

M.Sc. (Previous)

Environmental Sciences -2010-2011

The M.Sc. (Previous) examination shall consist of four theory papers, each of three hours duration. There shall be two practical examinations based on theory papers. The practical examination shall be of ten hours, divided in two days.

	<u>Marks</u>
Paper-I: Basic Concepts and Elements of Ecology	100
Paper-II: Earth Processes and Natural Cycles	100
Paper-III: Energy, Natural Resources and Their Conservation	100
Paper-IV: Pollution and Environmental Monitoring	100
Practical -I	100
Practical -II	100

Pattern of question paper in the annual examination and distribution of marks:

Each theory paper in the annual examination shall have three sections i.e. A, B, and C. In section A, total 10 questions will be set in the paper, selecting at least two from each unit. These questions to be answered in a word or so. All questions are compulsory. Each question carries 1 mark, total 10 marks.

In section B, there shall be total 10 questions, selecting two questions from each unit, five questions to be answered by the student selecting at least one from each unit. Answer should be given in approximately 250 words. Each question carries 10 marks, total 50 marks.

In section C, 04 descriptive type questions will be set in the examination paper from five units of the syllabus of the paper, selecting not more than one question from a unit. Each question may have two sub divisions. Students are required to answer any two questions approximately in 500 words. Each question is of 20 marks, total 40 marks.

M.Sc. (Previous)
Environmental Sciences -2010-2011

PAPER-I

BASIC CONCEPTS AND ELEMENTS OF ECOLOGY.

Duration: 3 hours

M.M.: 100

UNIT-I

Basic concepts of ecology; Scope of Ecology and its relations with other disciplines Ecology in India; Principles pertaining to ecosystem; ecosystem components; Production and decomposition in nature; Principles of limiting factors; Homeostasis in ecosystem; Energy flow in ecosystem; ecosystem energetics; Trophic relations and ecological pyramids; Food chains and food webs; Processes of primary productivity; gross and net productivity; Productivity in different ecosystems

UNIT-II

Biogeochemical cycles in nature; concepts and significance; Carbon cycle; Nitrogen cycle; Phosphorus cycle; Sulphur cycle; Synecology : Biotic community concept and community classification; Pattern in vegetation and measures of non-randomness; Ecotone and continuum concept; Species diversity, ecological dominance and ecological Niche; Ecological succession, concept of climax and community stability.

UNIT-III

Autecology : Basic principles; concept of population growth and survivorship; Ecotypic differentiation, ecophene and ecads; Population characteristics and dynamics; Population growth forms and concept of carrying capacity; Population regulation; Physicochemical characteristics of freshwater environment; Lentic and Lotic ecosystems; Classification of lakes; Origin of lakes; Salt lakes of the world .

UNIT-IV

Biotic communities of ponds and lakes; Thermal stratification in lakes; Fish production and aquaculture; Eutrophication: causes, consequences and control measures; Conservation and management of freshwater habitats; physicochemical characteristics of marine ecosystem;

Ecological zonation of marine environment; biotic communities of oceanic regions; Coral reefs and mangroves; estuarine ecology: physicochemical aspect and biotic communities.

UNIT-V

Physicochemical characteristics of terrestrial environment; Forest Biomes; Grassland Biomes Desert Biomes; Tundra Biomes; Descriptive and interpretive phytogeography; Descriptive zoogeography; Endemism; age and area hypothesis; Flora and vegetation of India; Dispersal dynamics.

BOOKS RECOMMENDED:

- 1 Chapman & Reiss : Ecology-Principles and Applications, Cambridge University Press,U.K
- 2 Enger and Smith: Environmental Science- a study of relationships (7th edition), Mcgraw-Hill Companies, Inc. USA.
- 3 R.G.Wetzel: Limnology - Lake and River Ecosystems, Academic Press, USA.
- 4 Botkin and Keller: Environmental Science, John Wiley and Sons. , USA.
- 5 E.P.Odum: Fundamentals of Ecology (3rd edition) Saunders.
- 6 Paul I. Hancock and Brian J. Skinner (2000): The Oxford Companion to the Earth, Oxford University Press, U.K.

