

DEPARTMENT OF ENVIRONMENTAL SCIENCE

Session: 2015-17

M. Sc. Environmental Science

Credit matrix for M.Sc. Environment Science Program

Semester	Core Program (PC)	Program Elective (PE)	Interdisciplinary/Open Elective	Foundation course	Project work /Dissertation	Total
I	31	-	-	-	-	31
II	25	6	2	2	-	35
III	25	6	-	-	-	31
IV	8	-	-	-	20	28
Total	89	12	2	2	20	125

Scheme of M.Sc. Environmental Science Program

Choice Based Credit System

SEMESTER-1

S.No.	Course No.	Nomenclature of Paper	Type	L-T-P (Hours)	Credits	Evaluation Scheme		
						Theory	IA	Total marks
1	ENV-101	Environmental Toxicology	PC	4-0-0	4	80	20	100
2	ENV-102	Environmental Biology	PC	4-0-0	4	80	20	100
3	ENV-103	Analytical Techniques	PC	4-0-0	4	80	20	100
4	ENV-104	Environmental Pollution	PC	4-0-0	4	80	20	100
5	ENV-105	Solid waste Management	PC	4-0-0	4	80	20	100
6	ENV-106	Lab Course-I	PC	0-0-20	10	-	-	150
7	ENV-107	Seminar-1	PC	0-1-0	1			50

Total Credits: 31

Total Marks: 700

SEMESTER-2

S.No.	Course No.	Nomenclature of Paper	Type	L-T-P (Hours)	Credits	Evaluation Scheme		
						Theory marks	IA	Total
1	ENV-201	Natural Resources	PC	4-0-0	4	80	20	100
2	ENV-202	Biodiversity	PC	4-0-0	4	80	20	100
3	ENV-203	Biostatistics and Environmental Modeling	PC	4-0-0	4	80	20	100
4	ENV-204	Resource Management	PC	4-0-0	4	80	20	100
5	ENV-205	Lab Course-II	PC	0-0-16	8	-	-	100
6	ENV-206	Waste water treatment Technology	PE	4-0-0	4	80	20	100
	ENV-207	Environmental Geology	PE	4-0-0	4	80	20	100
7	ENV-208	Lab Course-III	PE	0-0-4	2	-	-	50
8	ENV-209	Seminar- II	PC	0-1-0	1	-	-	50
9	ENV-210	Foundation Course	-	2-0-0	2	40	10	50
10	ENV-211	Interdisciplinary	OE	2-0-0	2	40	10	50

Total Credits: 35
Total Marks: 800

SEMESTER-3

S.No.	Course No.	Nomenclature of Paper	Type	L-T-P (Hours)	Credits	Evaluation Scheme		
						Theory marks	IA	Total
1	ENV-301	Environmental Chemistry	PC	4-0-0	4	80	20	100
2	ENV-302	Remote Sensing and Geographical Information	PC	4-0-0	4	80	20	100
3	ENV-303	Elementary concept of Physical Environment	PC	4-0-0	4	80	20	100
4	ENV-304	Environment Impact Assessment	PC	4-0-0	4	80	20	100
5	ENV-305	Lab Course-IV	PC	0-0-16	8	-	-	100
6	ENV-306	Environmental Microbiology	PE	4-0-0	4	80	20	100
	ENV-307	Cell and molecular Biology	PE	4-0-0	4	80	20	100
7	ENV-308	Lab Course-V	PE	0-0-4	2	-	-	50
8	ENV-309	Summer Training Report	PC	0-0-0	01			50

Total Credits: 31
Total Marks: 700

SEMESTER-4

S.No.	Course No.	Nomenclature of Paper	Type	L-T-P (Hours)	Credits	Evaluation Scheme		
						Theory marks	IA	Total
1	ENV-401	Environmental Laws	PC	4-0-0	4	80	20	100
2	ENV-402	Environmental Management & Planning	PC	4-0-0	4	80	20	100
3	ENV-403	Dissertation	PC	0-0-40	20	-	-	300

