



TUMKUR UNIVERSITY

**COURSE STRUCTURE AND SYLLABUS
(CBCS SCHEME)**

B.Sc. ENVIRONMENTAL SCIENCE

SCHEME OF INSTRUCTION & EXAMINATION
B.Sc PROGRAMME COURSE MATRIX FOR SEMESTER I-IV

NO	COURSE NUMBER IN SEMESTER	TITLE OF THE PAPER	TYPE OF INSTRUCTIONS & HOURS PER WEEK	CREDITS	HOURS OF EXAM (SEE) PER COURSE/SEM	MAX MARKS FOR IA/COURSE/SEM	MAX MARKS FOR SEE/COURSE/SEM	TOTAL MARKS/COURSE/SEM
1	1.3	Fundamentals of Environmental science	T 4	4	3	10	90	100
2	1.4	Environmental Science – Practical's I	P 4	2	3	-	50	50
3	2.3	Environmental Biology	T 4	4	3	10	90	100
4	2.4	Environmental Science – Practical's II	P 4	2	3	-	50	50
5	3.3	Environmental Geosciences	T 4	4	3	10	90	100
6	3.4	Environmental Science – Practical's III	P 4	2	3	-	50	50
7	4.3	Environmental Chemistry	T 4	4	3	10	90	100
8	4.4	Environmental Science – Practical's IV	P 4	2	3	-	50	50
OPEN ELECTIVE								
9	4.9	Man and Environment	T2/P4	2	3	-	50	50

B.Sc PROGRAMME COURSE MATRIX FOR SEMESTER V and VI

N O	COURSE NUMBE R IN SEMEST ER	TITLE OF THE PAPER	TYPE OF INSTRU CTIONS & HOURS PER WEEK	CREDITS	HOURS OF EXAM (SEE) PER COURSE /SEM	MAX MARKS FOR IA/COURSE /SEM	MAX MARKS FOR SEE/COURSE /SEM	TOTAL MARKS/COU RSE/SEM
1	5.1	Environmental Microbiology and Biotechnology	T 3	3	3	10	90	100
2	5.2	Natural resource and management	T 3	3	3	-	50	50
3	5.3	Environmental Science – Practical's v/vi	P 6	3	3	10	90	100
4	6.1	Environmental Safety, Health and Management	T 3	3	3	-	50	50
5	6.2	Disaster management	T 3	3	3	10	90	100
6	6.3	Environmental Science – Practical's VII/VIII	P 6	3	3	-	50	50

B.Sc. ENVIRONMENTAL SCIENCE – SYLLABUS

I SEMESTER

1.3 Fundamentals of Environmental science – *Theory Paper*

Unit 1: Introduction to Environmental Science-Definition, Scope, Importance. Relationship with other branches of science: environmental biology, environmental chemistry, environmental engineering, environmental geology, environmental physics. Environmental Education- Objectives of environmental education. **(10 hrs)**

Unit 2: The earth system: environmental, subsystems: - atmosphere, hydrosphere, lithosphere and biosphere. Water resource: - Hydrological cycle – introduction, components- Evaporation, trans- evaporation, condensation, percolation and precipitation. Factors affecting different steps of hydrological cycle. Conditions of the surface area and storage characteristics. **(10 hrs)**

Unit 3: Evolution of Universe – Theories – Big bang theory, steady state theory and pulsating theory, Evolution of elements – origin of earth , sun and solar systems, origin and evolution of life and life forms related experiments. **(10 hrs)**

Unit 4: Climatology: Weather and climate, tropical monsoon climate - Humidity, temperature, pressure, wind. Microclimate: causes and fluctuation of environmental factor, topography, microclimates of valleys and urban area. **(10 hrs)**

Unit 5 Abiotic factors - nature of response of organism to abiotic factors –Essential elements and limiting factors - Liebig –Black-Man Laws of limiting factors. Shelford law of tolerance. Classification of organisms according to temperature tolerance and regulation. Thermal adaptation of plants and animals. Effect of light on plants and animals. **(10 hrs)**

