

Sri Dev Suman Uttarakhand University

First Year: 2020 – 2021

Environmental Science

Paper – I

Basic Concepts of Ecology & Evolution

Duration 2 ½ Hrs

M.M.: 50

UNIT-I

Fundamental principles of environment; Man's attitude towards environment, Rise of agriculture, Domestication of animals, Ancient civilization and environment.

Ecology : Definition , aim, scope and branches; Historical background of ecology : Ecology in Indian classics and ancient Greek and Roman Literature, growth of ecology from 12th to 20th Century; Growth of plant as well as Animal Ecology in India.

UNIT-II

Natural processes – Primeval atmosphere and origin of life; Structure and composition of present day atmosphere; atmosphere and earth radiation balance; Hydrosphere: atmospheric humidity and precipitation, hydrological cycle. Lithosphere – soil formation, soil texture, soil profile, soil classification.

UNIT- III

Energy - Brief idea of Biogas, biomass, solar energy, coal, hydro – power and nuclear power. Environmental impacts of energy use. Energy conservation.

UNIT- IV

Evolution and Ecology : Evolution – evidences and theories of organic evolution. Darwinism & Lamarckism. Adaptation, co-evolution, speciation and selection. Evolution of Man.

UNIT - V

Plant nomenclature : Plant kingdom – classification, general characters and examples of different groups.

Animal kingdom – Classification and general characters upto class level with examples.

First Year: 2020 – 2021

Environmental Science

Paper – II

Ecological Organisations

Duration 2 ½ Hrs

M.M.: 50

UNIT-I

Population ecology : Definition, natality, mortality, fecundity, age and sex ratio; population growth form and concept of carrying capacity, population regulation.

UNIT-II

Community ecology - The biotic community concept; community characteristics- analytical characteristics of the community - quantitative, qualitative characteristics, synthetic characteristics of community, IVI and concept of ecological dominance.

UNIT-III

Methods of studying vegetation, gradient analysis and continuum concept, concept of ecotone and edge effect. Species diversity and diversity indices; community classification; Ecological niche.

UNIT-IV

Interspecific interactions - Commensalism, Amensalism, Mutualism, Protocooperation, Symbiosis, Predation, Parasitism, Competition, Epiphytism, Types of association-Colonization, Aggregation, Social organization and behaviour.

UNIT-V

Ecological succession; Types, cause and processes of succession, hydrosere, xerosere, significance of ecological succession; concept of climax.

First Year: 2020 – 2021

Environmental Science

Paper – III

Ecosystem Ecology

Duration 2 ½ Hrs

M.M.: 50

UNIT-I

The Ecosystem - Ecosystem concept, its structure and function, homeostasis in the ecosystem.

Energy flow in ecosystems, food chains, food webs, trophic levels, ecological pyramids, ecological efficiencies.

UNIT-II

Major ecosystems of the world: The pond ecosystem, the ocean ecosystem, the forest ecosystem, the grassland ecosystem, the desert ecosystem; Productivity in different ecosystem.

UNIT-III

Concept of production and decomposition in nature, concept of productivity – primary and secondary production; gross and net production; standing crop, turn over, energy subsidies, methods of measuring primary productivity.

UNIT-IV

Concept of plant growth; Primary production process, factors affecting growth and pattern of resource allocation in plants; Plant growth indices and their ecological significance.

UNIT-V

Biogeochemical cycles with special reference to water, nitrogen, carbon, phosphorus and sulphur.

First Year: 2020 – 2021

Environmental Science

Practical

Duration 4 Hrs

M.M.: 50

	Regular	Ex - Students
1. Major Exercise	15	15
2. Minor Exercise	10	10
3. Spots	15	15
4. Viva – Voice	05	10
5. Record	05	-
Total	50	50

ENVIRONMENTAL SCIENCES

PRACTICALS

1. Examination of Soil:

- i) Determination of soil structure
- ii) Determination of soil texture
- iii) Determination of soil moisture
- iv) Determination of soil organic matter
- v) Study of soil profile
- vi) Quantitative estimation of carbonate / bicarbonates / chlorides
- vii) Estimation of percentage of calcium carbonate by rapid titration method
- viii) Water holding capacity, wilting coefficient and specific gravity, bulk density, porosity.

