create prepared experts who are furnished to manage the logical, lawful, financial, mechanical, and approach- based concerns identified with the condition and asset the board. M.Sc. Environmental Science program additionally expects to build up an all-encompassing way to deal with natural and asset- based issues in understudies from various scholarly, social, and expert foundations. The educational program has been structured basically on the idea of reasonable improvement in a between disciplinary system, with an accentuation on research and application.

**Programme outcomes (Pos) (M.Sc. Environmental Science):**

PO.1. Ability of Problem Analysis: Student will be able to analyze the problems of physical as well as cultural environments of both rural and urban areas. Moreover, they will try to find out the possible measures to solve those problems.

PO.2. Conduct Social Survey Project: They will be eligible for conducting social survey project, which is necessity for the assessment of development status of a particular group or section of the society.

PO.3. Individual and teamwork: Works effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.

PO.4. Application of modern instruments: Students will be able to apply various modern instruments for data collection and field survey.

PO.5. Application of GIS and modern Geographical Map Making Techniques: Students will learn how to prepare map based on GIS by using the modern geographical map-making techniques.

PO.6. Critical Thinking: Students will able to understand and solve the critical problems of physical and cultural environment.

PO.7. Development of Observation Power: As a student of Geography, they will be capable to develop their observation power through field experience and in future, they will be able to identify



the socio-environmental problems of a locality.

PO.8. Development of Communication Skill and Interaction Power: After the completion of the course, they will be efficient in their communication skill as well as power of social interaction.

PO.9. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO.10. Enhancement of the ability of Management: Demonstrate knowledge and understanding of the management principles and apply these to their own work, as a member and leader in a team, to manage projects. They will perform effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO.11. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions and accept responsibility for them.

PO.12. Understand Environmental Ethics and Sustainability: Understand the impact of the acquired knowledge in societal and environmental contexts and demonstrate the knowledge of need for sustainable development.

PO.13. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context social, environmental and technological changes.

PO.14. Presentation Skill: Students are being able to understand and write effective reports and design credentials, make effective demonstrations, give and receive clear instructions.

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Title of the Course: Environmental Biology & Biodiversity								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-01	MS-EN111T	03	00	03	45	30	70	100

Course outcomes (Cos):

- To understand the basics of biological environment
- To understand various Ecological concept like energy fixation and transportation
- Plant and animal behavior in ecosystem
- To understand the population and community dynamics in ecosystem
- To acquire the knowledge related with carrying capacity of ecosystem
- To know the functioning of microbial ecosystem

Unit. No.	Name of the Unit	Course contents	Number of lectures
1	Environmental Biology: Concepts and Scope:	Concept of Ecosystem; Biosphere as an ecosystem; ecological processes and life support systems.	3
2	Fundamental Concepts of Ecology.	Ecology: Definition, development and scope. Ecology as an experimental science Ecosystems: concept, components and functioning. • Energy Fixation (photosynthesis and chemosynthesis) and energy flow through food chains (grazing and detrital) and webs (include Y shaped energy flow model). Ecological efficiencies and pyramids. Trophic levels Influence of environmental factors (including temperature, light, moisture, soil, nutrients) on organisms and their adaptations in response to them	6
3	Ecology of Populations And Communities	Population Ecology: Abundance and distribution of a species • Commonness, rarity and vulnerability of extinction of a species. Population Dynamics: Patterns of survival, age distribution, dispersal and rates of change. Attributes of K- selected and r-selected species, Population Growth Community Ecology:	10

		<p>Competition, Exploitation (including herbivore, predation, parasitism),</p> <p>Mutualism (including commensalism, cooperation, symbiosis), Food webs and concepts of niche and keystone species.</p> <p>Nutrient cycling, Biogeochemical cycles (Carbon, Nitrogen, Phosphorus),</p> <p>Limiting factors and their tolerance Succession, development,</p> <p>Climax and stability of ecosystems</p> <p>Cake and other ecological models, model of successions</p>	
4.	Plant And Animal Behavior	<p>Ethology and socio-biology: General definition and concept</p> <p>Types of behavior</p> <ul style="list-style-type: none"> <li>• Feeding Behavior: Herbivores, Carnivores, Parasites, Saprophytes,</li> <li>• Response of prey / plants (deterrence, defence, reward).</li> </ul> <p>Animal Architecture and use of tools</p> <ul style="list-style-type: none"> <li>• Circadian and other rhythms.</li> <li>• Migration, orientation, navigation, and homing</li> <li>• Communication (including visual, olfactory, tactile, auditory, chemical)</li> <li>• Aggression, Territoriality, Altruism.</li> </ul> <p>Reproductive Behaviour: Courtship, Mating, Parental care, breeding systems.</p> <p>Instinct and Learning: Genotype and phenotype behavior.</p>	10
5.	Terrestrial and aquatic Biomes	<p>Climatic and edaphic factors of terrestrial biomes. Heinrich Walter's Biome Climate Diagrams Classification of land biomes –</p> <p>soil, climate and vegetation characteristics.</p> <p>Natural history, wildlife, geography and human influences.</p> <p>Mountain Biome: Replication of latitudinal changes in the altitudes of high mountains.</p> <p>Terrestrial biomes, ecosystem diversity, forest and vegetation types in India.</p> <p>Freshwater Biomes (Rivers, streams, lakes, ponds)</p>	8

		Marine Biomes (including mangroves, coral islands, kelp forests, saltwater marshes, seashores, estuaries) and their natural history Wetlands – definitions, types, ecological functions and resources	
6.	Concept of Carrying Capacity	Biotic and abiotic components of environment, concept of sustainability and carrying capacity, tragedy of commons, human population and food, water and energy security.	7

