

B.Sc. ENVIRONMENTAL SCIENCE
Scheme of Examinations

Ist Semester

Paper-I Elements of Ecology

Paper-II Ecosystem Dynamics

Paper-V Practicals

IInd Semester

Paper-III Biodiversity Components

Paper-IV Biodiversity Conservation
and Ecosystem Services

Paper-V Practicals

Outline of Examinations

Paper	Nomenclature	Internal Assessment	External	M. Marks
Ist Semester				
I	Elements of Ecology	10	40	50
II	Ecosystem Dynamics	10	40	50
IInd Semester				
III	Biodiversity Components	10	40	50
IV	Biodiversity Conservation and Ecosystem Services	10	40	50
V	Practicals*	0	100	100

* At the end of Second Semester

Syllabus and Courses of Reading
B.Sc. Environmental Science (First Semester)
(w.e.f. 2008-2009)

Paper-I: Elements of Ecology

Max. Marks : 40 + 10(IA)
Time : 3 Hours

Note:- Total Nine questions will be set. The candidates will attempt 5 questions in all, one from each unit. Question number one will be compulsory, consisting of short answer question, covering the entire syllabus. All the questions carry equal marks.

Unit-I

Definition, Scope and basic principles of ecology and environment.

Biological levels of organization, population, community, ecosystem and biosphere.

Climatic factors - Solar radiations, temperature, water and precipitation.

Unit-II

Soil formation, soil types, soil profiles.

Physical and chemical characters of soil, Soil biological characters.

Topographic factors.

Unit-III

Population: Basic concepts, population characteristics – density, natality, mortality, age-structure, population growth.

Ecological niche and habitat.

Positive and negative interactions of populations – competition, predation, parasitism, mutualism.

Unit-IV

Community: Basic concepts, community structure, growth forms, life form.

Analytical and synthetic characters of plant community.

Methods of plant community analysis.

Concept of keystone species and ecotone.

Paper-II: Ecosystem Dynamics

Max. Marks : 40 + 10(IA)

Time : 3 Hours

Note:- Total Nine questions will be set. The candidates will attempt 5 questions in all, one from each unit. Question number one will be compulsory, consisting of short answer question, covering the entire syllabus. All the questions carry equal marks.

Unit-I

Ecosystem : Basic concepts, components of ecosystem.

Trophic levels, food chains and food webs.

Ecological pyramids, ecosystem functions.

Energy flow in ecological systems, energy efficiencies.

Unit-II

Biogeochemical Cycles : Importance, gaseous and sedimentary cycles.

Carbon, Nitrogen, Phosphorus and Sulphur Cycles.

Global Oxygen Cycles.

Hydrological cycles.

Unit-III

Succession : Concepts of succession, Types of Succession.

Trends in succession.

Climax and stability.

Co-evolution and group selection.

Unit-IV

Major biomes of the world.

Characteristics of terrestrial fresh water and marine ecosystems.

Forests, grasslands, lake, river and marine ecosystems of India.

Suggesting Reading:

ELEMENTS OF ECOLOGY & ECOSYSTEM DYNAMICS

1. Muller-Dombois, D. and Ellenberg, H. (1974). Aims and Methods of Vegetation Ecology, Wiley, New York.
2. Odum, E.P. (1983), Basic Ecology, Sanders, Philadelphia.
3. Robert Ricklefs (2001). The Ecology of Nature. Fifth Edition. W.H. Freeman and Company.
4. Singh K.P. and J.S. Singh (1992). Tropical Ecosystems: Ecology and Management. Wiley Eastern Limited, Lucknow, India.
5. Singh, J.S. (ed.) 1993. Restoration of Degraded Land: Concepts and Strategies. Rastogi Publications, Meerut.
6. Smith, R.L. (1996). Ecology and Field Biology, Harper Collins, New York.
7. Botkin, D.B. and Keller, E.A. 2000. Environment Science: Earth as a living planet. Third Edition. John Wiley and Sons Inc.

