

**DR. BABASABEB AMBEDKAR MARATHWADA
UNIVERSITY
AURANGABAD**

Syllabus

Of

**B.Sc. (Environmental Science)
I st, II nd and III rd Year**

In

Credit & Semester Pattern

Effective From

Academic Year

June 2009-2010 onwards

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.
B.SC. [ENVIRONMENTAL SCIENCE] IN SEMESTER PATTERN

Year	Semester	Course Code	Paper Number	Paper Title	Credits	Marks
I Year	I	EVS-111	Paper-I	Concepts of Environment	3	50
		EVS-112	Paper-II	Ecology	3	50
		EVS-113	Paper-III	Lab Course - I	1.5	50
		EVS-114	Paper-IV	Lab Course – II	1.5	50
	II	EVS-121	Paper-V	Environmental Chemistry	3	50
		EVS-122	Paper-VI	Population Ecology	3	50
		EVS-123	Paper-VII	Lab Course – III	1.5	50
		EVS-124	Paper-VIII	Lab Course – IV	1.5	50
II Year	III	EVS-231	Paper-IX	Water Management & Natural Resources	3	50
		EVS-232	Paper-X	Environmental Microbiology	3	50
		EVS-233	Paper-XI	Lab Course - V	1.5	50
		EVS-234	Paper-XII	Lab Course – VI	1.5	50
	IV	EVS-241	Paper-XIII	Air Pollution	3	50
		EVS-242	Paper-XIV	Solid Waste, Soil and Noise Pollution	3	50
		EVS-243	Paper-XV	Lab Course - VII	1.5	50
		EVS-244	Paper-XVI	Lab Course – VIII	1.5	50
III Year	V	EVS-351	Paper-XVII	Water Pollution	3	50
		EVS-352	Paper-XVIII A OR Paper-XVIII B	Environmental Geology and Meteorology OR Treatment Technology	3	50
		EVS-353	Paper-XIX	Lab Course – IX	1.5	50
		EVS-354	Paper-XX	Lab Course –X	1.5	50
	VI	EVS-361	Paper-XXI	Environmental Issues	3	50
		EVS-362	Paper-XXII A OR Paper-XXII B	Toxicology OR Industrial Safety and Hazardous Waste	3	50
		EVS-363	Paper-XXIII	Lab Course – XI	1.5	50
		EVS-364	Paper-XXIV	Lab Course –XII	1.5	50

Note: For theory paper 1 credit = 15 periods and for practical paper 1 credit = 30 periods.

B. Sc. I year, Semester I

EVS – 111 (Paper – I): Concepts of Environment

UNIT – I **(10)**

- i) **Introduction:** Definition of environment; Environmental Science – definition, scope & importance.
- ii) **Evolution:** Evolution of the universe; evolution of the elements; origin of the earth; solar system; evolution of life; atmosphere of the primitive earth.

ABIOTIC COMPONENTS OF ENVIRONMENT

UNIT – II : Atmosphere: **(08)**

Definition; structure and composition of atmosphere; evolution of atmosphere; composition of air; atmospheric temperature; atmospheric pressure; earth's radiation balance.

UNIT – III : Lithosphere **(09)**

Definition; structure of lithosphere; soil formation (pedogenesis) – physical, chemical and biological weathering; soil composition; soil profile; physico-chemical properties of soil; soil erosion.

UNIT IV : Hydrosphere **(08)**

Definition; structure of water molecule; properties of water (physical and chemical); distribution of water on earth; global water balance (GWB); gases in water; hydrological cycle.

UNIT – V : Biosphere **(07)**

Definition; components of biosphere; soil as habitat for living organisms; water as habitat for living organisms.

UNIT – VI Environmental balance: **(03)**

Balance in O₂ and CO₂ in air; thermal balance ; balance in predator and prey population.

Reference Books:

1. Environmental Science – Enger, Smith and Smith W.M.C. Brown company publication
2. Environmental Science - Taylar and Miller
3. Environmental Biology – Vishwaswarup Mukahrjii
4. Environmental Science – Botkin and Kelter, John Wiley and Sons, New York.
5. Environmental Science – S.C. Santra
6. Principles of Environmental Biology – Nayer
7. Fundamental of Ecolgoy – Odum E.P.
8. Environmental Science - Neble

EVS-112 (Paper-II): Ecology

UNIT-I Introduction : (09)

Ecology- Definition; branches; scope; and its relation to other divisions of sciences; aut ecology and syn ecology.