Reference Books:

1. Environmental Science - Arms Karen
2. Principles of Environmental Science-Watt, K. E. F. (1973) McGraw-Hill Book Company.
3. Environmental Science –Noble, B .J. Kormandy, E.J. (1981). The way world works, Prentice-Hall Inc., N .J.
4. Environmental Science-Turk A. , Turk J. Wittes J.T. and Wittes, R.E.
5. Environmental Issues: Measuring, Analyzing, Evaluating, Abel, Daniel C. McConnell, Robert L. Abel, Daniel C. Edi. 2 Prentice Hall Publication
6. Chaudhuri AB and Sarkar DD (2003) Megadiversity Conservation, Flora, Fauna and Medicinal Plants of India's Hotspots. Daya Publishing House, New Delhi.
7. Gary K Meffe and Ronald Carroll C (1994) Principles of Conservation Biology. Sinauer Associates Inc., Massachusetts.
8. Groombridge B (Ed.) (1992) Global Biodiversity Status of the Earths Living Resources. Chapman & Hall, London.
9. IUCN (1992) Global Biodiversity and Strategy.
10. Sharma PD (2000) Ecology and Environment. Rastogi Publications, Meerut, India.
11. Singh MP, Singh BS and Soma S. Dey (2004) Conservation of Biodiversity and Natural Resources. Daya Publishing House, New Delhi.
12. Virchow D (1998) Conservation and Genetic Resources, Springer-Verlag, Berlin.

Title of the Course: Environmental Chemistry								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-02	MS-EN112T	03	00	03	45	30	70	100

**Course outcomes (Cos):**

- To understand the basics of stoichiometry
- To understand the fluid properties
- Acquire the factors influencing waves and oscillation
- Application of optics in spectrophotometry crystallography
- To understand the application to atomic physics, lasers, and spectroscopy
- To understand the application to nuclear physics, and thermodynamics

Unit No.	Name of the Unit	Course contents	Number of lectures
1.	Stoichiometry	<ul style="list-style-type: none"> <li>• Gibb's energy,</li> <li>• Chemical Potential,</li> <li>• Chemical equilibria,</li> <li>• Acid- Base reactions, Solubility Product,</li> <li>• Solubility of Gases in Water,</li> <li>• The carbonate system,</li> <li>• Unsaturated and Saturated Hydrocarbon,</li> <li>• Radionuclides,</li> </ul>	8
2.	Physical Chemistry	<ul style="list-style-type: none"> <li>• Chemical bonding,</li> <li>• Chemical reactions and equations,</li> <li>• Organic functional groups,</li> <li>• Classes of organic compounds.</li> <li>• Free radical reactions, Catalytic processes.</li> <li>• Elemental cycles (C, H, N, S, O, P) and their environmental significance.</li> <li>• Reversible and Irreversible reactions of Water,</li> <li>• Cations and Anions in Water and their Sources,</li> <li>• Mass Balancing,</li> </ul>	10

3.	Soil chemistry	<ul style="list-style-type: none"> <li>• Definition of soil, life on soil, composition of soil, mineral matter in soil, organic matter in soil, soil respiration, process of soil formation, factors affecting soil, soil profile, soil microorganisms, types of soils, micro and macro plant nutrients, nutrient functions</li> </ul>	07
4	Chemistry of biologically important molecules.:	<ul style="list-style-type: none"> <li>• Hydrocarbons :-Chemistry of hydrocarbon decay, environmental effects, effects on macro and micro organisms</li> <li>• Surfactants:Cationic, anionic and nonionic detergents, modified detergents Pesticides:</li> <li>• Classification, degradation, analysis, pollution due to pesticides and DDT problems Synthetic Polymers:</li> <li>• Microbial decomposition, polymer decay, ecological considerations, Photosensitive additives</li> </ul>	10
5	Destruction of some hazardous substances	<ul style="list-style-type: none"> <li>• Definition, characterization, UN classification, Identification, Chemistry of Various Organic and Inorganic Compounds. Carcinogenic compounds and their effects , Acid halides and anhydrides, alkali metals, cyanides and cyanogens bromides, chromium, aflotoxins, halogenated compounds</li> <li>• Lead and its compounds: Physical and chemical properties, behavior, human exposure, absorption, influence</li> </ul>	10

### Reference books

1. Environmental Chemistry- A.K.Dey New Age International publishers
2. Destruction of hazardous chemicald- G.Lunn, E.B.Sandome
3. Hazardous substances in chemical lab-G.D.MuMivir
4. Essentials of Nuclear Chemistry, H. J Arnikar, Wiley Eastern Limited, 4th Edition.(1995)
5. Destruction of hazardous chemicals- G.Lunn, E.B.Sandome
6. Hazardous substances in chemical lab-G.D.MuMivir

Title of the Course: Environmental Geoscience								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
<b>DSC-03</b>	MS-EN113T	02	00	02	30	15	35	<b>50</b>

Course outcomes (Cos):

- To understand the basics of earth origin and related theories
- Information related with surface processes and landforms
- Genesis, physical, chemical and biological changes in soil wrt environmental parameters