Syllabus and Courses of Reading
B.Sc. Environmental Science (First Semester)
(w.e.f. 2008-2009)

Paper-III: Biodiversity Components

Max. Marks : 40 + 10(IA)
Time : 3 Hours

Note:- Total Nine questions will be set. The candidates will attempt 5 questions in all, one from each unit. Question number one will be compulsory, consisting of short answer question, covering the entire syllabus. All the questions carry equal marks.

Unit-I

Biodiversity: Basic concepts, importance and conservation needs.
Species diversity, Biological and phylogenetic species concept.
Basic concepts of speciation, species extinction.

Unit-II

Biological classification, taxonomic nomenclature.
Principles of classification and nomenclature of plants.
Micro-organism: main taxonomic groups of micro-organism.
Organization and function of a bacterial and fungal cell.

Unit-III

General characteristics, habitat and economic importance of photosynthetic bacteria.
Chemoautotrophs, bacteria, blue-green algae, yeasts, fungi and algae.
Microbial toxins in environment, microbial diseases of man.

Unit-IV

Bryophytes and lichen, land habit in Bryophytes, role of bryophytes in soil building.
Lichens as ecological indicators.
Pteridophytes, gymnosperms and angiosperms, general characteristics, habitat, role in environment and economic uses.

Paper-IV : Biodiversity Conservation and Ecosystem Services

Max. Marks : 40 + 10 (IA)

Time : 3 Hours

Note:- Total Nine questions will be set. The candidates will attempt 5 questions in all, one from each unit. Question number one will be compulsory, consisting of short answer question, covering the entire syllabus. All the questions carry equal marks.

Unit-I

Introduction to classification of animal kingdom.

Diversity of insects, nematodes, fishes, birds, reptile and other mammals.

Animal food and fisheries.

Role of animal and insects in pollination and seed dispersal.

Economic importance of wild life.

Unit-II

Factors for decline of biological diversity.

Approaches for conservation of biological diversity.

Protection of wild flora, fauna and natural habitats.

Concept of threatened species.

Threatened and endangered animals of India.

Unit-III

Food, timber and medicinal plants non-timber forest produce.

Importance of tropical rain forests and wetlands.

Wild life sanctuaries, National Parks and Biosphere Reserve.

Concept of genetic diversity, gene and germ-plasm banks.

Unit-IV

Biodiversity convention.

International and national efforts to conserve biodiversity.

Socio-cultural aspects of biodiversity.

Biotechnological needs for biodiversity conservation.

Traditional knowledge and biodiversity conservation.

Suggesting Reading:

BIODIVERSITY COMPONENTS & BIODIVERSITY CONSERVATION AND ECOSYSTEM SERVICES

1. Chandel, K.P.S., Shukla, G. And Sharma, N. (1996). Biodiversity in Medicinal and Aromatic Plants in India Conservation and Utilization, National Bureau of Plant Genetic Resources, New Delhi.
2. Council of Scientific and Industrial Research (1986). The Useful Plants of India Publication and Information Directorate, CSIR, New Delhi.
3. Nair, M.N.B. et. al. (Eds.) (1998). Sustainable Management of Non-wood Forest Products. Faculty of Forestry, University Putra. Malaysia. 434 004 PM Serdang, Selangor, Malaysia.
4. Soule, M.E. (ed.) (1986). Conservation Biology. The Science of Scarcity and Diversity. Sinaur Associates, Inc., Sunderland, Massachusetts.
5. Singh, J.S., Singh, S.P. and Gupta, S.R. 2006. Ecology, Environment and Resource Conservation, Anamaya Publishers, New Delhi.

Paper-V : Practical

Max. Marks : 100

Time : 6 Hours (in two sessions)

Section-A

1. Determination of requisite size of the quadrant for vegetation analysis.
2. Analysis of frequency distribution of plants in a piece of vegetation by quadrat method.
3. To determine chlorophyll content of the given plant material.
4. To determine basal cover of trees in a forest ecosystem/forest plantation.
5. Quantitative analysis of soil organic carbon.
6. Quantitative analysis of soil pH.
7. To study pore space, water holding capacity and bulk density of soil.
8. Identification of rocks and minerals on the basis of physical characters.