Unit 6: Biodiversity concepts, classification of biological diversity- levels of biodiversity, Bio diversity in relation to global environmental changes, Hotspots of biodiversity. Values, Threats and Conservational aspects of Biodiversity **(10 hrs)**

Referenc

1. Fundamentals of Soil Science – Forth H.D. (1984) – John Wiley
2. Environmental Science- Turk J & Turk A (1984)- Saunders
3. Geography and man’s environment strahler & strahler (1977) Eiley
4. Environmental Science –Eugene E.D. (1983) W.C. Brown Co.
5. Man and Biosphere today-Dusman, R.S. (1974) Sterling publication
6. Man and Changing environment- R.G. Franke, D.N. Franks Publ: Holt, Rinehart & Winston.
7. The Earth: Our physical Environment- W.L. Donn-John Wiley & Sons ,N. Y.
8. Environmental Science- S. C. Santra, New Central Book Agency Private limited, London

1.4 Environmental Science Practical's - I

1. Determination of PH of water sample using PH paper/ PH meter
2. Humidity: Principle and use of dry & wet bulb thermometer.
3. Pressure: Aneroid barometer
4. Wind: direction and speed- wind vane and anemometer.
5. Construction of wind rose: wind vane and anemometer.
6. Observation & Identification of flora & fauna of permanent slide under Microscope.
7. Mean rainfall calculation over a drainage basin using Thiessen's Polygon method and Isohyetal method.
8. Demonstration of Rain gauge.
9. Demonstration of Altimeter.
10. Determination of turbidity of water sample using sacchi disc.
11. Determination of CaCo₃ in water sample.

II SEMESTER

2.3 Environmental Biology - Theory Paper

Unit 1: Basic components of an ecosystem- Structure and functional aspects of an ecosystem tropic structure, ecological Niche, ecological dominance stabilities and diversity rule. **(10 hrs)**

Unit 2: Major ecosystem; physical, chemical and biological characteristic features of terrestrial, grassland, arid land, wetland, aquatics, ponds, lakes, rivers, estuaries and ocean ecosystem. **(10 hrs)**

Unit 3: Ecological balance. Energy in an ecosystem; pattern of flow of energy through the ecosystem: laws of thermodynamics in relation to energy flow. Food chain-detritus and grazing. Ecological pyramids- pyramid of biomass, pyramid of energy, pyramid of number. Foodweb. Ecological Succession, Productivity- primary productivity and net productivities. **(10 hrs)**

Unit 4: organic and abiotic phases of geochemical cycles; types biogeochemical cycles , water cycle, gaseous cycle- the carbon cycle, the nitrogen cycle , oxygen cycle, sedimentary cycle- sulphur and phosphorus cycle. **(10 hrs)**

Unit 5: population density; natality, mortality. Life table, age distribution; age pyramids, sex ratio, biotic potential and environmental resistance: population growth and rate, dispersion, emigration, immigration, migration and regulation of population size. **(10 hrs)**

Unit 6: Biogeography:- pattern of distribution of biota concept of continental drifts, concept of Endemic species. Descriptive phytogeography- Major plant community of the world, phytogeography of India. Zoogeographical regions - palaeartic region, neartic region, Neotropical region, Ethiopian region, Australian region. **(10 hrs)**