Unit. No.	Name of the Unit	Course contents	Number of lectures
1	Earth: Origin, Structure, Dynamics & Composition	<ul style="list-style-type: none"> <li>• Origin: Origin of Earth &amp; its spheres (Lithosphere, Biosphere, Hydrosphere, Atmosphere)</li> <li>• Structure: Internal Structure of Earth - Core, Mantle and Crust;</li> <li>• Thermal, Magnetic &amp; Gravitation Fields of the Earth</li> <li>• Dynamics: Concepts of Plate Tectonics &amp; Sea Floor Spreading, Mountain building (folding and faulting), Earthquakes, Volcanism</li> <li>• Composition: Igneous, Sedimentary &amp; Metamorphic Rocks; Processes and formation; Characteristics of major Rocks and Minerals.</li> </ul>	08
2	Surface processes & landforms	<ul style="list-style-type: none"> <li>• Processes and agents of weathering, erosion, transportation and deposition; Cycles of erosion- Davis and Penck Models</li> <li>• Mass-wasting;</li> <li>• Erosional and depositional landforms: Glacial, Aeolian, Fluvial, Coastal, shallow marine and deep marine.</li> <li>• Concept of Engineering &amp; Urban Geology</li> </ul>	8
3	Soil	<ul style="list-style-type: none"> <li>• Genesis of Soil; Soil Profile; Soil texture, structure; Bio-, Physico-, Chemical properties of soil; Soil Classification; Soil types w.r.t. genesis;</li> </ul>	8

		<ul style="list-style-type: none"> <li>• Fertility; Lateritization; Land use and Land capability classification;</li> <li>• Water-logging, salinization, desertification and degradation of soil.</li> </ul>	
4	Earth Resources:	<ul style="list-style-type: none"> <li>• Occurrence, exploitation and environmental impacts Coal, Hydrocarbons and mineral resources.</li> </ul>	6

### Reference Books

1. The Earth System (3rd Edition) 3rd Edition- Lee R. Kump, James F. Kasting, Robert G. Crane
  2. Holmes' Principles of Physical Geology 4th ed. 1993 Edition Arthur Holmes (Ed) P. Mc L. D. Duff
  3. Introduction to Physical Geology 1998. G.R. Thompson, & J. Turk
  4. Planet Earth: Cosmology, Geology, and the Evolution of Life and Environment- Cesare Emiliani
  5. Environmental Geology – K.S. Valdiya
  6. Plate Tectonics & Crustal Evolution- Kent. C. Condie, 1997
  7. Tectonic Geomorphology – D. Burbank & R. S. Anderson, 2012
  8. Mineralogy: Berry Mason, Dietrich
  9. Rock Forming Minerals: Deer, Howie, Zussman
  10. A.D. Howard and I Remson : Geology in Environmental Planning
  11. Sorio: Geology for Engineers.
  12. Rise and Wateson: Elements of Engineering Geology.
  13. Todd, D.K.: Groundwater Hydrology.
  14. Davis S.N. and Dewiest R.J.M.: Hydrogeology.
  15. Economic Geology: Economic Mineral Deposits 2<sup>nd</sup> ed.
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Title of the Course: Practical Based on EN-111								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
<b>DSC-04</b>	MS-EN114P	00	02	02	30	15	35	<b>50</b>

**Course outcomes (Cos):**

- To understand the importance of quadrat methods in field ecology studies
- To know the accumulation of biomass and photosynthesis relation
- To analysis the biomass and productivity of freshwater lake pond and river
- Student will well acquainted with basic microbial techniques
- Student will learn sample processing and analysis on various instruments

Unit	Title	No. of practical
1.Environmental Biology & Biodiversity	Vegetation studies by line and belt and quadrates methods	2
	To study wetland floral and faunal diversity	2
	Determine the carbon sequestration of indigenous plant in college campus	1
	Estimate the organic carbon of soil	1
	Determination of CO <sub>2</sub> and water transparency by Sacchi disc	1
	Determining the rate of photosynthesis and chlorophyll content in an aquatic plant	1
	Estimation of Phytoplankton ,zooplankton and Productivity of lake	1
	a)Preparation of media for microbial culture, b) Gram Staining. c) Isolation and culturing of microbes  from soil / water samples	4
	Bacterial growth curve enzyme analysis from soil samples	2

Title of the Course: Practical Based on EN-112								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
<b>DSC-05</b>	MS-EN115P	00	02	02	30	15	35	<b>50</b>

Course outcomes (Cos):

- To understand the principle and theory of conductivity meter
- To understand the principle and theory of potentiometer meter
- To understand the principle and theory of colorimeter meter
- To understand the principle and theory of spectrophotometer
- To understand the principle and theory of Paper Chromatography
- To understand the principle and theory of thin layer Chromatography

Sr.No	Title	No. of practical
	Determine of cell constant of the conductivity cell	<b>1</b>
	Determination of solubility and solubility product of the given sparingly soluble salt by conductivity meter	<b>1</b>
	Estimation of halides in water samples by Potentiometer	<b>1</b>
	Potentiometric titration of strong/weak and against weak/strong base	<b>1</b>
	Preparation of water samples and analysis of Sodium (Na) using Flame photometer	<b>1</b>
	Preparation of water samples and analysis of Potassium (K) using Flame photometer	<b>1</b>
	Verification of beer's law using CuSO <sub>4</sub> solution	<b>1</b>
	Determine the concentration of given KMnO <sub>4</sub> solution by verifying the Beer's law using colorimeter.	<b>1</b>
	Spectrophotometric determination of Nitrogen,	<b>1</b>
	Spectrophotometric determination of Phosphorus	<b>1</b>
	Spectrophotometric determination of Sulphate	<b>1</b>
	Preparation of samples and analysis using Paper Chromatography	<b>1</b>

Title of the Course: Practical Based on EN-113								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-06	MS-EN116P	00	02	02	30	15	35	50