Total Credits: 28

Total Marks: 500

Grand Total Marks-2700

Grand Total Credits – 125

- **Programme Core (PC):** These are core courses in every semester and the students have to compulsorily study these courses to complete the requirement of the programme.
- **Program Elective (PE):** This course has to be chosen by the student from the given program elective papers of the respective semester and the lab course-during IInd and IIIrd semester.
- **Foundation Course:** This course will be based upon the basics of the programme that leads to the better understanding of the student and will be compulsory.
- **Interdisciplinary Open Elective (OE):** The students are required to have one open elective paper in IInd semester of their choice from any other M.Sc. course/Department in the M.D. university campus.
- Student will deliver a seminar in Ist and IInd semester. The evaluation of the seminar will be done by the faculty members at the basis of presentation only.
- The candidate shall be required to undergo Summer Training (4-5 weeks) at the end of IInd semester. She/he will be required to submit a comprehensive report before the commencement of the IIIrd next semester examination. The evaluation of the training report will be based on the Seminar/Presentation on the Training Report to be presented by each candidate in the department.
- In the IVth semester, the student will carry out dissertation work and the report has to be submitted by 30th June. The evaluation of the dissertation will be done by external examiner (approved by VC from the panel approved in PGBOS) and the internal examiner (Guide). The final marks will be mean of Internal + External. The written part of Dissertation report shall account for 250 marks and the viva voce will be conducted for the remaining 50 marks. One copy of dissertation has to be submitted in the department, one for the guide and soft copy for the library. Any Patent/IPR based on dissertation report will be in the name of MDU, student and the guide as inventor.

SYLLABI
M.Sc. Environmental Sciences

Semester-I

ENV - 101 Environmental Toxicology

Max. Marks : 80

Time : 3 Hours.

Note : 1. Nine questions will be set in all.

2. Question No. 1 will be objective covering the entire syllabus & compulsory. The remaining eight questions will be set with two questions from each unit. The candidate will be required to attempt five in total, Question 1 and four by selecting one from each section.

Unit - I

Toxic chemicals in the environment - air, water & their effects, Pesticides in water, Biochemical aspects of arsenic, cadmium, lead mercury, carbon monoxide, ozone and PAN pesticide.

Unit - 2

Mode of entry of toxic substance, biotransformation of xenobiotics detoxification, Carcinogens in air, chemical carcinogenicity, mechanism of carcinogenicity, Environmental carcinogenicity testing.

Unit - 3

Insecticides, MIC effects, Concept of major, trace and Rare Earth Element (REE)-possible effects of imbalance of some trace elements

Unit- 4

Biogeochemical factors in environmental health, Epidemiological issues goiter, fluorosis, arsenic poisoning.

References :

1. Environmental chemistry - Sodhi
2. Principles of Environmental chemistry - Manhan
3. Environmental hazards & human health R.B. Philip
4. Toxicology - principles & applications – Niesink & Jon devries
5. Parasitology - Chatterjee
6. Preventive & Social medicines – Perk

ENV - 102 Environmental Biology

Max. Marks : 80

Time : 3 Hours.

Note: 1. Nine questions will be set in all.

2. Question No. 1 will be objective covering the entire syllabus & compulsory. The remaining eight questions will be set with two questions from each unit. The candidate will be required to attempt five in total, Question I and four by selecting one from each section.

UNIT - I

Definition, principles and scope of ecology, human ecology and human settlements, evolution, origin of life and speciation, Ecosystem stability-cybernetics and ecosystem regulation, evolution of biosphere.

UNIT - II

Ecosystem structure and functions, abiotic and biotic component, Energy flow, food chain, food web, Ecological Pyramids-types, biogeochemical cycles, ecological succession, Ecads and ecotypes.

UNIT - III

Population ecology- density, natality, mortality, survivorship curves, age distribution, growth curves and models, r & k selection, population interactions- Mutualism, Parasitism, Predator-Prey relations, System Theory and Ecological Model.