Reference

1. Environmental science-Turk A.(1984) Saunders
2. Environment Science –Eugen E.D. (1983) W.C. Brown Co.
3. Man and Biosphere today-Dusman, R.S. (1974) Sterling publication
4. Basic ecology E. Odum (1983) Sunders
5. Concepts of Ecology Koromondy
6. Introduction to ecology-colinvaux, P.A (1973) John Wiley
7. Ecology of tropical oceans-Longhurst, A.R. and Daniel Pauly, Academic press
8. Ecology of inland waters and estuaries- Reid, G.K. (1961) Reinhold pub.
9. Practical methods in ecology and environmental science, Trivedi R.K. and others, (1987)
10. Encyclopaedia of environmental science-parker S.P. (1980)
11. Ecology- study of ecosystems-Kisra K.C. and others-wheeler and comp. Allahabad
12. New approaches to monitoring aquatic ecosystem- Boylo T.P. (1987), ASTM, Philadelphia

2.4 Environmental Science Practical's – I

1. Observation and identification of flora and fauna.
2. Study of microbes found in water sample and soil samples including pond as Ecosystem.
3. Study of ecological adaptations and morphological peculiarities of organisms Hydrophytes, Xerophytes, Epiphytes and Halophytes.
4. Quadrant methods of sampling vegetation – construction of quadrant. Determine the area of quadrat using given data.
5. To calculate the frequency percentage of different species of plants in an area using artificial ecosystem.
6. A study of artificial ecosystem.
7. Determination of temporary hardness of water sample.
8. Study of electrical conductivity of different water sample.
9. Visit to study the pond/ forest ecosystem.
10. Visit to study of social forestry .

III SEMESTER

3.3 Environmental Geosciences – *Theory Paper*

Unit 1: Fundamentals of Environmental Geology:-Scope and relevance of Environmental Geology, Structure and composition of Lithosphere. A brief study on the interior of the earth. **(10 hrs)**

Unit-2: weathering and mass Wasting: - Mechanical, Chemical and biological weathering, factors affecting weathering, economic resources resulting from weathering. Forms of mass wasting, factors affecting mass wasting. **(10 hrs)**

Unit 3: Soil System: - Meaning and importance, components of soil system – flora , fauna and organic matter, mineral matter, soil solution and soil atmosphere. Soil structure, texture, Soil profiles and horizons. Soil forming process and factors of soil formation classification of soils. **(10 hrs)**

Unit 4: Soil erosion and sedimentation: - Types of soil erosion, factors and causes of soil erosion, sedimentation processes, sedimentation and environmental problems. Corrective measures of erosion and sedimentation. Waste land reclamation. **(10 hrs)**

Unit 5: Definition of a rock, classification of Rocks: - Igneous, sedimentary and metamorphic rocks. Rock cycles, extrusive and intrusive forms of igneous rocks, tubular classification of igneous rocks, Tyrell classification of sedimentary rocks based on mode of formation. Based on grain size rudaceous, Arenaceous, Argillaceous depositional environmental – terrestrial, lacustrine environment, fluvial and marine. **(10 hrs)**

Unit 6: Geomorphological studies: Nature and types of land forms, role of geological agents – river, wind and ocean. Principles of remote sensing and its application in environmental sciences. Application of GIS in Environmental Management. **(10 hrs)**

References:

1. General geology By: V. Radha Krishna, V.V.P. Publishers, 18, West street Chidambara Nagara, Tuticorn T.N./ 628.
2. Physical Geology Judson et. al., (1976) Prentice hall of india. New Delhi
3. The Encyclopaedia of Geological Sciences Mc Graw Hill, New York, USA
4. Principles of Geomorphology, Thernbury W.D. John Wiley, New York. USA
5. The dynamic earth, Wyllie P.K. (1971). John wiley, New York, USA

3.4 Environmental Science Practical's – III

1. Sampling techniques of soil
2. Identification of soil types, soil texture and structures.
Major and minor elements- computation and histogram presentation, soil grading using sieve.
3. Study of important rock forming and economic minerals in hand specimens.
4. Determination of specific gravity of soil samples
5. Identification of major rock types – igneous, Sedimentary and metamorphic
6. Study of fossils and their ecological significance- plants, Invertebrates
7. Soil analysis – Major elements like Ca^{2+} , Mg^{2+} , Na^{+} and K^{+}
8. Hydrological parameters – Porosity and permeability etc.
9. Determination of PH of soil samples
10. Determination of lime content of the soil
11. Determination of water holding capacity of different soil.
12. Study of electrical conductivity of soil samples.