**Course outcomes (Cos):**

- Physically examine and identification of rocks and mineral samples
- To know the soil Textural analysis technique.
- To develop the skill of climatic maps and diagram from provided data
- Study of textural soil analysis
- To understand and draw the climatic maps

Unit	Title	No. of practical
<b>Environmental Geosciences</b>	<b>Minerals</b> Quartz, Calcite, Aragonite, Orthoclase, Mica, Haematite, Kyanite, Hornblende, Chlorite, Baryte, Halite, Gypsum, Galena, Pyrite, Anhydrite, Apatite, Fluorite, Asbestos	<b>3</b>
	<b>Rocks</b> Igneous: Granite, Rhyolite, Basalt, Gabbro, Diorite, Dunite, Sedimentary: Conglomerate, Sandstone, Limestone, Shale, Laterite Metamorphic: Marble, Slate, Schist, Gneiss	<b>2</b>
	Textural analysis of soil & Ternary Plots	<b>2</b>
	Slope analysis, aspect maps and Drainage analysis	<b>3</b>
	Exercises based on adiabatic lapse rates	<b>2</b>
	Climatic maps and diagrams – circular, graph, wind roses	<b>3</b>

Title of the Course: Atmospheric Science								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
<b>DSE-01</b>	MS-EN117T	02	00	02	30	15	35	<b>50</b>

Course outcomes (Cos):

- To understand the basics composition and related theories
- Information related with surface process climate change
- Genesis, physical and chemical I changes in atmosphere wrt environmental parameters
- To understand the climatology and weather parameter, energy budget and atmospheric stability phenomenon
- Understand the monsoon behavior

Unit. No.	Course contents	Number of lectures
1	Atmosphere <ul style="list-style-type: none"> <li>• Evolution, Composition and Structure; Elements of weather and climate; Weather Parameters (temperature, wind pressure, relative humidity, rainfall);</li> <li>• Climatology of weather parameters; Long and Short term climatic effects Insolation; The energy system and its balance; Flux of solar system in the biosphere;</li> <li>• Earth's radiation budget; Net radiation and latitudinal heat balance; Green House Effect and Human influence on radiation balance. Atmospheric pressure, measurements &amp; Distribution;</li> </ul>	10
2	<ul style="list-style-type: none"> <li>• Pressure &amp; Wind Belts; local winds; Geostrophic &amp; gradient winds; Air masses, Classification and modifications of air masses. Fronts, Classification of fronts.</li> <li>• Atmospheric moisture- Condensation; Forms of precipitation; Cloud Classification;</li> <li>• Indian Monsoon; Inter-tropical Convergence Zone (ITCZ); Walker Circulation: El Nino- La Nina</li> </ul>	10

3	<ul style="list-style-type: none"> <li>• Atmospheric Stability &amp; Instability; Dry and moist adiabatic lapse rate; Environmental lapse rate, plume behaviour</li> <li>• Environmental Meteorology - Atmospheric chemical transport models; emission inventory- aerosol and gas pollutants;</li> <li>• National Air Quality Standards and Indices; Dry and wet deposition fluxes of gas and aerosol pollutants;</li> <li>• Intercontinental and hemispheric transport of air pollutants</li> </ul>	10
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**Suggested readings :**

1. Atmospheric Sciences: An introductory Survey by J.M. Wallace and P.V. Hobbs, Academic Press.
2. Atmosphere, Weather and Climate by R.J. Barry and R.G. Chorley (Methuen Publication)
3. General Climatology by Critchfield
4. An Introduction to Meteorology by S. Pettersen
5. The Monsoons by P.K. Das ( National Book Trust, India)
6. General Climatology by H.J. Critchfield
7. An introduction to climate by G.T. Trewartha
8. Physical Climatology by W.D. Sellers
9. World Survey of Climatology by H.E. Landsberg (Ed.)

Title of the Course: Practical Based on EN-117								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSE-2	MS-EN118P	00	02	02	30	15	35	50

Course outcomes (Cos):

- Information related with surface process climate change
- Genesis, physical and chemical changes in atmosphere wrt environmental parameters
- To understand the climatology and weather parameter, energy budget and atmospheric stability phenomenon
- Understand the monsoon behavior

Sr.No	Practical	No. of practical
1.	Wind Rose Diagram	1
2.	Climographs	1
3.	Circular Graphs: Climatograph	1
4.	Water Budget Diagram	1
5.	Modified Köppen - Geiger Climatic Classification	1
6.	Estimation of distribution of solar radiation/ insolation over Earth's surface	1
7.	<ul style="list-style-type: none"> <li>• Exercises based on incoming and outgoing solar radiations</li> <li>• Estimations of dry and wet deposition fluxes of gases and aerosol pollutants</li> </ul>	1
8.	<ul style="list-style-type: none"> <li>• Global average temperature estimations with &amp; without Greenhouse effect</li> </ul>	1
9.	<ul style="list-style-type: none"> <li>• Plume dispersion model (case studies) (optional)</li> </ul>	1
10.	<ul style="list-style-type: none"> <li>• Exercises based on adiabatic lapse rates</li> <li>• Climatic maps and diagrams – circular, graph, wind roses</li> </ul>	1

Title of the Course: Environmental Instrumentation								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
RM-01	MS-EN119T	04	00	02	60	30	70	100

Course outcomes (Cos):

- To understand the basics Basics principles of analytical instruments
- To understand Spectroscopy principle, structure and function
- To acquire the knowledge related chromatography
- To know the techniques of sample collection of air, water and soil .