M.Sc. (Previous)
Environmental Sciences -2010-2011

PAPER-II

EARTH PROCESSES AND NATURAL CYCLES

Duration: 3 hours

M.M.: 100

UNIT-I

Evolution of atmosphere; Chemical composition and thermal stratification of present day atmosphere; Atmosphere and earth radiation balance; Circulation of earth's atmosphere and world precipitation pattern; Precipitation to evaporation ratio; hydrological cycle; World climate regimes; climate types of India.; Climate classification : Brief historical account; Basis of climate classification; Köppen's climate classification system; Climate and Biosphere : Concept of "climate system".

UNIT-II

Climate control of distribution of plants; Climate control of distribution of Animals; Gaia hypothesis; Climate and biosphere feedback mechanisms; Climatic elements in crop production; Climate and habitable areas; Climate and rural housing; Climate and buildings ; The need of climatic data; Microclimate and architectural design; Climate classification for housing.

UNIT- III

The human body and heat balance; Empirical estimates of physical feeling ; Climate and human health; Climate and race temperament ; Clothing insulation and clothing zones of the world; Soil formation and development ; Soil structure and soil components; Soil classification; Correspondence of soil with vegetation and climate; Soil biology and soil fertility.

UNIT-IV

Atmospheric moisture and precipitation; Water and plant relationships; Ecological adaptations in hydrophytes ; Ecological adaptations in xerophytes; Animal adaptations to aquatic and desert environment; Importance of light to plants ; Plant and animal adaptation to light; Tree layering

and shade tolerance, concept of adaptive geometry of trees; Photoperiodism and its ecological significance; Light in relation to plant communities.

UNIT-V

Importance of temperature to plants; Thermoperiodism and phenology; Effect of temperature on distribution of plants; Extreme temperature injury in plants; Heat budget and temperature regulation in plants and animals; Concept of niche overlap and competition for resources; Mutualism and Commensalism; Predation and Parasitism; Animals in pollination and dispersal of fruits; Fire factor- kinds, adaptations to fire and significance of vegetation burning.

BOOKS RECOMMENDED:

1. Daubenmire: Environmental Factors.
2. Thompson and Perry : Climatology
3. Paul I. Hancock and Brian J. Skinner (2000) : The Oxford Companion to the Earth, Oxford University Press, U.K
4. Chapman & Reiss : Ecology-Principles and Applications, Cambridge University Press,U.K
5. Paul Colinvaux: Ecology2 (1986) John Wiley and Sons.
6. A.K.De (1999) : Environmental Chemistry (3rd Edition),New Age International (P) Ltd Publishers, New Delhi

M.Sc. (Previous)
Environmental Sciences -2010-2011

PAPER-III

ENERGY, NATURAL RESOURCES AND THEIR CONSERVATION

Duration: 3 hours

M.M.: 100

UNIT-I

Natural resources and their classification; Biosphere reserves; Nature conservation and its importance in national Economy; Human use of surface and ground water; Environmental impact of resource exploitation; Resources of oceans and their conservation; Origin and composition of sea water; Conventional and non-conventional energy resources; Renewable and non-renewable energy resources; Commercial and non-commercial energy demand; Economic and environmental perspectives of energy demand; Energy conservation.

UNIT-II

Types of energy resources; Coal and Nuclear energy; Crude oil; Natural gas and natural gas liquids; Geothermal energy, Tidal power, refuse; Biomass fuel types ; Availability of biomass fuels in India; Energy plantation; Petrocrops and energy weeds; Organic residues;

UNIT -III

Solid and liquid fuels; Biogas production; Conservation and management of biomass fuels; Concept of environmentally sustainable technology (EST); Management of Nuclear energy; Sun as source of energy; solar radiation and its spectral characteristics; Biological diversity: Definition, concepts and importance of biodiversity conservation; Endangered flora of India
Endangered fauna of India; Biodiversity conservation; Red Data book.

UNIT-IV

Conservation of wild life - Its significance and status in India; Project Tiger; Management of zoological collections; Importance of biodiversity in Ecotourism; Wildlife reserves; Sanctuaries

and National parks of India; Endemic flora and fauna of tropics with special reference to India; Impact of tourism on wildlife; National and International strategies for conservation; Hotspots of biodiversity; Gene pool; Ecological genetics.

UNIT-V

Conservation of forests - Indian strategies and plannings; Agroforestry; Social forestry; Management of forest products; Forests and tribals; Chipko Andolan; Conservation of land resources - global and Indian perspectives; Land use planning and management; Soil erosion - causes and consequences; Soil conservation; Wetland conservation with special reference to Rajasthan.