IV SEMESTER

4.3 Environmental Chemistry and Pollution – *Theory Paper*

Unit 1: Concept and scope of environmental chemistry, definition, Nomenclature, environmental segments, chemistry of atmosphere, troposphere, stratosphere, mesosphere, thermosphere, ionosphere, lithosphere, hydrosphere and biosphere. **(10 hrs)**

Unit 2: Air pollution definition: - Sources and types of gaseous and particulate matters; role and effects of oxides of nitrogen, sulphur, carbon. Photochemical smog, green house effect, acid rain, ozone depletion and their effect on flora and fauna. **(10 hrs)**

Unit 3: Water pollution: Sources and types of water pollution. Classification of organic and inorganic water pollutants, biodegradable and non biodegradable pollutants. Concepts of DO, BOD, COD and eutrophication and their effect on flora and fauna **(10 hrs)**

Unit 4: Soil pollution: Definition, sources, types, organic and inorganic pollutants, pesticides, acid mine drainage, radioactive materials and their effect on flora and fauna. **(10 hrs)**

Unit 5: Radio activity: Sources, types and properties of radiation. Interaction of radiation with matter, ionizing and non-ionizing radiation. Impact of radioactive pollution on plants and animals. **(10 hrs)**

Unit 6: Toxicology: Sources, types, toxic chemical in environment. Neuro toxicity and carcinogens. Impact of toxic chemicals on enzymes. Biochemical effect of arsenic, cadmium, lead, mercury, cyanide, SO_x , CO , NO_x and Pesticides. **(10 hrs)**

References:

1. A Text book of Environmental Science – Prabhat Patnaik
2. A Textbook of Environmental Sciences - Purohit
3. Elements of Environmental Chemistry – J. Hussain
4. Environmental Instrumentation and Analysis Handbook – R.D. Down and J.H. Lehr
5. Environmental Analysis and Instrumentation - N. Rajvaidya and D. K. Markande
6. Environmental Monitoring and Analysis - Dr. Aradhana Salpekar

4.4 Environmental Science Practical's – IV

1. Analysis of polluted Soil & Water: Physical properties, nutrients, bacterial parameters.
2. Alkalinity of soil.
3. Total hardness of water.
4. Estimation of chlorides in water samples.
5. Estimation of total alkalinity in water samples.
6. Estimation of carbon di-oxide in water samples

OPEN ELECTIVE

4.9 MAN & ENVIRONMENT – *Theory Paper*

Unit 1: (08 hrs)

Biodiversity concepts, classification of biological diversity- levels of biodiversity, Bio diversity in relation to global environmental changes, Hotspots of biodiversity. Values, threats and Conservational aspects of Biodiversity.

Unit 2: (08 hrs)

Population density; natality, mortality. Age distribution; age pyramids, sex ratio, biotic potential and environmental resistance: population growth and rate, dispersion, emigration, immigration, migration and regulation of population size.

Unit 3: (08 hrs)

Air pollution: Sources and types of gaseous and particulate matters; effects and control measures. *Water pollution:* Sources and types of water pollutants. Causes, effects and control measures. *Soil pollution:* Definition, sources, types, organic and inorganic pollutants, pesticides. *Radioactive pollution:* Sources, types and properties of radiation. Impact of radioactive pollution on plants and animals.

Unit-4: (08 hrs)

Occupational health and safety. Occupational health and hazards-physical-chemical and biological. Occupational diseases- prevention and control.

Man-made Hazards: Biophysical hazards - Frost hazards in agriculture.

Technological Hazards - Nature and significance. Lessons from Bhopal and Chernobyl disasters.