Unit. No.	Name of the Unit	Course contents	Number of lectures
1	Basics principles of analytical instruments	spectroscope, diffraction, chromatography, electronic transition, fundamentals of optics and photometry, principles of microscopy	8
2	Spectroscopy	Introduction, basic principles, Electromagnetic radiations and interactions with matters: Define Spectroscopy, Types of spectroscopy, Absorption spectrum, Emission spectra, Wave length and Wave number, Electromagnetic radiation, Quantisation of energy, Electronic, vibrational and rotational spectroscopy. fluorescence and phosphorescence. Absorption of radiation, Beer-Lambert's law, deviation of Beer-Lambert's equation and its limitations. UV-Visible spectroscopy, Fluorescence spectroscopy, IR/Raman spectroscopy, Flame Photometry, Atomic Absorption Spectroscopy, NMR Spectroscopy and Mass spectroscopy	12
3	Principle of X-ray diffraction:	X- ray spectra, Bragg's law and intensity of X- rays, Mosley's law, XRD techniques	8
4.	Introduction to Chromatography	Classification – Theory – distribution coefficient, rate of travel, retention time, retention volume, adjusted retention volume, specific retention volume, column capacity, separation number, peak capacity, shapes of chromatic peak, column efficiency, resolution	12
5.	Gas Chromatography	Principle, carrier gas, stationery phase, instrumentation, sample injection, column detectors (TCD, FID, ECD), effect of temperature on retention, qualitative and quantitative analysis High Performance Liquid Chromatography: Principle, instrumentation, column, sample injection, detectors (absorbance, refractive index, electrochemical), mobile phase selection, ion pair chromatography.	12
6.	Environmental sampling	Introduction to sampling techniques and analytical methods to measure environmental contamination in air, water, soils, and food. Safe Laboratory Practices, Quality assurance and Quality control	8
			60

## References:

1. Skoog D. A. and Crouch S. R., Principles of Instrumental Analysis (7th Edition)
2. Ewing G. R., Instrumental Methods of Chemical Analysis (5th Ed.), McGraw Hill.
3. Rouessac F. , Rouessac A., Chemical Analysis: Modern Instrumentation Methods and Techniques,
4. Wiley Kemp W., Organic Spectroscopy, Palgrave Macmillan, 1991



**SEMESTER -II**

Title of the Course: Water and Soil pollution : Management and Mitigation								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-07	MS-EN121T	03	00	03	45	30	70	100

**Course outcomes (Cos):**

- To understand the basics of freshwater, marine water, groundwater and soil pollution
- Student will know about the sources and effects of water and soil pollution
- Understanding the control measures and techniques to mitigate the pollution
- Additional awareness creating by explain the case studies

Unit. No.	Name of the Unit	Course contents	Number of lectures
1	Freshwater Pollution	<ul style="list-style-type: none"> <li>• Types and sources, Inorganic and organic pollutants responsible for water pollution:</li> <li>• Biological pollutants; Pesticides; Radioactive pollutants, etc.</li> <li>• Effluent standards, Drinking water standards, Characteristics of Domestic waste, Characteristics of Agricultural waste.</li> <li>• Consequences of water pollution: Effects on health, on biosphere and on economy.</li> <li>• Remedial measures of Freshwater pollution.</li> <li>• Case studies based on freshwater remediation using traditional and modern technology</li> </ul>	15
2	Marine Water Pollution:	<ul style="list-style-type: none"> <li>• Sources, types;</li> <li>• Ballast water pollution pollution due to off shore drilling, deep mining and oil extraction and other sources;</li> <li>• Prevention methods, control measures using bioremediation (bio-surfactants, microcosms), physical (booms, skimmers, absorbents etc) and chemical methods (dispersants, detergents etc).</li> </ul>	15

		<ul style="list-style-type: none"> <li>• Case studies based analysis of marine water pollution and prevention• strategies.</li> </ul>	
3	Ground water Pollution	<ul style="list-style-type: none"> <li>• Sources, groundwater contamination zones,</li> <li>• groundwater remediation- in situ and ex situ techniques;</li> <li>• bioremediation strategies -bio-venting, biosparging, bio-slurping, permeable reactive barriers;</li> <li>• groundwater monitoring using Piezometer, slug and pumping tests;</li> <li>• Darcy's Law for estimation of hydraulic parameters,</li> <li>• Simulation for aquifer yield prediction, Artificial recharge and induced infiltration, Land subsidence; Coastal aquifers &amp; Sea water intrusion</li> <li>Environmental regulatory bodies preventing groundwater pollution;</li> <li>• Case studies based insight in to groundwater remediation techniques</li> </ul>	15
4.	Soil Pollution and Control	<ul style="list-style-type: none"> <li>• Types, Effects and sources and consequences.</li> <li>• Mechanism of interaction of waste with soil.</li> <li>• Transport processes — biological process-microbial transformation of heavy metals.</li> <li>• Specifications for disposal of sewage and effluent on land for irrigation and ground water recharge.</li> <li>• Methodology of wastewater disposal on land.</li> <li>• Impacts on land of solid waste disposal MSW and industrial solid</li> <li>• wastes (fly ash from thermal power station, lime sludge from</li> <li>• pulp and paper mills).</li> <li>• Disposal of hazardous solid waste (heavy metals, toxic organic compounds) on land its impact.</li> <li>• Deterioration of soil due to mining activities</li> <li>• Case study of restoration of land due to a disposal of fly ash and iron ore extraction</li> </ul>	15