Section-B

1. Temporary wet amount technique for the observation of living organism.
2. Ecological comments on charts/material/fresh plant material (as per syllabus).
3. Comments on economic uses of plant material (as per syllabus).
4. Preparation of field report based on the survey of local flora.
5. Study of centre of diversity of plants from maps.

Section-C

1. Comments on life cycle of some economically important insects.
2. Identification of museum specimens of some economically important fishes.
3. Study of flora and fauna through charts and maps.
4. Preparation of field report based on the visit to a Wild Life Sanctuary/National Park/Zoo/Biosphere Reserve.

Distribution of Marks:

1.	One experiment from Section-A	20 marks
2.	One experiment from Section-B	20 marks
3.	One experiment from Section-C	20 marks
4.	Viva-voce (based on theoretical aspects of Experiments prescribed)	10 marks
5.	Lab Record	10 marks
6.	Field Report	20 marks
	Total	<hr/> <u>100 marks</u>

B.Sc. ENVIRONMENTAL SCIENCE
Scheme of Examinations

IIIrd Semester

Paper-VI	Renewable and Non Renewable Energy Resources	3 periods/per week
Paper-VII	Natural Resources and Forest Management	3 periods/per week
Paper-X	Practicals	6 periods/per week

IVth Semester

Paper-VIII	Physico Chemical Environment	3 periods/per week
Paper-IX	Environmental Pollution	3 periods/per week
Paper-X	Practicals	6 periods/per week

Outline of Examinations

Paper	Nomenclature	Internal Assessment	External	M. Marks	Time
IIIrd Semester					
VI	Renewable and Non Renewable Energy Resources	10	40	50	3-Hours
VII	Natural Resources and Forest Management	10	40	50	3-Hours
IVth Semester					
VIII	Physico Chemical Environment	10	40	50	3-Hours
IX	Environmental Pollution	10	40	50	3-Hours
X	Practicals*	0	100	100	6-Hours of 2 session

* At the end of Fourth Semester

Syllabus and Courses of Reading

Paper – VI : Renewable and Non Renewable Energy Resources

Max. Marks : 40+10(IA)

Time : 3 Hours

Note :- Total 9 questions will be set. The candidates will attempt 5 questions in one from each unit. Question number one will be compulsory, consisting of short answer question, covering the entire syllabus.

Unit -I

Energy Utilization : Basic concepts and role in human civilization
Energy scenario in India
Renewable and non renewable sources of energy
Sustainable use of energy resources

Unit -II

Non Renewable Energy Resources: Fossil fuels and their reserves
Nuclear energy, types, uses and effects
Energy utilization and its effects on environment
Energy crisis

Unit -III

Renewable Energy Resources: Hydropower,
Solar energy, geothermal, tidal and wind energy,
Biomass energy, biogas and its advantages.

Unit -IV

Energy conservation : In agriculture and industrial sector.
Energy plantation ; Petro crops
Hydrogen as a source of energy
Energy from waste

Syllabus and Courses of Reading

Paper – VII : Natural Resources and Forest Management

Max. Marks : 40+10(IA)

Time : 3 Hours

Note :- Total 9 questions will be set. The candidates will attempt 5 questions in one from each unit. Question number one will be compulsory, consisting of short answer question, covering the entire syllabus.

Unit -I

Biological resources : Types and uses of biological resources
Forest Management
Forest resources of India
Wild life conservation efforts in India,
Project tiger, range management

Unit -II

Water resources : Types and uses of water resources
Methods of enhancing fresh water supply
Watershed management & its importance
Sustainable use of water resources

Unit -III

Soil ; types of soil, soil erosion
soil conservation techniques
Types of land use,
Land conservation strategies

Unit -IV

Concept of sustainable development
Environment education
Major conservation efforts – WWF, IUCN, UNEP, CITES, ENVIS.
Role of NGO's in Environment protection
Role of remote sensing in resource management.