Disasters and Hazard Management: Human and ecological impacts, risk assessment and vulnerability analysis, national preparedness and adaptation strategies. Role of GIS and remote sensing in surveillance, monitoring, risk assessment, estimation of losses and planning

References:

- Global Environmental Issues - Ed. Frances Harris and Frances Harris
- Global Environmental Issues - K. Jagamohan Reddy
- Global Environmental and Pollution Issues by Dr. Aaradhana Salpekar and Dr. Kadambari Sharma

V SEMESTER

5.1 Environmental Microbiology and Biotechnology – Theory Paper

Unit 1:

Soil microbes:- Types, physical and chemical characters, soil profile,

Soil Microorganisms -Bacteria, fungi, actinomycetes, algae, protozoa, and viruses.

Interactions between plants and microorganisms-types of interactions (positive and negative) Microorganisms of rhizosphere, rhizoplane and phylloplane, mycorrhiza(Types and its applications).Microbes and biogeochemical cycles-Nitrogen, sulphur, carbon and phosphorous.Bioleaching-Copper and Iron-ore form available, areas of deposits, methods of leaching, mechanism and significance.Biodegradation-Cellulose, Pectin, plastics and pesticides. Microbes and organic pollutants; environmental laws and issues concerning release of genetically engineered microbes.Xenobiotic compounds-Persistence and biomagnifications of xenobiotic compounds, bioremediation. **(08 hrs)**

Unit 2:

Air microbiology- Introduction, definition, atmospheric layers, sources of microorganism, air micro flora of indoor and outdoor air. Factors affecting air micro flora, significance of air borne microbes, endo toxins, control and management of air borne microbes. Techniques of trapping air borne microorganisms-gravity slide, plate exposure,Vertical cylinder, Hirst spore trap, Rotarod sampler, Andersen sampler, Bukard trap, hand held air sampler, impingers and filtration. Advantages and disadvantages of these techniques. Biohazards in occupational environment, allergy testing. **(08 hrs)**

Unit 3:

Water microbiology- Introduction, distribution of microorganisms in the aquatic environment. Sources and types of water pollution, biological indicators of water pollution. Water-borne diseases-Bacterial (Cholera), Viral (Hepatitis A) and Protozoan (Amoebiasis). Determination of the sanitary quality of water-MPN index, membrane filtration,Biological

Oxygen Demand. Chemical oxygen demand. Water purification in municipal water supply, parameters of potable water. Solid waste management and waste water treatment.

(08 hrs)

Unit 4

Practical aspects of genetic engineering. Microorganisms from extreme environment - use of extremophilic microorganisms in waste treatment and methane production from agro industrial wastes, production of enzymes like cellulase, proteases, amylases, alcohol and acetic acid production. **(08 hrs)**

Unit 5

Microbial process involvement, vermi composting, bio fertilizer, bio pesticide production. Bio-mining - microbial leaching of low grade mineral ores, molecular probes for organisms in mines and mine tailings, Petroleum pollutant biodegradation and second generation biofuels. **(08 hrs)**

Unit 6

Bioremediation: Concept, role of bioremediation in controlling various pollution problems e.g. solid waste, sewage water, industrial effluents, heavy metals and radioactive substances. Phytoremediation - Abatement of different types of pollution using plants, types of phytoremediation, mechanism involved with case studies. **(05 hrs)**

References:

1. Environmental Biotechnology: A Bio systems Approach - Daniel Vallero
2. Environmental Biotechnology (Oxford Higher Education)- B.C. Bhattacharyya and Rintu Banerje
3. Environmental Biotechnology -Dr Alan H. Scragg
4. Environmental Biotechnology: Theory and Application - Gareth M. Evans and Judith C. Furlong
5. Alexander M. Introduction to Soil Microbiology, Wiley Eastern Limited, New Delhi.
6. Alexopoulos C.J and Mims C.W. Introductory Mycology, New Age International, New Delhi.
7. Aneja K.R. Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom cultivation, New Age International, New Delhi.
8. Hirst, C.J. Environmental Microbiology, ASM Press, Washington D.C.
9. Mehrotra R.S. Plant Pathology Tata McGraw Hill Publications Limited, New Delhi.
10. Pelczar M.J. Chan E.C.S and Krieg N.R. Microbiology McGraw Hill Book Company, New York.
11. Prescott Lansing M. Harley John P. and Klein Donald A. Microbiology, WCB McGraw-Hill New York.