BOOKS RECOMMENDED:

- 1 Oliver S. Owen: Natural Resource Conservation - an ecological approach, (3rd edition), Mcmillan Publications. Co. Inc. New York
- 2 Raymond F. Dasmann: Environmental Conservation (5th edition), John Wiley and Sons.
- 3 K. chapman and A.S. Mathure: Environmental Resources, Kongman Scientific and Technical, England.
- 4 H.S. Mathure: Environmental Resources - The crisis of Development, RBSA Publishers.
- 5 Maheshwar Dayal: Renewable Energy, Konark Publishers Pvt. Ltd.
- 6 Sutherland: The Conservation Hand Book, Research Management and Policey, Blackwell Science Ltd. U.K.

M.Sc. (Previous)
Environmental Sciences -2010-2011

PAPER-IV

POLLUTION AND ENVIRONMENTAL MONITORING

Duration: 3 hours

M.M.: 100

UNIT -I

Sources of major air pollutants (SO₂, NO₂, O₃, Co and HF); Chemistry of secondary pollutants; Air pollution and meteorology; Photochemical smog and acid rain; Indoor Air Pollution; Effect of gaseous air pollutants on plants; Effect of gaseous air pollutants on animals; TSP and their effects on plants and animals; Air pollution tolerance index; Air quality standards; Eurostandards; Air pollution control.

UNIT-II

Sources of water pollution; Classification of water pollutants; Water quality standards; Water pollution control; Ganga action plan; Marine pollution; Sources of soil pollution; Heavy metals : sources and effect on biological systems; Pesticides : sources and effect on biological systems; Detrimental effects of soil pollutants on soil microbiota : Ecological consequences; Soil pollution control.

UNIT-III

Sources and classification of Radioactive pollutants; Effect of radioactive pollution on biological systems; Sources and measurement of noise pollution; Noise exposure levels and standards; Noise pollution control and abatement measures; Principles of air monitoring; Air sampling methods; Air sampling instruments and sampling operations; Site selection and sampling periods ; Analysis of air samples: Stack sampling

UNIT-IV

Principles of water quality monitoring; Methods of water sampling; Water sampling instruments; Physicochemical analysis of water; Bacteriological sampling and analysis of water quality; Site selection and methods of soil sampling; Physicochemical analysis of soil

Bacteriological analysis of soil; Bio monitoring of air, water and soil environment; Concept of indicator species and their environmental significance.

UNIT-V

Sources and chemical characterization of solid wastes; Solid waste disposal and management; Sources and chemical characterization of liquid wastes; Liquid wastes disposal and management; Disposal and management of radioactive wastes; Basic principles of Remote sensing ; Energy interaction and spectral reflectance of earth surface features; Remote sensing observation platforms; Imaging sensors and digital image processing; Applications of remote sensing.

BOOKS RECOMMENDED:

- 1 Robert Noyes : Hand Book of Pollution Control Processes, Jaico Publishers, Mumbai
- 2 Kaytal and Satake: Environmental pollution, Anmol Publications, New Delhi.
- 3 Kudesia: Noise Pollution and its Control, Pragati Prakashan, Meerut.
- 4 Paul I. Hancock and Brian J. Skinner (2000) : The Oxford Companion to the Earth, Oxford University Press, U.K
- 5 V.P.Kudesia (2001): Noise Pollution and its Control. Pragati Prakashan, Meerut.
- 6 Basra, Amarjit S. and Basra Ranjit K (1997): Mechanism of Environmental Stress Resistance in Plants, Harwood Academic Publishers, Netherlands.

M.Sc. (Previous)

Environmental Sciences -2010-2011

SCHEME OF PRACTICAL EXAMINATION

<u>S.No.</u>	<u>Exercise</u>	<u>Regular</u>
1	Major Exercise	20
2	Minor Exercise/Case Study -I	15
3	Minor Exercise/Case Study-II	15
4	Slide Preparation	10
5	Spotting (1-10)	20
6	Viva-voce	10
7	Record	10
	Total :-	100

M.Sc. (Previous)