UNIT - IV

Earth's major ecosystem - terrestrial and aquatic ecosystem, soil microorganism and their functions, coastal management, criteria employed for disposal of pollutants in marine ecosystem, coastal water system and man-made reservoirs, biology and ecology of reservoirs.

References

1. Basic ecology - E. P. Odum
2. Ecology and field biology - R.L. Smith
3. Ecology - P.D. Sharma
4. Fundamentals of ecology - E.P. Odum
5. Principles of ecology – Rickleff

ENV - 103 Analytical Techniques

Max. Marks : 80

Time : 3 Hours.

Note : 1. Nine questions will be set in all.

2. Question No. 1 will be objective covering the entire syllabus & compulsory. The remaining eight questions will be set with two questions from each unit. The candidate will be required to attempt five in total, Question 1 and four by selecting one from each section.

Unit - I

Principles and application of Spectrophotometry (UV-Visible spectrophotometry), Titrimetry, Gravimetry, Colourimetry, NMR, ESR, Microscopy-phase, light and fluorescence microscopes, Scanning and Transmission electron microscopes.

Unit - 2

Chromatographic techniques (Paper chromatography, thin layer chromatography, ionexchange chromatography, Column chromatography), Atomic absorptionspectrophotometry, cytophotometry and flow cytometry, Fixation and staining, Principles and techniques of nucleic acid hybridization and Cot curves, Principle of biophysical method used for analysis of biopolymer structure, Hydrodynamics methods, Plasma emissionspectroscopy.

Unit - 3

Electrophoresis, solid and liquid scintillation, X-ray fluorescence, X-ray diffraction. Flamephotometry, Gas-liquid chromatography, High pressure liquid chromatography – autoradiography, Ultracentrifugation.

Unit- 4

Methods for measuring nucleic acid and protein interactions, DNA finger printing Molecular markers RFLP, AFLP, RAPD, Sequencing of proteins and nucleic acids, southern, northern, western blotting techniques, PCR polymerase chain reaction.

References :

1. Principles of Biophysical chemistry - Uppadahay -Uppadahay and Nath.
2. Analytical Techniques - S.K. Sahani

ENV - 104 Environmental Pollution

Max. Marks : 80

Time : 3 Hours.

Note

1. Nine questions will be set in all.
2. Question No. 1 will be objective covering the entire syllabus & compulsory. The remaining eight questions will be set with two questions from each unit. The candidate will be required to attempt five in total, Question I and four by selecting one from each section.

UNIT - I

Air pollution- natural and anthropogenic sources of pollution, primary and secondary pollutants, transport and diffusion of pollutants, gas laws governing the behaviour of pollutants in the atmosphere, Methods of monitoring and control of air pollution, SO₂, NO_x, CO, SPM.

UNIT - II

Water pollution - types sources and consequences of water pollution, physico-chemical and bacteriological sampling, Analysis of water quality, standards, sewage and wastewater treatment and recycling, water quality and standards.

UNIT - III

Soil pollution chemical and bacteriological sampling as analysis of soil quality, soil pollution control, industrial waste effluents and heavy metals and their interactions with soil components.

UNIT - IV

Noise pollution - sources of noise pollution, measurement and indices, Marine pollution, sources of marine pollution and its control, Effects of pollutants on human beings, plants, animals and climate, air quality standards and air pollution.

References

1. Air pollution and control - K.V.S.G. Murlikrishan
2. Industrial noise control - Bell & Bell
3. Environmental engineering - Peary
4. Introduction to environmental engineering and science- Gilbert Masters.

ENV - 105 Solid Waste Management

Max. Marks : 80

Time : 3 Hours.

Note : 1. Nine questions will be set in all.

2. Question No. 1 will be objective covering the entire syllabus & compulsory. The remaining eight questions will be set with two questions from each unit. The candidate will be required to attempt five in total, Question 1 and four by selecting one from each section.

Unit - I

Sources, generation, classification & composition of solid wastes. Solid waste management methods - Sanitary land filling, Recycling, Composting, Vermi composting, incineration, energy recovery from organic waste.