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5.2 Natural Resources and Management – *Theory Paper*

Unit-1

Introduction to Natural Resources – Classification of natural resources – List of natural resources – Values of natural resources - Demands on Natural Resources - Population, lifestyle and natural resources - Impact of poor natural resource management. **(08 hrs)**

Unit-2

Land resources:-Definition, Land use pattern in India. Waste Land: Types. Desertification: Definition - Causes and impacts. **(08 hrs)**

Unit-3

Water resources – Hydrological cycle – Surface water - Ground water, Dams. Uses and impacts on environment. Marine resources: Biotic and abiotic resources. **(08 hrs)**

Unit-4

Living Resources-Agriculture-types of cultivation-high yielding varieties –HYV chemicals Fertilizers& their impacts-Microbes-useful& harmful bacteria in soil, water, Air – fungi beneficial & harmful. **(08 hrs)**

Unit-5

Forest and Mineral Resources forest produce – food- fodder – fuel wood. Fibre -Timber - Minerals –Metal & non metal resources, non – conventional energy resources **(08 hrs)**

Unit 6

Sustainable development: Urban planning and environmental management, Understanding the resource ecology and life-supporting capacity of resources. Economic models: Green building concept- green technology concept. **(05 hrs)**

References:

1. Natural Resources - Christian Lannerberth
2. Environmental Science - Santra
3. A Text book of Environmental Science - PrabhatPatnaik
4. A Textbook of Environmental Sciences- Purohit
5. Natural Resources: Exploration and Development - Satish Tiwari
6. Natural resources - S. B. Ghosh
7. Target 3 Billion: Innovative Solutions towards Sustainable Development - APJ Abdul Kalam and Srijan Pal Singh
8. Sustainable Development (Encyclopaedia of Sustainable Development) - P. C. Sinha
9. Urban Environmental Management - Shahab Fazal

5.3 Environmental Science Practical's V/VI

Environmental Microbiology and Biotechnology

1. Study of airborne microorganisms (bacteria and Fungi) in different environments by exposure plate method.
2. Study of fungi in seeds by blotter method.
3. Effect of fungicidal seed treatment on fungal plant pathogen.
4. Study of air samplers-Anderson's sampler, Hirst Spore trap, Rotorod sampler and vertical cylinder.
5. Determination of Biological Oxygen Demand.
6. Microbial examination of water by coli form, MPN methods-for potable and sewage water.
7. Study of fungi-*Cladosporium*, *Helminthosporium*, *Mucor*, *Curvularia*, *Altenaria*, *Geotrichum* and *Trichoderma*. (specimens)

Natural Resources and Management

1. Estimation of minerals from various sources.
2. Quantification of soil nutrients (NPK, Na, Ca).
3. Visit to forest ecosystem and studies on vegetation mapping.
4. Studies on Gene pool of forest ecosystems using curated databases.
5. Case studies on river linking and its implications

VI SEMESTER

6.1- Environmental Safety, Health and Management – *Theory Paper*

Unit-1

Definition- need for good health- factors affecting health. Types of diseases {deficiency, infection, pollution diseases}. Personal hygiene- Food (balanced diet). Food habits & cleanliness, food adulterants. **(08 hrs)**

Unit-2

Public health: communicable diseases, mode of transmission (epidemic and endemic diseases). Management of hygiene in public places (railway stations, bus stands and other public places). **(08 hrs)**