2. Community studies:

To determine the minimum size of a quadrat for a grassland / forest by species area curve method.

Determination of frequency, density, abundance and IVI with the help of Quadrat method.

To determine the index of dominance in a grassland community.

3. Aquarium as an ecosystem.

4. Determination of rate of production by harvest method.

5. Rapid field tests for pH, carbonate, nitrate and chloride.

ENVIRONMENTAL SCIENCES

BOOKS RECOMMENDED:

- 1 E.P. Odum: Fundamentals of Ecology, Saunders (3rd Edition)
- 2 Subhramanyam and Sambhamurthi : Ecology
- 3 K.C. Agarwal: Fundamentals of Environmental Biology, Nidhi Publishers, Bikaner.
- 4 V.Verma: Plant Ecology (4th Edition) Emkay Publishers.
- 5 Paul Colinvaux: Ecology, John Wiley and Sons.
- 6 P.D.Sharma: Ecology and Environment, Rastogi Publications, Meerut.

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Second Year: 2020 – 2021

Environmental Science

Paper – I

Ecological factors, adaptations and Distribution

Duration 2 ½ Hrs

M.M.: 50

UNIT-I

Ecological factors in relation to plants and animals:

1. Edaphic
2. Light
3. Temperature
3. Precipitation
5. Topography

Laws of limiting factors – Leibig and Shelford's.

UNIT-II

Ecological adaptation- Xerophytes, hydrophytes, halophytes, adaptations and ecotypes; Plant indicator; animal fitness to habitats; fossorial, arboreal, aquatic, volant adaptations.

UNIT-III

Patterns in vegetation – brief idea of morphological, environmental and sociological patterns. Measurement of non-randomness in vegetation, continuous and discontinuous distribution, interpretive phytogeography. Endemic areas and theories of endemism; Endemic flora of India.

UNIT-IV

Major biomes of the world: Forest, savannah, grassland, desert and tundra biomes. Flora and vegetation of India; vegetation of Rajasthan.

UNIT-V

Zoogeographical regions – Palaearctic, Nearctic, Neotropical, Ethiopian, Oriental, Australian region, Dynamic biogeography – Dispersal dynamics, barriers, dispersal pathways, continental drift theory, land bridge, centre of origin, age and area hypothesis; Migration.

Second Year: 2020 – 2021

Environmental Science

Paper – II

Aquatic Ecology

Duration 2 ½ Hrs

M.M.: 50

UNIT-I

Physico-chemical characteristics of aquatic habitats (light, temperature, pH, nitrate and phosphate); lentic and lotic habitats; Lakes and Ponds; ecological zonation in the lake environment.

UNIT-II

Definition and general account of lakes; origin of lakes, classification of lakes; Productivity of lakes; Lake fertility and fish production; Eutrophication.

UNIT-III

Biotic communities of lakes: Plankton, Benthos, Nekton and Neuston, Diversity and Biomass of plankton and benthos in time and space, aquaculture.

UNIT-IV

Features of marine environment, zonation of marine environment, biotic communities of marine environment; Brief account of pelagic, coastal, deep sea, coral reefs and mangrove communities; Marine resources.

UNIT-V

Estuarine ecology, Definition and types, biota and productivity, Ecological adaptation in estuarine environment. Eco- characteristics of Chilka lake.

Second Year: 2020 – 2021

Environmental Science

Paper – III

Terrestrial Ecology

Duration 2 ½ Hrs

M.M.: 50

UNIT-I

Physico-chemical characteristics of terrestrial ecosystem, Grassland ecosystem – Grassland environment; food chain and trophic levels, energetics of grasslands, productivity of grassland, biogeochemical cycles operating in grasslands; grass legume association; Grasslands in relation to soil and water conservation.