Suggested Readings

Renewable and Non-Renewable Energy Resources and Natural Resources and Forest Management

1. Donahue R.L. and Miller R.W. 1997 Soils In Our Environment, Prentice Hall of India Pvt. Ltd., New Delhi.
2. Morgen, M.D. Morgen J.M. and Wiersima J.H. 1993, Environmental Science : Managing Physical and Biological Resources Wm C Brown Publishers London.
3. Tyler Miller Jr. G. 2005. Living in the Environment. Wadsworth Publishing Company, Belmont California.
4. Botkin, D.B and Keller E.A., 2000, Environmental Studies : The earth as a living plant. Charles E. Merrill, Publishing Co. London.
5. Shastri M.N.1995, Energy Options : Himalaya Publishing House, New Delhi.
6. Dhaliwal G.S., Sangha G.S. and Ralhan P.K. 2000, Fundamentals of Environmental Science, Kalyani Publishers, New Delhi.
7. Singh J.S., Singh S.P. and Gupta S.R., 2006, Ecology Environment and Resource Conservation, Anamaya Publishers, New Delhi.

Syllabus and Courses of Reading

Paper – VIII : Physico -Chemical Environment

Max. Marks : 40+10(IA)

Time : 3 Hours

Note :- Total 9 questions will be set. The candidates will attempt 5 questions in one from each unit. Question number one will be compulsory, consisting of short answer question, covering the entire syllabus.

Unit -I

Earth Atmosphere : Origin and Composition
Distribution of temperature and pressure in atmosphere.
Radiation budget of earth's atmosphere
Thermal Inversion.

Unit -II

Brief idea about composition and origin of earth
Internal structure of earth,
landforms,
Rocks types ; igneous, Metamorphic and sedimentary rocks

Unit -III

Aquatic environment : Fresh water, Eco System, Coastal eco systems,- a general account of mangroves and coral reefs.
Ground water aquifers, Causes for depletion
Water conservation strategies

Unit -IV

Climate classification ; monsoons,
Influences of meteorological factors on air quality,
Types of ionizing radiations,
Effect of UV radiations on physical and biological systems.

Syllabus and Courses of Reading

Paper – IX: Environmental Pollution

Max. Marks : 40+10(IA)

Time : 3 Hours

Note :- Total 9 questions will be set. The candidates will attempt 5 questions in one from each unit. Question number one will be compulsory, consisting of short answer question, covering the entire syllabus.

Unit -I

Air pollution : sources of air pollution,
Primary and secondary air pollutants.
Origin and effects of SO_x, NO_x, CO_x, CFC, Hydrocarbon,
Photochemical smog, heavy metals, particulates, control of air pollution.

Unit -II

Water pollution : sources and types of water pollution,
Effects of water pollution,
Eutrophication,
A brief idea of marine and ground water pollution

Unit -III

Soil pollution : Causes of soil pollution
Effects of soil pollution
Pesticides in soil environment and their effects
Biological magnification, pollution through mining

Unit -IV

Climate change : Causes and effects,
Threats to stratospheric ozone,
Green house effect, acid rain, climate convention.
Sources and effects of noise pollution, noise standards.

Suggested Readings

Physico Chemical Environment & Environmental Pollution

1. Brady, N.C. 1990. The nature and properties of Soils, Tenth Edition. Mac Millan Publishing Co., New York.
2. Botkin, D.B and Kodler E.A., 2000, Environmental Studies : The earth as a living planet. John Wiley and Sons Inc.
3. Rao M.N. and H.V.N. Rao, 1989 : Air Pollution, Tata McGraw Hill Publishing Co. Ltd., New Delhi
4. Tyler Miller Jr. G. 1990. Living in the Environment. Wadsworth Publishing Company, Belmont California.
5. Odum, E.P., 1983, Basic Ecology. Halt Saundurs, International Edition Japan.
6. De, A.K. 1990, Environmental Chemistry, Wiley Eastern Ltd., New Delhi.
7. Singh J.S., Singh S.P. and Gupta S.R., 2006, Ecology Environment and Resource Conservation, Anamaya Publishers, New Delhi.
8. Sodhi G.S. 2005, Fundamentals of Environmental Chemistry : Narosa Publishing House, New Delhi.