Unit-3

Occupational health and safety. Occupational health and hazards-physical-chemical and biological. Occupational diseases- prevention and control. **(08 hrs)**

Unit-4

Industrial safety and management techniques: Industrial safety standards and regulations. Accidents-definitions-prevention and control. **(08 hrs)**

Unit-5

Safety management system- concepts of safety management systems- EMS ISO 14000 and 14001. OSHA. PUBLIC LIABILITY INSURANCE ACT- MINING ACT. **(05 hrs)**

Unit 6

Health maintenance: Survey, analysis and recommendations regarding health and safety problems in the working and living environment. Treatment of variation, with demographic, vital statistics and epidemiological data. Hazard evaluation in polluted environment with specific emphasis on radiological health. **(05 hrs)**

References:

- Global Environmental Issues - Ed. Frances Harris and Frances Harris
- Global Environmental Issues - K. Jagamohan Reddy
- Global Environmental and Pollution Issues by Dr. Aaradhana Salpekar and Dr. Kadambari Sharma

VI SEMESTER

6.2 Environmental Disaster Management – Theory Paper

Unit 1

Environmental Hazards: Classification, Causes and Distribution.

Natural Hazards - Geological hazards, earthquakes, volcanoes, mass-movement, tsunami. Hydrological hazards - Floods, droughts, cyclones and hurricanes. Atmospheric/Climatic hazards - extreme weather events, global climatic change. **(08 hrs)**

Unit 2

Man-made Hazards: Biophysical hazards - Frost hazards in agriculture, epidemics and wildfires. Technological Hazards - Nature and significance. Lessons from Bhopal and Chernobyl disasters. **(08 hrs)**

Unit 3

Disasters and Hazard Management: Human and ecological impacts, risk assessment and vulnerability analysis, national preparedness and adaptation strategies, hazards policies and agencies and Land use classification. Role of GIS and remote sensing in surveillance, monitoring, risk assessment, estimation of losses and planning. **(08 hrs)**

Unit 4

Prediction of natural disasters: Precaution and disaster management, Safety verses production in industry and Modelling of Hazards. **(08 hrs)**

Unit 5

Man-made Hazards: Biophysical hazards - Frost hazards in agriculture, epidemics and wildfires. Technological Hazards - Nature and significance. Lessons from Bhopal and Chernobyl disasters. **(08 hrs)**

Unit-6

Medical Management of disaster – Disaster Impacts and response – Identification of dead – Search rescue –first and relief phase – Vaccination, basic sanitation and personal hygiene.
(05 hrs)

References:

- The Global Casino: An Introduction to Environmental Issues, Fourth Edition -Nick Middleton
- Global Environmental Change: The Threat to Human Health
- Occupational Health - G. French

6.3 Environmental Science Practical's VII/VIII

Environmental Safety, Health and Management

1. Population modeling using Leslie's matrix.
2. Case studies on environmental issues and human health: Ozone, water resources
3. Awareness studies on environmental disasters.
4. Basic Hygiene and safety standards.
5. Potable water quality assessment.
6. Study of environmental carcinogens.

Environmental Disaster Management

1. Preparation of environmental zonation map for landslide.
2. Preparation of hazard zonation map for earthquakes.
3. Case studies on recent natural environmental hazards: tsunami
4. Case studies on recent man-made environmental hazards: Bp oil disaster.
5. Study of various hazard prediction models.
6. Preparation of a plan for environmental hazard mitigation.

B.Sc. Environmental Science Question paper pattern – Theory

Maximum Marks: 90

Time: 3 hours

PART – A

Answer any ten questions in one or two sentences

10x2=20

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

PART – B

Answer any six questions. Short note type

6x5=30

- 13.
- 14.
- 15.
- 16.
- 17 a)
b)
- 18 a)
b)
- 19.
- 20.

PART – C

Answer any four questions. Essay Type

4X10=40

- 21.
- 22.
- 23.
- 24.
- 25.