Unit - 2

Solid Waste Management Plan, Waste minimization technologies, Hazardous Waste Management, Sources & Classification, physicochemical properties, Hazardous Waste Control & Treatment.

Unit - 3

Hospital Waste Management. Hazardous Waste Management & Handling rules, 1989 & 2000 (amendments)

Unit- 4

Disaster Management, Fly ash generation & utilization, Primary, secondary & tertiary & advance treatment of various effluents.

References :

1. Solid Waste Management CPCB. New Delhi.
2. Ecotechnology for pollution control & environmental management - By R.K. Trivedi & Arvind Kr.
3. Basic Environmental Technology - J.A. Nathanson

Semester –II

ENV - 201 Natural Resources

Max. Marks : 80

Time : 3 Hours.

Note

1. Nine questions will be set in all.
2. Question No. 1 will be objective covering the entire syllabus & compulsory. The remaining eight questions will be set with two questions from each unit. The candidate will be required to attempt five in total, Question I and four by selecting one from each section.

UNIT - I

Sun as a source of energy, solar radiations and its spectral characteristics fossil fuels classification, composition, physico- chemical characteristics and energy content of coal, petroleum and Natural gas.

UNIT - II

Principles of generation of hydroelectric power, tidal power, thermal energy conversion, wind, geo thermal energy, solar collectors, photovoltaic, solar ponds, oceans.

UNIT - III

Nuclear energy- fission and fusion, bio energy -energy from biomass and biogas, anaerobic digestion, energy use patterns in different parts of the world. Impacts of large scale exploitation of solar, wind, hydro and ocean energy.

UNIT - IV

Mineral resources and reserves, ocean ore and recycling of resources, Environmental impact of exploitation, processing and smelting of Mineral, oceans as need areas for exploitation of Mineral resources.

References

1. Living in the environmental - T.J. Miller.
2. Natural resource conservation - Owen & Chiras.
3. Encyclopedia Energy - I & II.

ENV - 202 Biodiversity

Max. Marks : 80

Time : 3 Hours.

Note : 1. Nine questions will be set in all.

2. Question No. 1 will be objective covering the entire syllabus & compulsory. The remaining eight questions will be set with two questions from each unit. The candidate will be required to attempt five in total, Question 1 and four by selecting one from each section.

Unit - I

Biodiversity - definition, hot spots of Biodiversity, strategies for Biodiversity Conservation, National Parks, Sanctuaries and Biosphere reserves, gene pool.

Unit - 2

Aquatic common flora and fauna in India - phytoplankton, zooplankton and macrophytes, terrestrial common flora and fauna in India - forests, endangered and threatened species.

Unit - 3

Strategies for Biodiversity Conservation, cryopreservation, gene banks, tissue culture and artificial seed technology, new seed development policy 1988, conservation of medicinal plants.

Unit- 4

International conventions, treaties and protocols for Biodiversity Conservation, Biodiversity in the welfare of mankind, Species concept, Biological nomenclature theories of biological classification.

References :

1. Global Biodiversity - W.R. L.IUCN
2. Ecology of natural resource - Ramade
3. Ecology - P.D. Sharma

ENV - 203 Biostatistics and Environmental modelling

Max. Marks : 80

Time : 3 Hours.

Note

1. Nine questions will be set in all.
2. Question No. 1 will be objective covering the entire syllabus & compulsory. The remaining eight questions will be set with two questions from each unit. The candidate will be required to attempt five in total, Question I and four by selecting one from each section.

UNIT - I

Measurement of central tendency - mean (Geometric and Harmonic), median, mode, Measurement of dispersion moments, standard deviation, skewness and kurtosis, Correlation and linear regression of one independent variable, Basic laws and concepts of probability

UNIT - II

Definition of random variable, density function, Basic concepts of binomial and normal distributions. Sampling measurement and distribution of attributes, moments, matrices and simultaneous linear equations, tests of hypothesis and significance.

UNIT - III

Role of modelling in environmental sciences, Model classification deterministic models, stochastic models, steady state models, dynamic models, different stages involved in model building. Simple microbial growth kinetics Monod equation, methods for formulation of dynamic balance equations mass balance procedures.