Ecosystem- Concept and structure of ecosystem; functions of ecosystem; biotic components of ecosystem(producer, consumer and decomposer); abiotic components of ecosystem.

UNIT –II (09)

Food chain; food web; trophic structure; ecological pyramid; energy in ecosystem; energy flow in ecosystem; laws of thermodynamics; entropy; concept of productivity; role of species in ecosystem.

UNIT – III Types of Ecosystems: (08)

Terrestrial ecosystem – dessert ecosystem; grassland ecosystem; forest ecosystem (evergreen and deciduous); mountain ecosystem and marsh land .

UNIT – IV Aquatic ecosystem: (08)

Freshwater ecosystem; lentic ecosystem – ponds and lakes; lotic ecosystem – rivers and streams; marine ecosystem; brackish water ecosystem; estuarine ecosystem.

UNIT – V (03)

Concept of habitat; ecological niche; guild.

UNIT – VI Adaptation (08)

Significance of ecological adaptation; ecological adaptation in plants and animals- Zeric adaptations in plants and animals; adaptations of plants and animals to aquatic habitat; arboreal adaptations in plants and animals.

Reference books:

1. Principles of Ecology – P.S., Verma and V.K. Agarwal
2. Fundamentals of Ecology – Odum E.P.
3. Principles of Environmental Science – Wart K.E.F. (1973) Mc Graw Hill Book Company.
4. Ecology and Environment – P.D. Sharma
5. Elements of Ecology – P.D. Sharma
6. Ecology – M.P. Arora
7. Basic Ecology – E.P. Odum
8. Concept of Ecology – E.J. Koromondy, 1996, concept of modern biology series, prentice Hall.
9. Modern Concepts of Ecology – H.D. Kumar
10. Principles of Environmental Biology – P.K.G. Nair, Himalaya pub. House, Delhi

EVS – 113 (Paper – III): Lab Course – I

1. To study the laboratory safety rules.
2. To study the cleaning methods of glass wears.
3. To study the First-Aid and emergency treatment in laboratory.
4. To study the laboratory equipments and instruments.
5. To study the preparation methods of reagents.
6. Collection and preservation of phytoplankton and zooplankton samples from different water bodies (river, pond, lake etc.)
7. To study the phytoplankton's (any 6 specimens).
8. To study the zooplankton's (any 6 specimens).
9. Collection of aquatic, xerophytes and mesophytic plants/animals specimens.
10. Study of xeric adaptation in plants, morphometrically and histologically.
11. study of xeric adaptations in animal (at least 5 specimens morphometrically)
12. To study the aquatic adaptations in plants morphometrically and histologically (at least 5 specimens)
13. Study of mesophytic specimens (at least 5 specimens).

EVS – 114 (Paper - IV): Lab Course – II

Field Visits:

1. To study the terrestrial ecosystems and collection of samples/specimens. (Student should submit field visit report and collection).
2. To study the aquatic ecosystems and collection of samples/specimens (student should submit collected samples/specimens)
3. To study the man modified ecosystem/agricultural ecosystem.
4. Tutorials.

B.Sc. I year, Semester II

EVS – 121 (Paper – V): Environmental Chemistry

UNIT – I Introduction:

(09)

Concept and scope of environmental chemistry;
Definition and description of various terms :- contaminant, pollutant, receptor, sink, aerosols, particulates, pathways of pollutants, TLV, COD, BOD, chemical toxicology, hazardous chemicals, carcinogens, occupier, effluent , etc.;;
Earths radiation balance; Earths energy balance.

UNIT – II The natural cycles of the environment:

(09)

The carbon cycle; the oxygen cycle; the nitrogen cycle; the phosphorus cycle;& the sulphur cycle.

UNIT –III (08)
Ozone depletion – causes and effects; Global warming – major green house gases, causes and effects; Acid rain – causes and effects.

UNIT –IV (08)
Acid – base reactions in water; Acid – base and Ion-exchange reactions in soil; Chemical reactions in the atmosphere – reactions of sulphur di-oxide and nitrogen oxide etc.; Photochemical reactions in the atmosphere – oxygen and ozone chemistry.