Environmental Sciences -2010-2011

PRACTICAL-I

Duration: 5 hours per day for two days

M.M. 100

- 1 Determine the minimum size of the quadrat by species area curve method.
- 2 Find out the percentage frequency values of grassland species using 1×1 size quadrat. Classify the species into frequency classes A to E and prepare the frequency diagram. Compare results with Raunkiaer's standard frequency diagram.
- 3 Study of vegetation by line transect.
- 4 Determination of importance value index (IVI)
- 5 Determination of Biomass of producers.
- 6 Find out the effect of varying quadrat size 25 × 25, 50 × 50, 75 × 75 cm and 1 × 1 m. on percentage frequency result on same grassland plot considered in exercise-2.
- 7 Find out the similarity and dissimilarity indices between a disturbed (grazed) and undisturbed (ungrazed) grassland.
- 8 Find out the species diversity index in disturbed and protected vegetation areas.
- 9 Determine the pattern (non-randomness) in vegetation
- 10 Find out the leaf area index of a crop field.
- 11 Estimation of total chlorophyll content of herbaceous vegetation on per square meter of land area basis.
- 12 Study the internal features of ecological adaptation in selected hydrophytes and xerophytes.
- 13 Studies on biotic interactions.
- 14 Study of fauna in relation to environment/environmental stress.
- 15 Elementary knowledge of the principles and working of weather instruments.
Thermometers.

Wet and dry bulb thermometer
Thermograph
Barometer, Fortin's and Aneroid
Anemometer

16 Representation of climate data :

- I
 - (1) Simple graph
 - (2) Combine bar and line graph
 - (3) Climograph
 - (4) Hythergraph
 - (5) Rainfall variability graph
 - (6) Wind rose
- II Observation of India weather maps.

17 Study of climatic conditions obtained in open field and under the shade of trees for temperature, light intensity, wind velocity, RH etc. and comparison of the ground vegetation of these areas.

BOOKS RECOMMENDED:

- 1 J. Pandey and M.S.Sharma: Environmental Science - Practical and Field Manual, Yash Publications, Bikaner

M.Sc. (Previous)

Environmental Sciences -2010-2011

PRACTICAL-II

Duration: 5 hours per day for two days

M.M. 100

- 1 Analysis of air samples-
 - (i) SO₂
 - (ii) SPM
 - (iii) Dust fall
 - (iv) CO₂
- 2 Analysis of Water samples -
 - (i) Dissolved O₂
 - (ii) Chlorides
 - (iii) Nitrates
 - (iv) Phosphates
 - (v) Silicates
 - (vi) Hardness
 - (vii) BOD
 - (viii) COD
 - (ix) Primary productivity
 - (x) pH
 - (xi) Conductivity
 - (xii) Dissolved organic matter
 - (xiii) Carbonates and bicarbonates
- 3 Analysis of Soil samples -
 - (i) Texture
 - (ii) Moisture contents
 - (iii) pH

- (iv) Conductivity
 - (v) Water holding capacity
 - (vi) Chlorides
 - (vii) Nitrates
 - (viii) Total phosphorus and organic carbon
- 4 Principle of working of Bomb calorimeter and determination of the calorific values of-
 - (i) Common grasses
 - (ii) Legumes
 - (iii) Rice straws
 - (iv) Fatty materials
 - 5 Estimation of crude proteins
 - 6 Study of petro plants and energy plantation found in and around Udaipur, general information through herbarium sheets and field study.
 - 7 To compare the soil erosion and water run off from bare and plant covered plots.
 - 8 Qualitative and quantitative analysis of planktons in polluted waters.
 - 9 Study of foot prints and demarcation of territorial limits of few wild animals.
 - 10 Local field excursions and visits.

BOOKS RECOMMENDED:

- 1 J. Pandey and M.S.Sharma: Environmental Science - Practical and Field Manual, Yash Publications, Bikaner
- 2 S.K.Maiti: Hand Book of Methods in Environmental Studies (Vol.1, Water and Waste Water) ABD Publishers, Jaipur.
- 2 N.Manivasakam: Physico Chemical Examination of Water, Sewage and Industrial Effluents, Pragati Prakashan, Meerut.
- 3 M.L.Jackson: Soil Chemical Analysis, Prentice Hall of India Pvt. Ltd. New Delhi.

M.Sc. (Final)

Environmental Sciences -2010-2011

The M.Sc. (Final) examination shall consist of three compulsory papers I and II and III common for all the students and One Elective paper- IV, i.e. total four theory papers, each of three hours duration. There shall be two practical examinations. The practical-I will be based on paper I and II. The Practical-II will be based on paper II and III. Each practical examination shall be of ten hours, divided in two days.