UNIT-II

Basis of grassland classification, Major grassland types in the world, grasslands in India with special reference to Rajasthan; Range management.

UNIT-III

Forest ecosystem – Major forest types of the world and of India; forest ecosystem, forest environment, food chains, energetics and biogeochemical cycles operating in forests. Forest biota.

UNIT-IV

Desert ecosystem – Introduction to world deserts, causes of desertification and control, climate of desert; Ecological adaptations to desert in plants and animals.

UNIT-V

Flora and fauna of Indian desert, Dryland farming, sylvipastoral agro forestry, solar energy utilization, arid horticulture and resource management activities with special reference to Rajasthan. Aims and activities of CAZRI, Desert Development Board and Arid- Forestry Research Institute (AFRI).

Second Year: 2020 – 2021

Environmental Science

Practical

Duration 4 Hrs

M.M.: 50

	Regular	Ex - Students
1. Major Exercise	15	15
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4. Viva – Voice	05	10
5. Record	05	-
Total	50	50

Environmental Science

Practical

1. Measurement of depth of visibility in a lake or pond with the help of a Secchi disk.
2. Studies of water samples for :
 - i) pH
 - ii) Dissolved oxygen
 - iii) Alkalinity
 - iv) Total hardness
 - v) Chlorides
 - vi) Dissolved organic matter
 - vii) Suspended particulates
3. Observation of zooplanktons and phytoplankton, benthos, nektons and macrophytes.
4. Estimation of primary productivity with the help of dark and light bottle experiment.
5. Sampling equipments.
6. Analysis of vegetation by line transect method.
7. Determination of cover in a grassland community with the help of chart quadrat method.
8. Determination of DBH of the tree species in a forest and calculation of the basal area.
9. Characteristic adaptation of animals of ecological significance.
10. Morpho – anatomical characteristics of hydrophytes and xerophytes.
11. Study of primary productivity (in terms of chlorophyll) in relation to light.
12. Study of animal communities in a terrestrial ecosystem.

BOOKS RECOMMENDED:

- 1 P.D.Sharma: Ecology and Environment, Rastogi Publications, Meerut.
- 2 R.S.Ambasht : Ecology
- 3 Verma and Agarwal: Environmental Biology. S.Chand and Co. Ram Nagar, New Delhi.
- 4 V.B.Rastogi: Animal Ecology, Kedamath Ramnath, Meerut.

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Third Year: 2020 – 2021

Environmental Science

Paper – I

Toxicology

Duration 2 ½ Hrs

M.M.: 50

UNIT-I

Definition of Toxicology, toxic substances in the environment; Concept of dose-response relationship; acute toxicity, chronic toxicity, lethal concentration, effective concentration, median tolerance limits.

UNIT-II

Metabolism of toxic substances by animals – uptake, excretion, chemical localization and its consequences; hepatic metabolism; Synergistic and Antagonistic effects.

UNIT-III

Metabolism of toxic substances by plant – uptake, translocation, metabolism and excretion, pathogen toxins, herbicides; Atmospheric toxicants and plants; Algal toxins, Mycotoxins.

UNIT-IV

Environmental factors in human health; Occupational hazards and diseases and their prevention. Food poisoning, toxicity of drugs, antibiotics, pesticides, metals; drug allergies.

UNIT-V

Teratogenicity, carcinogenesis and brief idea of genotoxicity.

Fumacatories and masticatories – sources, uses, effects on human body and evil effects on the society.

Third Year: 2020 – 2021

Environmental Science

Paper – II

Population Ecology

Duration 2 ½ Hrs

M.M.: 50

UNIT-I

Pollution – definition, types.

Air pollution – Sources, gaseous pollutants (SO_2 , NO_2 , CO , O_3 , HF) and particulates; Acid rain, Fly ash, Aerosols, Green House Effect; Effects and control of air pollution; Air quality standards.