Paper – X : Practical

Max. Marks : 100

Time : 6 Hours (in two sessions)

Section – A

1. Identification of minerals and rocks on the basis of physical characteristics
2. To study a soil profile.
3. Measurement soil temperature and moisture.
4. To determine dissolved oxygen in a water body.
5. Climate classification on the basis of climographs.
6. Analysis of pesticides residues using TLC.
7. To analyse water quality using a water quality analysis kit.
8. To prepare a report on various types of local industrial effluents.
9. To prepare a report on occupational health hazards in relation to a local industry.
10. Measurement of noise level using sound level meter.

Section – B

1. To prepare energy budget of a cropping system aquaculture.
2. To determine the calorific content of the given plant material
3. To determine energy efficiencies from the given data.
4. Techniques of vegetative propagation of forestry trees.
5. Demonstration of soil conservation techniques.
6. Demonstration of water conservation techniques.
7. Preparation of report on Energy Plantation.
8. Demonstration of use of solar devices, photo-cells, wind-mills.
9. Demonstration of Biogas plant
10. Visit to a water shed management project.
11. Demonstration of extraction of forest products.

Suggested Readings

1. Allen, S.E., H.M. Grimshaw, J. Parkins, and C. Quarmby. 1974, Chemical Analysis of Ecological materials, Black will scientific publications, Oxford, IBH.
2. Anderson, J.M. and J.S.I, Ingram 1993,. Tropical soil biogas and fertility : A handbook of method, CAB International, Wailing ford, U.K.
3. Misra, R. 1968. Ecology workbook Oxford and IBH Publishing Co., New Delhi.
4. Michael, P. 1984. Ecological Methods for field and laboratory investigations. Tata –MxcGraw Hill Publishing Company Ltd., New Delhi.

Distribution of Marks :

- | | | |
|----|---|-----------|
| 1. | One experiment from section – A | 20 marks |
| 2. | One experiment from section – B | 20 marks |
| 3. | Viva –voce (based on theoretical aspects of experiments prescribed) | 10 marks |
| 4. | Practical Record | 10 marks. |
| 5. | Project report based on field training and seminars | 40 marks. |

Total **100 marks.**

*** Two trips are essential for the field training of the students.**

B.Sc. ENVIRONMENTAL SCIENCE
Scheme of Examinations

Vth Semester

Paper-XI	Environmental Monitoring
Paper-XII	Environmental Techniques & Impact Assessment
Paper-XV	Practicals

VIth Semester

Paper-XIII	Environmental Management
Paper-XIV	Eco Restoration and Development
Paper-XV	Practicals

Outline of Examinations

Paper	Nomenclature	Internal Assessment	External	M. Marks	Time
Vth Semester					
XI	Environmental Monitoring	10	40	50	3 Hours
XII	Environmental Techniques & Impact Assessment	10	40	50	3 Hours
VIth Semester					
XIII	Environmental Management	10	40	50	3 Hours
XIV	Eco Restoration and Development	10	40	50	3 Hours
XV	Practicals*	0	100	100	6 Hours of 2 Sessions

* At the end of Sixth Semester

Syllabus and Courses of Reading

Paper – XI : Environmental Monitoring

Max. Marks : 40+10(IA)

Time : 3 Hours

Note :- Total 9 questions will be set. The candidates will attempt 5 questions in one from each unit. Question number one will be compulsory, consisting of short answer question, covering the entire syllabus.

Unit -I

Environment monitoring : Concept, aims, measurement and data collection on Meteorological parameters – solar radiation, temperature Humidity, precipitation, wind direction and speed. Plume behaviour, wind rose – a brief idea.

Unit -II

Chemical aspect of air quality monitoring : sampling of gaseous and suspended particulate matter ; basic considerations, devices and methods used : absorption, adsorption, condensation, sedimentation, filtration, Impingement, electrostatic precipitation, centrifugal methods.