COMPULSORY PAPERS: Common for all students (core papers)

	<u>Marks</u>
Paper-I: Environmental Toxicology and Public Health	100
Paper-II: Global Environmental Changes, Natural Hazards and Impact Assessment	100
Paper-III: Biostatistics, Computer Application and Environmental Education and Laws	100

ELECTIVE PAPERS

Paper-IV (I): System Analysis and Modeling	100
Paper-IV (II): Environmental Engineering and Biotechnology	100
Practical -I	100
Practical -II	100

Pattern of question paper in the annual examination and distribution of marks:

Each theory paper in the annual examination shall have three sections i.e. A, B, and C. In section A, total 10 questions will be set in the paper, selecting at least two from each unit. These questions to be answered in a word or so. All questions are compulsory. Each question carries 1 mark, total 10 marks.

In section B, there shall be total 10 questions, selecting two questions from each unit, five questions to be answered by the student selecting at least one from each unit. Answer should be given in approximately 250 words. Each question carries 10 marks, total 50 marks.

In section C, 04 descriptive type questions will be set in the examination paper from five units of the syllabus of the paper, selecting not more than one question from a unit. Each question may

have two sub divisions. Students are required to answer any two questions approximately in 500 words. Each question is of 20 marks, total 40 marks.

M.Sc. (Final)

Environmental Sciences -2010-2011

PAPER-I

ENVIRONMENTAL TOXICOLOGY AND PUBLIC HEALTH

Duration: 3 hours

M.M.: 100

UNIT-I

General aspects of toxicology; Concepts of dose-response relationship; chronic toxicity
Short-term lethality and acute toxicity; Median tolerance limit; Risk assessment; Toxicity testing: Holistic and numeric approach; Drug toxicity and drug abuse; Metal toxicity in animals; Teratogenicity and carcinogenicity; Practical problems in toxicity testing

UNIT-II

Uptake of toxic substance by animals; Accumulation and chemical localization of toxic substances by animals; Detoxification and excretion of toxic substances by animals; Metabolism of toxic substances by animals; Food poisoning and pathogen toxins; Uptake of toxic substances by plants; Metabolic basis of toxicity of SO₂, NO₂, O₃, and heavy metals in plants; Microbial transport of toxic metals; Air and water borne toxins and diseases; Radiation toxicology and safety measures.

UNIT-III

Toxic effects of pollution on terrestrial animals; Toxic effects of pollutants on aquatic animals; Effect of pollutants on plants and plant communities; Effect of pollutants on plankton and microorganisms; Chemical hazard assessment and communication; Environmental factors in human health; Disease causing infectious organisms (virus, bacteria and parasites), teratogens and mutagens; Detailed account of AIDS and sexually transmitted diseases (STD); Causes and consequences of hazardous wastes in soil, water and air with respect to human health; Environmental health management.

UNIT-IV

Occupational hazard and diseases with reference to silicosis, byssinosis, anthrax and other lung diseases; WHO standards of working conditions; Physical factors effecting occupational health (heat, cold and temperature); Prevention of occupational diseases; Various international organizations : (WHO, ILO, UNICEF) on human health ; Air pollution and human health ;

Causes of air pollution and Air borne disease; Soil pollution: Sources and effects on human health ; Water pollution : Sources and effects on human health; Water borne disease; risk assessment and preventive measures.

UNIT-V

Nuclear pollution and human health; Case studies; Agricultural chemicals and human health; Hazardous wastes, human health and management; Noise pollution and human health hazards; Human health education and awareness; Hospital waste and human health; Indoor pollution and human health; Environmental health management in India; Occupational safety and health administration; Environmental health in tribals: Problems and remedies; Environmental protection: Issues and problems.

BOOKS RECOMMENDED:

- 1 Ming Ho-Yu: Environmental Toxicology, Lewis Publishers, New Delhi.
- 2 P.D.Sharma: Environmental Toxicology, Rastogi Publications, Merrut.
- 3 J.W.Vincoli: Lewis Dictionary of Occupational and Environmental Safety and Health, Lewis Publishers.
- 4 C.S.Rose: Environmental Toxicology- Current Development, Gordon and Breach Science Publishers, Australia.