UNIT-II

Air Pollution and Meteorology: Principles of air monitoring. Pollution indicators and Biomonitoring. Environmental problems of Rajasthan.

UNIT-III

Water pollution – kinds and sources of water pollutants, municipal water pollution, municipal sewers and sewage; Industrial and commercial water pollution. Safe drinking water, Water quality standards.

UNIT-IV

Land Pollution – Effects of agrochemicals – herbicides, pesticides and fertilizers; Mining and smelting. Radioactive pollution – Radiation and their types – non- ionizing and ionizing radiations; sources in environment, effects on man, animals and plants; Prevention.

UNIT-V

Noise pollution – sources and effects.

Thermal pollution – causes and effects.

Marine spillage – sources and hazards.

Third Year: 2020 – 2021

Environmental Science

Paper – III

Resource Conservation, Legislation, planning and Wildlife

M.M.: 50

Duration 2 ½ Hrs

UNIT-I

Natural resources and their conservation. Forests, minerals, water, aquaculture, sea, range management, land use; soil erosion and conservation.

UNIT-II

Concept of biological diversity, conservation of biological diversity, Endangered species, Red data book, threatened plant species of India; National Herbaria and Botanical Gardens.

UNIT-III

Wild life in India – Status and conservation efforts; protected species; Status of Wild life sanctuaries and National Parks in India; Biosphere Reserves.

UNIT-IV

Brief account of environmental acts and legislation; Role of UNEP, IUCN, ELC and MAB in conservation of nature and natural resources. Environmental Planning- problems of urban environment and planning; problems of rural environment and efforts for integrated rural development.

UNIT-V

Environmental Impact Assessment. Application of remote sensing for study and management of ecosystem. Concept of recycling and reuse of waste. Eco- conservation of Aravali.

Third Year: 2020 – 2021

Environmental Science

Practical

Duration 4 Hrs

M.M.: 50

	Regular	Ex - Students
1. Major Exercise	15	15
2. Minor Exercise	10	10
3. Spots	15	15
4. Viva – Voice	05	10
5. Record	05	-
Total	50	50

Environmental Science
Practical

ENVIRONMENTAL SCIENCES
PRACTICALS

Duration : 5 Hrs.

M.M.:75

1. Study of ambient air quality with respect to :
 - a) SPM
 - b) SO₂
 - c) NO₂
 - d) O₃
2. Study of water quality with respect to :
 - a) BOD
 - b) COD
 - c) Colour
 - d) pH
 - e) Dissolved oxygen
 - f) Total hardness
 - g) Alkalinity
 - h) Nitrates
 - i) Phosphates
3. Study of soil characteristics with particular reference to :
 - a) Porosity
 - b) Bulk density
 - c) Air content
 - d) Water holding capacity
 - e) pH

- f) Organic carbon
 - g) Total nitrogen
 - h) Sulphate-sulphur
 - i) Available phosphorus
 - j) Calcium
 - k) Metals
4. Calculation of Lc 50
 5. Study of plankton diversity in lake waters and calculation of similarity index.
 6. Examination of prepared histopathological slides to describe the toxicological effects of various environmental agents.
 7. To study the effect of certain toxicants on the chromosomes of *Tradescantia* / Onion.
 8. Field excursion to a polluted site, Forest and Wild life Sanctuary, National Park and submission of report.
 9. Study of external and internal adaptation and characteristics of important hydrophytes and xerophytes.

BOOKS RECOMMENDED:

- 1 P.D.Sharma : Environmental Toxicology
- 2 K.C.Agarwal: Environmental Pollution - Causes Effects and Control, Nidhi Publishers, Bikaner.
- 3 P.D.Sharma: Ecology and Environment, Rastogi Publications, Meerut.
- 4 F.Ranade (1984): Ecology of Natural Resources, John Wiley and Sons Singapore.