## Reference Books:

- 1 Groundwater In the Environment: An Introduction, Paul L Younger 2014, ISBN: 978-265-4636-7
2. Groundwater Hydrology, Bhagu R Chahar, McGraw Hill Education
3. Environmental Chemistry, B. K. Sharma
4. Environmental Chemistry and Pollution Control, S. S. Dara
5. Environmental Pollution, N. Manivasakam 6. Environmental Chemistry, Samir K. Banerjee

Year: I		Semester: II						
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
<b>DSC-08</b>	MS-EN122T	03	00	03	45	30	70	<b>100</b>

**Course outcomes (Cos):**

- To know the sources and effects of air pollution
- Impact of metrological parameters on dispersion of pollutants in atmosphere
- Chemical alteration in pollutant in various zones of atmosphere
- To study the various control measurement techniques available in atmosphere
- How to frame the EMP for air pollution monitoring and control
- Information about Noise Management & Mitigation

Unit. No.	Name of the Unit	Course contents	Number of lectures
1	Air Pollution: Causes and Effects	<ul style="list-style-type: none"> <li>• Definition, Composition of air, Classification, Sources,</li> <li>• Effect of gaseous and particulate pollutants on animals, plant and human health,</li> <li>• Economic effects of air pollutants, Vehicular Pollution , Industrial Pollution</li> </ul>	06
2	Air Pollution Meteorology & Chemistry	<ul style="list-style-type: none"> <li>• Wind,</li> <li>• Temperature,</li> <li>• Atmospheric stability,</li> <li>• Dispersion</li> <li>• Chemical Properties in Troposphere</li> <li>• Stratospheric Ozone Chemistry: Ozone formation &amp; destruction, Polar Stratospheric Clouds (PSPs).</li> </ul>	08
3	Air Quality Analysis	<b>Air monitoring instruments and techniques: sampling, storage and shipment of-</b> <ul style="list-style-type: none"> <li>• SOX, NOX, O3, C6H6,</li> <li>• Pb, CO,</li> <li>• Particulate Matters samples</li> </ul>	06
4	Air Pollution Control Technology :	<b>Basic Operating Principle, working and application of –</b> <ul style="list-style-type: none"> <li>• Cyclones,</li> <li>• Scrubbers</li> <li>• (Wet and Dry)</li> <li>• Settling chambers</li> </ul>	08

		<ul style="list-style-type: none"> <li>• Electrostatic precipitators.</li> <li>• Fabric filters</li> <li>• Control of gaseous pollutants –</li> <li>• Absorption, adsorption, condensation,</li> <li>• Vapor incineration.</li> </ul>	
5	Air Quality Management : Policy and Institutional Framework	<ul style="list-style-type: none"> <li>• Ambient Air Protection Policy,</li> <li>• Air Quality Norms, Regulation of Emissions from Stationary &amp; Non-Stationary Sources.</li> <li>• Public Informing and Participation in Decision Making Process, Planning and Implementation of Ambient Air Protection Measures.</li> </ul> <p><b>Strategies for Air Pollution Control –</b></p> <ul style="list-style-type: none"> <li>• Control of air pollution by fuel selection and utilization,</li> <li>• by process modification or equipment,</li> <li>• by site selection and zoning.</li> </ul>	08
6	Noise Pollution & Control	<p>Introduction to noise and vibrations, physics of sound and hearing, Noise Pollution- Sources and effects.</p> <p><b>Noise control at source:</b></p> <ul style="list-style-type: none"> <li>• Source path receiver concept,</li> <li>• control by design,</li> <li>• control by redress</li> </ul> <p><b>Noise control in the transmission path:</b> Acoustical separation, physical barriers, Isolators and Silencers Protecting the receiver: personal protection device</p>	06
7	Noise Monitoring and Impact Criteria	<ul style="list-style-type: none"> <li>• Noise measuring techniques,</li> <li>• national standard for noise, noise monitoring methods,</li> <li>• A-weighted Sound Level: The Basic Noise Unit; Maximum Sound Level (Lmax) During a Single Noise Event;</li> <li>• Sound Exposure Level (SEL):Exposure from a Single Noise Event Hourly Equivalent Sound Level(L<sub>eq</sub> (h));</li> <li>• Day-Night Sound Level (L<sub>dn</sub>): 24- Hour Exposure from All Events;</li> <li>• A Noise-Exposure Analogy for L<sub>eq</sub> and L<sub>dn</sub> Investigation and assessment of impact of noise,</li> <li>• Considerations in Applying the Noise Impact Criteria; Mitigation Policy Consideration;</li> <li>• Determining the Need for Noise Mitigation.</li> </ul>	08

8	Radiation Pollution	<p><b>Radioactivity</b> – Types and measurement.  <b>Classification of radio-active wastes</b> – gas, solid, liquid.  <b>Detection of nuclear radiations</b> –</p> <ul style="list-style-type: none"> <li>• G. M. counter,</li> <li>• scintillation counter,</li> <li>• semi-conductor detector.</li> </ul> <p><b>Radiation hazards and safety</b> – natural and manmade.  <b>Types of radiations-</b> Internal and external radiation hazards, safe handling methods, personal dosimeter, reactor safety.  <b>Units of measurement-</b></p> <ul style="list-style-type: none"> <li>• half-life period,</li> <li>• radiation dose measurement.</li> </ul> <p><b>Biological effects and health hazards:</b> Interaction of radiations with biological cells, somatic and genetic effects.  <b>Control measures</b> – treatment and disposal of radio-active waste, generation of waste from various sources. ICRP recommendations. AERB classification, maximum permissible dose.</p>	10
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## References:

- Reference Books 1. Fundamentals of Air Pollution – Daniel A. Vallero
2. Air Pollution: Health and Environmental Impacts – L.T Molina & B.R Gurjar
3. Advanced Air and Noise pollution Control – L.K Wang & N.C Pereira
4. Textbook of Noise Pollution & Its Control – S.C. Bhatia
5. Environmental Chemistry - A.K. De 6. Environmental Chemistry – B.K. Sharma

Title of the Course: Environmental Law, Ethics and Policy								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-09	MS-EN123T	02	00	02	30	15	35	50

#### Course outcomes (Cos):

- Candidates should be able to demonstrate knowledge and understanding of the issue
- Constitutional and secular approaches conservation approach
- Importance of legal aspect in air water soil and forest conservation and protection programme
- To understand Various amendments and its importance in present scenario  
Candidates should be able to discuss these areas critically.
- Various environmental agreements ,convention and its implementation programme at national and international level

Unit. No.	Name of the Unit	Course contents	Number of lectures
1	Fundamental Rights and ethics	<ul style="list-style-type: none"> <li>• Environmental Policies in the Indian Constitution</li> <li>• Role of constitution in environment protection,</li> <li>• Fundamental rights and duties, Article 48A, 51A (g)and 58A.</li> <li>• National Environmental Policy, Ethical dilemma, Issues of Sustainable Development</li> </ul>	8
2	Environmental Laws in India	<ul style="list-style-type: none"> <li>• Water Act, 1974 ,Air Act, 1981 Indian Forest Act, 1927/198 EPA, 1986</li> <li>• The Wildlife Act, 197 The Biological Diversity Act, 2002 ,National Forest Policy, 1988</li> </ul>	8
3	Rules and Regulations (As amended)	<ul style="list-style-type: none"> <li>• Hazardous Waste Rules, Solid Waste Management Rule Biomedical Waste Rules</li> <li>• E- waste rules Construction and Demolition waste Rules Concept of Eco sensitive zones, Coastal Regulation Zone</li> </ul>	6

4	Convention ,agreements and policies	<ul style="list-style-type: none"> <li>• UNFCCC,</li> <li>• Paris climate accord or Paris climate agreement 2015</li> <li>• Kyoto Protocol</li> <li>• Convention on Biodiversity</li> <li>• International Solar Alliance</li> <li>• CITES Ramsar Convention</li> <li>• Basel Convention</li> <li>• MARPOL</li> <li>• Cartagena Protocol on Bio-safety</li> <li>• Agenda 21</li> </ul>	08
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#### Reference Books

1. T. S. Doabia. 2017. Environmental and Pollution Laws In India. 3rd Edition. Publisher: Lexis Nexis
2. P. Leelakrishnan. 2016. Environmental Law in India. 4th edition. Publisher: Lexis Nexis.
3. S. K. Mohanty. 2009. Environment and Pollution Laws. Publisher: Universal.
4. P. Leelakrishnan. 2006. Environmental Law Case Book. 2nd edition. Publisher: Lexis Nexis.
5. Divan Shyam and Rosencrantz Armin. 2002. Environmental Law and Policy in India: Cases, Material & Statutes. Publisher: Oxford.

Title of the Course: : Practical based on EN 121								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-10	MS-EN124P	00	02	02	30	15	35	50

**Course outcomes (Cos):**

- Analysis of dissolved solids and its interpretation
- To understand the DO,BOD and COD importance in water and waste water analysis
- To understand sulphate and nitrate importance in water and waste water analysis
- Learn the techniques of calibration of water analysis instruments .

Unit	Title	No. of practical
1.	Determination of pH & Electrical Conductivity water , industrial effluent and Soil	1
2.	Determination of Solids (TS, TDS,TSS).	1
3.	Determination of Turbidity Nephelometer	1
4.	Determination of Total Alkalinity and Total Hardness of water sample.	2
5.	Determination of Chlorides and Residual Chlorine of water sample	1
6.	Determination of DO and BOD of given water sample.	2
7.	Determination of COD in given water sample.	1
8.	Determination of Sulfates of given water sample.	2
9.	Determination of nitrate of given water sample.	1
10.	Determination of Nitrate and nitrites of a water sample	1
11.	Texture Analysis of given soil sample	1
12.	Determination of Bulk density and water holding capacity of soil.	1
13.	To estimate organic carbon of soil sample	1
14.	To estimate cation exchange capacity of soil. 6. To determine sodium adsorption ratio of soil.	1



Title of the Course: : Practical based on EN 122								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-11	MS-EN125P	00	02	02	30	15	35	50

**Course outcomes (Cos):**

- Candidates should be able to demonstrate knowledge and understanding of the issue
- The students will understand the air sample collection, preservation and transportation techniques
- Candidates will aware the air pollution index of the area
- Collection of data of noise from various sites
- Demonstration of instruments and visits to industrial sector and laboratory will enrich the student with knowledge

Unit	Title	No. of practical
1.	Determination SO <sub>x</sub> concentration in air.	1
2.	Determination NO <sub>x</sub> concentration in air	1
3.	Determination PM 2.5 and PM10 Concentration in air.	1
4.	Determination of heavy metals in collected air samples	2
5.	Estimation of Carbon dioxide from air sample.	1
6.	Measurement of sounds by DB meter / SLM in silent, industrial, residential and commercial zones.	2
7.	Determination of SPL, Lmax, TWA, Leq, Ldn, L10, L50, L90.	2
8.	Determination of Noise dose.	1
9.	Industrial visit for Stack monitoring and sampling of air .	1
10.	Visit to state/central / NABL approved laboratory	1
11.	Demonstration of Giger /Scintillation Counter	1