M.Sc. (Final)

Environmental Sciences -2010-2011

PAPER-II

GLOBAL ENVIRONMENTAL CHANGES, NATURAL HAZARDS AND IMPACT ASSESSMENT

Duration: 3 hours

M.M.: 100

UNIT-I

Global warming: Basic principles of green house effect; Causes and consequences of global warming; Global warming potential of green house gases; Realized and effective warming; Climatic feedback mechanisms; Evolution of stratospheric ozone layer; Stratospheric ozone depletion- causes and consequences; Theories and mechanism of ozone depletion; Impact of ozone depletion on plants, animals and common future of man kind; Global efforts for abatement measures.

UNIT-II

Earthquakes; Desertification; Tropical cyclones and western disturbances; Volcanoes; Fire and famines; Floods and storms; El Nino; Prediction and perceptions of natural hazards; Management of natural hazards; Disaster management.

UNIT-III

Pollution threat to Taj Mahal; Bhopal Gas tragedy; Chernobyl accident; Pollution of Ganges; Tehri dam, Narmada dam; Environmental impact assessment: Basic concepts and significance; Impact assessment methodologies; EIA guidelines-1994; Environmental risk assessment.

UNIT-IV

Procedure for reviewing environmental impact analysis; Environmental impact statement; Prediction and assessment of impact on air environment ; Prediction and assessment of impact on water environment; Prediction and assessment of impact on noise environment; Prediction and

assessment of impact on biological environment; Prediction and assessment of impact on cultural and socio-economic environment; Eco-tourism; Restoration and rehabilitation technologies

UNIT-V

Environmental impact of traditional and modern agricultural systems; Environmental impact of tourism; Introduction to environmental planning; Land use policy for India; Environmental priorities in India and sustainable development; Environmental economics : Cost- benefit analysis; Guidelines for environmental audit; Urban and rural planning in India and land use pattern.

BOOKS RECOMMENDED:

- 1 Manahan: Environmental Chemistry, Lewis Publishers, Boca Raton, New York.
- 2 A.K.De: Environmental Chemistry, New Age International (P) Ltd., New Delhi.
- 3 Paul I. Hancock and Brian J. Skinner (2000) : The Oxford Companion to the Earth, Oxford University Press, U.K
- 4 T.N.Khosoo: Environmental Conservation and Strategies (1988) Ashis Publishing House, New Delhi.
- 5 Agarwal and Rana (1985) : Environment and Nature, Society of Biosciences.

M.Sc. (Final)

Environmental Sciences -2010-2011

PAPER-III

BIOSTATISTICS, COMPUTER APPLICATION AND ENVIRONMENTAL EDUCATION AND LAWS

Duration: 3 hours

M.M.: 100

UNIT-I

Measures of central tendency ; measures of dispersion; Frequency distribution of continuous variables; Properties and applications of normal distribution; Skewness and Kurtosis; Poisson and Binomial distribution; Standard Error of mean; t-test and paired t-test; Chi-square test
Coefficient of association (Cole's measure of association); Analysis of variance.

UNIT-II

Correlation coefficient; Testing the significance of correlation coefficient; Regression coefficient and line of best fit; Relationship between correlation and regression; Multiple regression; Basics of computer application; Characteristics of a computer; Problem solving using computer; Computer memory; magnetic hard disc; Floppy disc drives, magnetic tape drives; processor.

UNIT-III

Misuse of environment and need of environmental policy; Urbanisation and environment; Environmental education and awareness; Role of Universities in environmental education and eco-development; Agenda-21: Environment ethics; Legislation concerning environmental protection i.e. law relating hazardous substances and relevant provisions in the Factories Act 1948; Environment (Protection) Act,1986; Powers of the Central Government and provisions pertaining to prevention, control and abatement of environmental pollution; Report of Tewari committee; Environment (Prevention) Rules,1986.

UNIT-IV

Central and State Boards for prevention and control of air and water pollution; Air (Prevention and Control of Pollution) Act,1981; Air (Prevention and Control of Pollution) Amendment Act 1987 and Rules 1982; The water (Prevention and Control of Pollution) Act,1974; The water (Prevention and Control of Pollution) Amendment 1988 and Rules 1975

Motor vehicle Act 1988; Legislation related to forest and wildlife conservation; Forest conservation Act, 1980; Indian Forest Act (Revised), 1982; Wild life Protection Act 1972 and Amendment, 1991.