Unit -III

Water quality monitoring : water quality parameters,
Physical and chemicals characteristics of water :
Colour, turbidity, odour and taste, total solids, conductivity,
pH, acidity, alkalinity, hardness, Dissolved Oxygen, Biological Oxygen Demand
Chemical Oxygen demand

Unit -IV

Biological aspects of Environment Monitoring: Bio indicators of environmental monitoring
Microbiological quality of water
Bio indicators of water quality
Vegetation monitoring – a brief idea.

Syllabus and Courses of Reading

Paper – XII : Environmental Techniques & Impact assessment

Max. Marks : 40+10(IA)

Time : 3 Hours

Note :- Total 9 questions will be set. The candidates will attempt 5 questions in one from each unit. Question number one will be compulsory, consisting of short answer question, covering the entire syllabus.

Unit -I

Basic environmental techniques : Colorimetry,
Flame photometry,
Chromatography – paper chromatography, Thin layer chromatography,
Column chromatography, Gas chromatography, Gas Liquid chromatography.

Unit -II

Sampling methods : Random and non random sampling –
concepts of mean (Arithmetic mean, Geometric mean, Harmonic mean),
mode, median,
Standard deviation and Standard error
t-test and Chi. Square test

Unit -III

Principles of Environmental management,
Computer application in ecology and environmental monitoring,
Data tabulation of meteorological parameter, weather forecasting,
Measurement of soil salinity and acidification.

Unit -IV

EIA – Aims, objectives and methods
EIA case studies river valley, projects and thermal power plants
Geographical Information System
Remote sensing and application in environment

Suggested Readings

Environmental Monitoring & Environmental Techniques and Impact Assessment

1. Khopkar, S.M. 1993 : Environmental Pollution Analysis, Wiley Eastern Limited New York
2. Rao M.N. and H.V.N. Rao, 1989 : Air Pollution, Tata McGraw Hill Publishing Co. Ltd., New Delhi
3. Wild A., 1993 : Soils and the Environment, Cambridge University Press, Cambridge.
4. Tyler Miller Jr. G. 1990. Living in the Environment. Wadsworth Publishing Company, Belmont California.
5. Botkin, D.B and Keller E.A., 1982 : Environmental Studies : The earth as a living plant. Charles E. Merrill, Publishing Co. London.
6. Botkin, D.B and Keller E.A., 1995 : Environmental Science ; Earth as a Living Planet, John Wiley and Sons Inc., New York.
7. Manahan, S.E. 2000. Environmental Chemistry, Seventh Edition, Lewis Publishers, New York.
8. Singh J.S., Singh S.P. and Gupta S.R., 2006, Ecology Environment and Resource Conservation, Anamaya Publishers, New Delhi.
9. Gupta S.P. 2005, Statistical Methods, Sultan Chand and Sons, New Delhi.
10. Upadhaya A, Upadhaya K, Nath N, 1993, Bio Physical Chemistry, Principles and Techniques, Himalaya Publishing House, New Delhi.

Syllabus and Courses of Reading

Paper – XIII : Environmental Management

Max. Marks : 40+10(IA)

Time : 3 Hours

Note :- Total 9 questions will be set. The candidates will attempt 5 questions in one from each unit. Question number one will be compulsory, consisting of short answer question, covering the entire syllabus.

Unit -I

Air pollution : Sources, types and effects,
Effects of air pollution on plants and air quality,
Human health and animals,
Economic losses.

Unit -II

Control of Pollution : Control of stationary sources of pollution,
Particulate emission control, gaseous emission control
Role of plants and trees in air pollution abatement, green belt development for industries.

Unit -III

Waste Generation : Biodegradable and non biodegradable wastes
Agricultural, domestic and industrial wastes
Plastic waste and disposal,
Hazardous waste – origin and types

Unit -IV

Waste Management :Methods of waste disposal, inceneration, landfill,
Composting, Anaerobic waste degradation
Production of liquid and gaseous fuels from waste
Hazardous waste management

Syllabus and Courses of Reading

Paper – XIV : Eco Restoration and Development

Max. Marks : 40+10(IA)

Time : 3 Hours

Note :- Total 9 questions will be set. The candidates will attempt 5 questions in one from each unit. Question number one will be compulsory, consisting of short answer question, covering the entire syllabus.