UNIT-V (03)
Chemistry of decaying compounds - hydrocarbon decay

UNIT – VI Case Studies: (08)
London smog ; Bhopal disaster; Chernobyl disaster; climate change and green house effect.

Reference books:

1. Environmental Chemistry – A.K. Day
2. Environmental Chemistry – B.K. Sharma
3. Environmental Chemistry – Kanan Krishnan
4. Text book of Environmental Chemistry – B. N. Charkrawarti
5. A Text book of Environmental Chemistry – Dara S. S. S. Cahand, Publication.
6. Encyclopedia of Environmental pollution – R.K. Trivedi
7. Environmental Pollution and Health Hazard – R. Prakash and S. M. Choube.
8. Environmental Science – Botkin and Kelter, John Wiley and Sons, New York.
9. Environmental Chemcistry – M. Satake and Y. Meddow.
10. Environmental Pollution – Katyal and Satake, Anmol Publication, New Delhi.
11. Environmental Chemcistry – Colin & Baird

EVS – 122 (Paper – VI): Population Ecology

UNIT – I: Introduction: (10)
Definition of population and population ecology; Population characteristics – natality, mortality, density, migration, immigration, age distribution, age structure.

UNIT – II: Population Distribution: (04)
Population distribution patterns – uniform, random, clumped; Factor affecting distributions

UNIT – III: Population growth: (07)
Concept of population growth; population growth curves -sigmoid and J – shaped; population fluctuation; cyclic oscillations; concept of carrying capacity; population explosion;

UNIT – IV: Population regulation: (09)

Density dependant factor – food, space, over crowding etc.; Density independent factors – natural calamities like tsunami, floods, volcanic eruption, earthquakes, forest fire etc; Family planning.

UNIT – V :Community ecology: (07)

Definition and types of community; structure and classification; ecotone and edge effect;

UNIT – VI: Ecological Succession: (08)

Definition; types of succession; process of succession; concept of climax; examples of succession; community evolution.

Reference books:

1. Principles of Ecology – Verma and Agarwal
2. Fundamentals of Ecology – E. P. Odum
3. Basic Ecology – E.P. Odum
4. Environmental Ecology – K. C. Agarwal
5. Science of Ecology – Ehrlic/Roughgarden
6. Population Ecology – C. J. Creb
7. Ecology – Subramanyam
8. ecology principle and application – J. L. Chapman and M. J. Reiss
9. Environment and Ecology – Gourkrishna Dasmohapatra
10. Ecology – Ricklefs Miller.

EVS – 123 (Paper – VII): Lab Course – III

1. Collection and preservation of different types of soil samples.
2. To study the physical characteristics of soil such as colour, texture, temperature etc.
3. To study the soil profile.
4. To study the water holding capacity of soil.
5. To study the pH of soil sample.
6. To study the organic matter present in soil by ignition method.
7. To study the NPK of Soil Samples by using soil testing kit.
8. Determination of atmospheric carbon dioxide by using Zircondroffs method.
9. To study species area curve of plant species from terrestrial ecosystem/ college campus .
10. To study the relative density of plant/animals species by quadrat method.
11. To study the relative frequency of plant/animal species by quadrat method.
12. To study the relative abundance of plant/ animal species by quadrat method
13. To study the importance value index (IVI) of any tree plant species.

EVS – 124 (Paper – VIII): Lab Course – IV

1. Industrial visit – To study the process of manufacturing products/waste generation/ treatment process etc; (student should submit their industrial visit report).
2. Ecological data collection.
3. Seminar presentation and submission.
4. Compulsory study tour.

B.Sc. II year, Semester III

EVS 231(Paper – IX): Water Management and Natural Resources

Unit I: Water resources:

Surface water sources – lakes, streams, rivers

Underground water sources – Infiltration galleries, Infiltration wells

Types of lake, (Oligotrophic, Mesotrophic and Eutrophic)

Self purification of rivers.

Unit II: Water quality and uses of water:

Physical, Chemical and Bacteriological characteristics

Standards of drinking water

Uses: Domestic, Industrial, Agricultural, Recreational

Unit III: Pattern of drinking water supply system.

Rain water harvesting.

Watershed management.

Unit IV: Forest and Wild Life Resources:

Importance of Forest & Wildlife,

Deforestation, Afforestation,

National Parks and sanctuaries (Maldhok, Tadoba, Melghat),

Agricultural resources.