UNIT-V

Code of criminal procedure and environmental protection; Guidelines issued by the government of India for inspection of industries under pollution control laws; Scheme of labeling of environmentally friendly products (Ecomark); Public Liability Insurance Act,1991 and Rules,1991; Hazardous wastes management and handling rules,1989; Environmental Guidelines for industries; Industries which require industrial licensing; Industrial licensing procedure; Environmental clearances; Obtaining consent for handling hazardous substances.

BOOKS RECOMMENDED:

- 1 S.K.Mohanty: Environmental and Pollution Law Manual, Universal Law Publishing Co. Pvt. Ltd., New Delhi.
- 2 S.K.Agarwal: Environmental Laws, Nidhi Publishers, Bikaner.
- 3 Jain and Jain: Environmental Law in India, the Lawyers Home Indore.
- 4 K.C.Agarwal : Environmental Laws, Narosa Publishing House New Delhi.
- 5 Gupta and Rao : Principles of Statistics, Ist Ed. New Heights.
- 6 C.B.Gupta : Introduction to Statistical Methods 8th Editions, Vikas Publishing House, New Delhi.
- 7 S.P.Gupta : Statistical Method, S.Chand and Sons Publishers, New Delhi.

M.Sc.(Final)
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PAPER-IV(I)
SYSTEM ANALYSIS AND MODELING

Duration : 3 hours

M.M. : 100

UNIT-I

The nature of mathematical models, goals of model building, anatomy of mathematical models;
Basic mathematical tools in model building.

UNIT-II

Analysis of model properties; Approaches to the development of model.

UNIT-III

Statistical methods for environmental sciences; Modeling of river and estuary water quality.

UNIT-IV

System modeling for water pollution control; Urban air pollution modeling.

UNIT-V

Remote sensing; Urban planning.

BOOKS RECOMMENDED :

- 1 P..Millard and N.K.Neerchal (2001) : Environmental Statistics with S-plus, CRC Press,
USA

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Environmental Sciences -2010-2011

PAPER-IV (II)

ENVIRONMENTAL ENGINEERING AND BIOTECHNOLOGY

Duration : 3 hours

M.M. : 100

UNIT-I

Waste water treatment: Small scale sewage treatment (Septic tanks and Cesspools); Waste water treatment: Large scale sewage treatment (Primary, Secondary and Tertiary treatments)
Waste water treatment models; Ground water remediation; Water softening; Water demineralization; Desalination; Ion-exchange and reverse osmosis; Disinfection of water
Ozonation and chemosterilization of water.

UNIT-II

Improvement of air quality- basic principles; Particulate removal- use of air filters and negative ion generators; Control of gaseous pollutants; Biofiltration; Indoor air quality control; Basic principles of solar energy utilization; Solar energy collectors; Concept of solar passive houses; Solar desalination; Solar greenhouse technology.

UNIT-III

Building materials and constructional technology; Weather proofing and protection against dampness; Rural housing; Planning for time and resources for simple projects; Industrial ventilation; Fermentation technology; Vermiculture technology; Wastes as a source of microorganisms; organic compost and process of composting; Factors affecting the process of composting; Microbes in biogas production; Microbes in hydrogen and hydrocarbon production.

UNIT-IV

Biodegradation of petroleum (hydrocarbon); Microbial degradation of xenobiotics; Microorganisms in abatement of heavy metal pollution; Aeromicrobiology : Aeroallergens and aeroallergy; Microbial pathogens in human health: Causes, control and rehabilitation strategies; Environmental biotechnology: Scope and applications; Concepts of cleaner technology; General principles, tools and techniques of biotechnology; Application of plant tissue culture technology for micropropagation of stress tolerant plants; Application of immunofiltration,

immunoprecipitation and DNA probing methods for detection of microbial pathogens in aquatic environment.

UNIT-V

Microbes and their genetic engineering for degradation of pollutants;; Application of microbes as biofertilizer; Application of microbes as biopesticides; Microbes in biomining, biohydrometallurgy and biomineralization; Application of recombinant DNA technology for improvement of bacterial strains; Principles and applications of biosensors for detection of pollutants; Risk assessment for recombinant biosensors; Anaerobic biotechnology for sustainable waste treatment; Oil spills: Causes and recovery; Use of super bugs for removal of oil spills.

BOOKS RECOMMENDED :

- 1 Liu and Liptak : Environmental Engineer's Hand Book 2nd Editions, Lewis Publishers New York.
- 2 Saylor, Sanseverino and Davis : Biotechnology in the Sustainable Environment , Plenum Press, New York.
- 3 B.D.Singh : Plant Biotechnology.
- 4 Ralph Mitchell (1992) : Environmental Microbiology, John Wiley and Sons,USA.