Unit -I

Degraded lands : agricultural practices and land degradation,
Mining and its impact on soil quality
Conservation of degraded lands,
Rehabilitation of mine soils and salt affected soils,

Unit -II

Soil Conservation : Biological reclamation techniques
Bio fertilizers, microrhizae,
Vermi composting, afforestation,
Organic farming, Bio remediation.

Unit -III

Approaches for environmental awareness and education,
Role of media in environmental awareness,
Role of women in environmental awareness.
Eco development and environmental friendly products and technologies.

Unit -IV

National environmental policy
Environmental laws in India
Sustainability – concept, principles and practices
Sustainable management of resources
Ecological modelling – a brief idea.

Suggested Readings

Environmental Management & Eco Restoration and Development

1. Atlas, R.M. and Bartha R., 1987 : Microbial Ecology ; Fundamentals and Applications. 2nd Ed. Readign Mass, Addison Wesley.
2. Lim, D.V. 1989 : Microbiology West Publishing Company, New York.
3. Morgen, M.D. Morgen J.M. and Wiersima J.H. 1993, Environmental Science : Managing Physical and Biological Resources Wm C Brown Publishers London.
4. Owen, O.S and Chiras D.D., 1992 : Resource Conservation. An Ecological Approach. Macmillan Publishing Company, New York.
5. Tyler Miller Jr. G. 1990. Living in the Environment. Wadsworth Publishing Company, Belmont California.
6. Cunningham. W.P., 1994, Understanding Our Environmental : An Introduction W.C. Brown Publishers, Oxford.
7. Singh J.S., 1993, Restoration of degraded lands, Rastogi Publications, Meerut.
8. Singh J.S., Singh S.P. and Gupta S.R., 2006, Ecology Environment and Resource Conservation, Anamaya Publishers, New Delhi.

Paper – XV : Practical

Max. Marks : 100

Time : 6 Hours (in two sessions)

Section – A

1. A study of local sources and types of industrial waste.
2. To prepare a report on the effect of local industrial activities on human health.
3. Demonstration of composting techniques.
4. Visit to sewage treatment plants.
5. Vermi composting of organic wastes.
6. Anaerobic digestion of cattle waste.
7. Study of soil microbial activity
8. Field Ecology – Terrestrial and aquatic flora
9. Visit to waste water treatment plants.
10. Visit to industry for a survey of air pollution control equipments

Section – B

1. Measurement of humidity air temperature and wind speed.
2. Preparation of ombrothermic diagram from long term data on temperature and rainfall.
3. To analyse physical and chemical properties of water.
4. To determine soil salinity and alkalinity
5. Demonstration of the working of flame photometer.
6. Demonstration of working of an atomic absorption spectrophotometer for detecting heavy metals.
7. Estimation of Kjeldahl Nitrogen and phosphorous in

Suggested Readings

1. Rao M.N. and H.V.N. Rao, 1989 : Air Pollution, Tata McGraw Hill Publishing Co. Ltd., New Delhi
2. Misra, R. 1968. Ecology workbook Oxford and IBH Publishing Co., New Delhi.
3. Anderson, J.M. and J.S.I, Ingram 1993,. Tropical soil biogas and fertility : A handbook of method, CAB International, Wailing ford, U.K.
4. Khopkar S.M., 1993 : Environment Pollution Analysis, Eastern Limited, New York.

Distribution of Marks :

1.	One experiment from section – A	20 marks
2.	One experiment from section – B	20 marks
3.	Viva –voce (based on theoretical aspects of experiments prescribed)	10 marks
4.	Practical Record	10 marks.
5.	Project report based on site visited	40 marks.

Total **100 marks.**

* **Two excursion trips are essential for field training of the students.**