Title of the Course: Practical based on EN 123								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-12	MS-EN126P	00	02	02	30	15	35	50

**Course outcomes (Cos):**

- Legal report preparation of case studies
- Field studies encourages the awareness among students
- Functioning of NGT and its importance

Unit	Title	No. of practical
1.	Prepare the case study of pulp and paper mill under water act ,1974	1
2.	<b>Write legal report of hazard waste disposal site</b>	1
3.	Prepare the case study sugar under water act ,1974	1
4.	<b>Short Report on amendments made in Indian forest act ,1982</b>	1
5.	Explain the the legal penalties impose on violation of biodiversity act 2002	1
6.	Study a social and health issues near landfill site and prepare report	1
7.	Problems and legal norms for construction and demolition rules	1
8.	Write a short report on structure, function and importance of National Green Tribunal (NGT)	1
9.	Prepare report on ship wrecking yard – Case study Alang , Gujrat or any other	2
10.	Report on legal norms ,standards and penalties for tannery waste disposal	1
11.	Visit to MSW and BMW site	2
12.	Visit to Hazardous waste disposal site / industry	1

Title of the Course: Forestry and Habitat Management								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSE-03	MS-EN127T	02	00	02	30	15	35	50

#### Course outcomes (Cos):

- To know the importance of forest
- Acquire the knowledge of biotic and abiotic components
- Understanding the silviculture practices with traditional and advance practices
- Understanding the stages of tribal economy, education, cultural tradition, customs, ethos and participation in forestry programmes.
- To know the importance of forest Management Systems and Forest Protection

Unit. No.	Name of the Unit	Course contents	Number of lectures
1	Introduction	Definition of forestry and habitat management, Concepts, terms and terminologies, need, scope of the subject	2
2	Forest Ecology and Ethnobotany	Forest as a ecosystem, Biotic and abiotic components, productivity, nutrient cycling, stresses, Forest types in India and conservation initiatives. Role of Ethnobotany	6
3	Silviculture	Principles, ecological and physiological factors influencing vegetation, nursery system, Silvicultural systems – wood selection, felling, establishment and management of standards, technical methods and constraints, Silviculture practices in specialized ecosystems like Mangroves and Cold desert: Silviculture of trees -Traditional and advance methods, Silviculture of some of the economically important species in India	8
4	Agroforestry and Social Forestry	Scope and necessity; objectives, techniques, participatory approach, Research and Extension needs, stages of tribal economy, education, cultural tradition, customs, ethos and participation in forestry programmes. Joint Forest	4

		Management and Forest dwellers and their socio-economics.	
5	Forestry and Environmental Conservation	Soil and water Conservation through Forestry, Environment; components and principles of conservation, impact of deforestation; forest fires and various human activities like mining, construction and developmental projects, population growth on environment, pollution.	4
6	Forest Management Systems	Objective and principles; techniques; stand structure and dynamics, sustained yield relation; rotation of growing stock through management, Forest Working Plan, integrated approach, Forest Mensuration - Methods of measuring - diameter, girth, height and volume of trees; form-factor; volume estimation of stand, annual increment. Sampling methods and sample plots. Yield calculation; yield and stand tables. Forest cover monitoring through remote sensing, Geographic Information Systems, management and modelling. Surveying and Forest Engineering General principles, objects, types, methods	6

Title of the Course: Practical based on EN-127								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
<b>DSE-04</b>	MS-EN128P	00	02	02	30	15	35	<b>50</b>

Course outcomes (Cos):

- Enable students undertake practical work and apply appropriate Taxonomic and inventory skills
- Collect, analyze and present data on functions and relationships existing between organisms..
- To develop students' field work analysis and reporting skills.

Unit	Title	No. of practical
1	Identification of seeds and seedlings of multipurpose tree species	1
2	Estimation of organic matter from mono and poly culture vegetation area	1
3	Estimation of carbon sequestration of selected plants in forest	1
4	Identification and preparation of herbarium of medicinal plant	1
5	Identification and preparation of herbarium of indigenous and exotic plants	1
6	Estimate the forest land cover in provided satellite image with the help of stereoscope	1
7	Estimate the forest land cover in provided map by grid method	1
8	Visit and Prepare the migratory bird register of the wetland	1
10	Visit to agro-forestry fields to study the compatibility of mpts (multipurpose trees and shrubs) with agriculture crops	1
11	Visit to alley cropping agro-forestry model	1
12	Visit to agro-silvopastoral agroforestry model	1
13	Energy plantation, characteristics of tree spp. & advantages of energy plantation	1

Title of the Course: In-plant Industrial Training								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
<b>OJT-01</b>	MS-EN128P	00	04	04	60	30	70	<b>100</b>

Course outcomes (Cos):

- To understand the function and processing of administration
- Acquire the knowledge of instrumentation, process, methodology
- Student will prepare report
- Participate in EHS related activities in organization

Unit	Title	No. of Hours 60
1.	<p>SUMMER INTERNSHIPS / IN-PLANT TRAINING (2 CREDITS)</p> <ul style="list-style-type: none"> <li>• Students are expected to spend a minimum of 30 days during their semester break under the guidance of a competent professional / scientist at a research institute or research centre with the aim of learning techniques and their applications.</li> <li>• The assessments should be based on supervisor's feedback,</li> <li>• submission of a training report and a open presentation and Viva-voce.</li> </ul>	