M.Sc.(Final)

Environmental Sciences -2010-2011

SCHEME OF PRACTICAL EXAMINATION

<u>S.No.</u>	<u>Exercise</u>	<u>Regular</u>
1	Major Exercise	20
2	Minor Exercise	15
3*	Field study/Case Study	25
4	Slide Preparation	05
5	Spotting (1-10)	15
6	Viva-voce	10
7	Record	10
	Total :-	100

* Student will have to submit a type written report which should not exceed 25 pages.

M.Sc.(Final)
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PRACTICAL-I

Duration : 5 hours per day for two days

M.M. 100

- 1 To determine the dust capturing capacity and percent leaf area injury of selected plant species.
- 2 To determine the air pollution tolerance index (APTI) of selected plant species and comparison of plants for their relative susceptibility.
- 3 Study of biotic communities of polluted and unpolluted aquatic areas.
- 4 Preparation of slides - zooplankton and phytoplankton.
- 5 LC-50 test in *Limnea* for heavy metal.
- 6 Effect of heavy metals on seed germination and early seedling growth.
- 7 Effect of heavy metals on chlorophyll content, soluble proteins, phenols and carbohydrates.
- 8 Effect of heavy metals on ascorbic acid content in plant leaves
- 9 Study of variation in respiratory activity with increasing branch diameter
- 10 Study and identification of minerals.
- 11 Short term bioassay tests of industrial pollutants in relation to fresh water animals:
 - (a) Calculation of 96 hours LC-50
 - (b) Assessment of threshold concentration
 - (c) Calculation of MATC (maximum acceptable toxicant concentration)
 - (d) Calculation of application factor or safe concentration
- 12 Long term bioassay tests of industrial pollutants in relation to fresh water animals.
 - (a) Calculation of 7 days Lc-50
 - (b) Histological change in the various tissues effected by toxicants
 - (c) Bioaccumulation studies.

- 13 Estimation of total and faecal coliforms in water and calculation of MPN in given water samples
- 14 Field excursion to an industrial area to assess environmental impact.

BOOKS RECOMMENDED :

- 1 J. Pandey and M.S.Sharma: Environmental Science - Practical and Field Manual, Yash Publications, Bikaner
- 2 S.K.Maiti : Hand Book of Methods in Environmental Studies (Vol.1, Water and Waste Water) ABD Publishers, Jaipur.

M.Sc.(Final) Environmental Sciences -2010-2011

PRACTICAL-II

Duration : 5 hours per day for two days

M.M. 100

- 1 Test the Null hypothesis by computing SE of difference between two means.
- 2 Test the difference between the means of two samples using 't' test.
- 3 To determine the association between two species using Chi-square test.
- 4 To determine the correlation between two variables.
- 5 Study of biomass distribution pattern in relation to branch size of trees using allometric relationship
- 6 Introduction to biotechnological tools and techniques - principles and applications
- 7 Preparation of different types of media for culture of bacteria, algae and plant tissues
- 8 Isolation and culture of excised plant parts for micropropagation studies.
- 9 Isolation, purification and identification of mycorrhizal fungi
- 10 Isolation, purification and identification of aerobic bacteria from different soil and water sources.
- 11 Application of Gram's stain for identification of bacteria.
- 12 Study of stress tolerance *in vitro* using callus cultures
- 13 Application of stage and ocular micrometers for measurements of microbes.
- 14 Demonstration of biogas production by methanogenic bacteria.
- 15 Study of following :
 - (a) Organisms as biofertilizer-
Azolla, Anabaena, Nostoc, Aulosira, Plectonema, Oscillatoria, Tolypothrix, Glomus, Gigaspora, Sclerocystis, Rhizobium
 - (b) Different stages of micropropagation -
Shoot multiplication, rooting *in vitro* hardening.

BOOKS RECOMMENDED :

- 1 J. Pandey and M.S.Sharma: Environmental Science - Practical and Field Manual, Yash Publications, Bikaner
- 2 D.R.Cullimore : Practical Handbook for bacterial Identification, CRC Press.
- 3 Dr.O.P.Sharma : Advanced Practical Botany (2nd Edition) Pragati Prakashan, Meerut.