Note: Equal weightage should be given to all the units while preparing the question paper.

B.Sc. Environmental Science Question paper pattern – Practical

Maximum Marks: 50

Time: 3 Hours

1. Major Experiment:	12 Marks
2. Minor Experiment:	08 Marks
3. Spotters/Demonstrations:	20 Marks
4. Record Submission:	05 Marks
5. Viva-Voce:	05 Marks

Note: Scheme of valuation specific to each semester has to be prepared by the BOE for each examination separately

Internal Assessment:

Average of two internal tests:	05 Marks
Average of two assignments: (Frontier areas of Environmental science)	05 Marks

TOTAL: 10 Marks

2.9 Environmental Studies – Theory Paper (One-Semester Compulsory Core Module for Undergraduate Programmes)

Unit 1: Introduction to Environment (04 hrs)

- Inter-disciplinary nature of environmental studies;
- Scope and importance; Need for public awareness.

Unit 2: Ecosystems and its Importance (04 hrs)

- Ecosystem: Definition, structure and function, Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems :
 - a) Forest ecosystem
 - b) Grassland ecosystem
 - c) Desert ecosystem
 - d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit 3: Natural Resources and Management (04 hrs)

- Land resources and land use change; Land degradation, soil erosion and desertification.
- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
- Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).
- Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Unit 4: Biodiversity and Conservation (04 hrs)

- Levels of biological diversity : genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots
- India as a mega-biodiversity nation; Endangered and endemic species of India
- Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

Unit 5: Environmental Pollution and Control (04 hrs)

- Environmental pollution : types, causes, effects and controls; Air, water, soil and noise pollution
- Nuclear hazards and human health risks
- Solid waste management: Control measures of urban and industrial waste.

- Pollution case studies.

Unit 6: Sustainable Development and Environmental Laws (04 hrs)

- Sustainability and sustainable development practices.
- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture
- Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act.
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

Unit 7: Interaction of Society with Environment (04 hrs)

- Human population growth: Impacts on environment and climate change.
- Resettlement and rehabilitation of project affected persons; case studies.
- Disaster management: floods, earthquake, cyclones and landslides.
- Environmental movements: Chipko, Silent valley.
- Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
- Environmental communication and public awareness, case studies.

Unit 8: Environmental Extension (04 hrs)

- Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
- Study economically important plants and plantation by every student (1 Student 2 Plants compulsory).
- Study of simple ecosystems-pond, river, etc.

Reference Books

- 1 Bharucha, E. 2003, Textbook for Environmental Studies, University Grants Commission, New Delhi and Bharati Vidyapeeth Institute of Environmental Education and Research, Pune. 361.
- 2 Carson, Rachel. 1962. Silent Spring (Boston: Houghton Mifflin, 1962), Mariner Books, 2002
- 3 Economy, Elizabeth. 2010. The River Runs Black: The Environmental Challenge to China's Future.
- 4 Gadgil, M. & Ramachandra, G. 1993. *This fissured land: an ecological history of India*. Univ of California Press.
- 5 Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
- 6 Grumbine, R. Edward, and Pandit, M.K. Threats from India's Himalaya dams. *Science* 339.6115 (2013): 36-37.
- 7 Heywood V.H. & Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge University Press.

- 8 McCully, P. 1996. *Silenced rivers: the ecology and politics of large dams*. Zed Books.
- 9 McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
- 10 Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.

Question Paper Pattern for Common Paper on Environmental Studies (CBCS)

Time: 3 hours

Maximum Marks: 50

PART - A

Answer any FIVE of the following.

2x5=10

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.

PART - B

Answer any FOUR of the following

5x4=20

- 07.
- 08.
- 09.
- 10.
- 11.

PART - C

Answer any TWO of the following

10X2=20

- 12.
- 13.
- 14.

Note: Equal weightage should be given to all the units while preparing the question paper.