Unit V: Energy Resource:

Electric energy, Fossil fuel energy, Geothermal energy, Tidal energy,

Wind energy, Solar energy, Biodiesel / Biomass energy, Mineral resources,

Use of natural resources and their exploitation.

Reference Books

- 1) Environmental science – S.C. Santra , New central book agency
- 2) A. Text Book of Environmental studies- D.K. Asthana and Meera Asthava.
- 3) Ecology and Environment- P.D. Sharma, Rastogi Pub.
- 4) Fundamentals of Ecology – E.P. Odum.
- 5) Environmental Science - Kunnighan and Saigo, W.C.B. Pub.
- 6) A Text book Environmental Studies – G.R. Chatwal and Harish Sharma, Himalaya Pub.
- 7) Fundamental Concepts in Environmental Studies. – Mishra, S. Chand Pub.
- 8) Environmental Studies – Erich Bharucha, UGC Pub.

EVS 232 (Paper – X): Environmental Microbiology

Unit I: Introduction:-Definition, branches of Microbiology, (Medical, Industrial, Mycology, Environmental microbiology), History of microbiology, Kingdom of Protista, Concepts and classification of prokaryotes and eukaryotes. (Bacteria and Cyanobacteria) and (Algae, fungi and protozoans)

Unit II: Bacteria: Morphology, general characters, Classification of bacteria based on temperature, pH, oxygen requirement, carbon and energy source, growth of bacteria.

Unit III: Viruses: Morphology, General character of viruses, Distribution (Animal, Plant, Bacteriophage viruses),
I) Pure culture: Concept, Preparation and Preservation,
II) Control of microorganisms: - Sterilization and disinfection
Physical agents, (Heat, Radiation, filters)
Chemical agents (Acid, Ethylene oxide, Alcohol and Heavy Metals).

Unit IV: Diseases Caused by Micro-organisms with their casual organism, Symptoms, prevention and control measures,
I) Bacterial – Cholera, Typhoid, Shigellosis,
II) Viral – Influenza, Hepatitis, HIV,
III) Fungal- Aspergosis, dermatitis
IV) Protozons- Malaria, Amoebiasis.

Unit V: Definition and concept of vaccination, Antigen and Antibodies as a preventive measures against microbial disease.

Unit VI: - Industrial microbiology: - Fermented products: Beverages and Alcohol production, Dairy products – Chees, Curd, Pharmaceutical Products – Antibiotics& Vitamins, Preservatives (Class I & Class II)

Reference Books:-

- 1) Environmental Microbiology – Vijaya Ramesh, M .J. P. Pub.
- 2) Role of Microbes in the Management of Environmental Pollution – edited by R. Tiwari.
- 3) Practical Microbiology- R.C. Dubey, D.K. Maheshwari, S. Chand Pub.
- 4) Elements of Bio-technology – B.D. Singh.

EVS 233 (Paper –XI): Lab Course V

- 1) Study of instruments used in water analysis:
pH meter, Conductivity meter, Turbidity meter
- 2) Study of penetration of light in water reservoir by Sacchi disk
- 3) Determination of pH and temperature of water sample
- 4) Determination of Alkalinity of water sample
- 5) Measurement of Rain fall
- 6) Determination of Residual chlorine from treated water
- 7) Determination of Acidity from water
- 8) Determination of Dissolved oxygen from water
- 9) Determination of hardness of water
- 10) Determination of Chlorides from water
- 11) Study of primary productivity of water reservoir
- 12) Study of endangered species (wild animals)

EVS 234 (Paper –XII): Lab Course VI

1. To study the principles and applications of instruments use microbiological study
– Incubator, Inoculation chamber, Microscope
2. To study the morphological characters of bacteria by simple staining method.
3. Study of bacteria by Grams staining method.
4. IMVIC Test (Faecal & non faecal test).
5. Qualitative analysis of water by MPN technique.
6. Identification of bacterial growth by streak plate, pour plate method.
7. Motility of bacteria by hanging drop technique.
8. Sterilization of culture media.
9. Preparation of pure cultures.
10. Membrane technique (Demonstration).
11. Negative Staining.
12. Standard plate count.

B.Sc. II year, Semester IV

EVS 241 (Paper – XIII): Air Pollution

Unit I: Introduction to air pollution

Episodes of air pollution disasters.

Unit II: Sources and classifications of air pollutants

Sources of air pollutants

Factors affecting air pollution,

Classification of air pollutants

Fugitive emissions.

Unit III: Effects of air pollution on:

Human health

Animals,

Vegetation,

Materials & property,

Unit IV: Pollution control methods -

Particulates pollution control methods

Unit V: Air sampling analysis

Air pollution legislation

Reference Books

- 1) M.N.Rao, Air Pollution –Tata Mc Graw Hill, Pub.- Comp. Wd, New Delhi
- 2) A.C. Stern (Air Pollution) – Academic Press
- 3) Air Pollution - V.P.Khudesia
- 4) Air Pollution – B.K. Sharma
- 5) APHA – Std. methods (20th edition) APHA Pub.
- 6) Encyclopedia of Env. Pollution – Chatwal & others, S. Chand and Comp., New Delhi.
- 7) Environmental Chemistry – A.K. Dewily Eastern LTD.
- 8) Air pollution control – NEERI , Nagpur
- 9) Pollution control in process industries – S.D. Mahajan

EVS 242 (Paper – XIV): Solid Waste, Soil and Noise Pollution

Unit I: Solid Waste: - Introduction

Classification of solid waste,

Types of solid waste (Domestic, Industrial, Biomedical & Hazardous Waste)

Sources of solid waste,

Concept of segregation at source.

Unit II: Solid Waste Management:-

3-R's: Reduce, Reuse, and Recycle of solid waste

Collection,

Disposal method,

Eco-friendly techniques: Composting & Vermicomposting.

Unit III: Soil:

Introduction: Composition of soil

Soil formation, types of soil, Soil profile

Nutrients present in soil.

Conservation of soil, soil erosion.

Unit – IV: Soil: Organic matter, formation, importance of organic fertilizers,

Soil microbiology,

Standards or soil quality required for various crops,

Soil pollution cause and remedies

Role of soil ecology in geo-chemical cycles

Unit V: Noise:

Introduction, Definition, Scale

Permissible exposure decibel limits

Sources of noise

Equipment used for noise measurement,

Noise measurement

Characteristics of sound

Mechanism of hearing,

Noise Pollution control (at Industrial and residential places)

Standards prescribed for Noise in Indian Context.

Reference Books:-

- 1) Soil Conservation – Norman Hudson, IInd Ed, and English Language book Soc.
- 2) Soil and Water Conservation- Resurges , Standard Pub. And distributor
- 3) Soil Pollution and Soil Organism – P.C. Mishra , Ashish Pub. Home.
- 4) Soil Microbiology – Pawar and Daginwale
- 5) Wealth from Waste – S.C. Bhatia (Vol.II) , Atlautic Pub.
- 6) Environmental Chemistry – B.K. Sharma

EVS 243 (Paper –XV) : Lab Course – VII

- 1) Study of various equipments used in air pollution.
- 2) Detection & identification of Pollen grains.
- 3) Dust fall measurement by sedimentation method (Tiles).
- 4) Detection of SO₂ gas & its effect on plants.
- 5) Detection of H₂S gas & its effect on plants.
- 6) Detection of NH₃ gas & its effect on plants.
- 7) Measurement of atmospheric temperature by maximum & minimum thermometer.
- 8) Preparation of PDA.
- 9) Detection & identification of fungal spores/colonies by PDA.
- 10) Study of various sampling techniques.
- 11) Demonstration of HVAS (High Volume Air Sampler).

EVS 244 (Paper –XVI): Lab Course - VIII

- 1) Collection & preservation of soil samples.
- 2) Determination of lime by titration method.
- 3) Determination of organic carbon from soil samples.
- 4) Determination of electrical conductivity of soil samples.
- 5) To study the pH of solid waste: acidic/ alkaline.
- 6) Determination of NPK of solid waste samples.
- 7) Determination of Moisture content of solid waste.
- 8) Measurement of Noise by Noise meter (dBmeter).
- 9) To study to the growth of microorganisms present in solid waste by :
 - a) Streak plate method
 - b) Spread Plate method
 - c) Pour Plate method.
- 10) To study the percentage composition of degradable & non-bio degradable waste.
- 11) Isolation of bacteria from soil samples.
- 12) Isolation of Fungi from soil samples.