UNIT - IV

Models of population growth and interactions Lotka-Volterra model, Leslie's matrix model, Point source stream pollution, Box model, Gaussian plume model, Linear, simple and multiple regression models, validation and forecasting.

References

1. Dynamics of Environmental Bioprocesses-Modelling and simulation-Snape and Dunn.
2. Environmental Modeling- Jorgensen

ENV - 204 Resource Management

M.M. : 80
Time : 3 Hrs.

Note : 1. Nine questions will be set in all.

2. Question No. 1 will be objective covering the entire syllabus & compulsory. The remaining eight questions will be set with two questions from each unit. The candidate will be required to attempt five in total, Question 1 and four by selecting one from each section.

Unit - I

Resource management meaning & concept, management of rangelands & watersheds, management of Agricultural system.

Unit - 2

Management of waste resources, Management of forests, effects of deforestation. Management of fresh water ecosystem conservation strategies for non-renewable energy resources.

Unit - 3

Wildlife Management & conservation efforts for threatened species, Water Management, Ganga Action Plan, Yamuna Action Plan, Environmental priorities in India.

Unit- 4

Reclamation & Management of waste lands, soil erosion, soil conservation, rural planning & land use pattern. Sustainable development, urban planning for India, Land use policy for India.

References :

1. Natural resources conservation - Oliver Ss. Owen.
2. Living of environment - T.J. Miller
3. Ecology of Natural resources - Ramade
4. Environmental Science- Cunningham Saigo
5. Restoration of degraded lands- J.S. Singh

Program Elective
ENV– 206 Waste Water Treatment Technology

M.M. : 80
Time : 3 Hrs.

Note

1. Nine questions will be set in all.
2. Question No. 1 will be objective covering the entire syllabus & compulsory. The remaining eight questions will be set with two questions from each unit. The candidate will be required to attempt five in total, Question I and four by selecting one from each section.

Unit-I

Overview of standards of water quality in relation to public health - Potable and nonpotable water; Methods of water sampling for pollution analysis. Principal forms of Water Pollutants and their sources; Pollution of stream, lakes and phenomenon of eutrophication; Ocean pollution – oil pollution; Ground water pollution and its control; Water pollution prevention.

Unit II

Methods of monitoring Pollution; Biological methods; Detection methods for DO, BOD, Pathogen monitoring by heterotrophic plate count; Multiple tube method; Membrane filtration methods; Other emerging techniques such as enzyme detection, hybridization, PCR, Gene probe technology etc.; Strategies for controlling pathogen transfer; Chemical methods- Detection methods for COD, pH, alkalinity, TSS, TDS, Total organic carbon, oil, grease etc.; Biosensors for pollution

Unit III

Sewage and waste water treatments systems, Primary, secondary and tertiary treatments, Biological treatments - aerobic versus anaerobic treatments; Environmental pollution control- Bioremediation, Bioaugmentation and Biostimulation; Biofilms in treatment of waste water; Bioreactors for waste water treatments.

Unit IV

Physicochemical characteristics and treatment strategies for effluent generated by Distillery and fermentation industry; Fertilizers and pesticide manufacturing industries; Dyes and textile industries; Paper and pulp industries; Tanneries; Pharmaceuticals; Thermal power plants; Food and dairy industries; Iron and steel industries; Organic solvents; Chlorinated minerals and inorganic chemical industries and petrochemicals.

References

1. Nicolas P Cherewsinott, Handbook of water and waste water Treatment Technology, Boston Oxford Auckland Johannesburg Melbourne ,N Delhi
2. Frederick W Pontinus, Water Quality and Treatment. American water works Association, MC Graw Hill Inc.
3. S K Agarwal, Water Pollution, APH Publishing Corporation.
4. Ronald L Dooste, Theory and Practical of water and waste water Treatment.
5. Bill T. Ray, Environmental Engineering, PWS Publishing company.

Program Elective
ENV - 207 Environmental Geology

Max. Marks : 80
Time : 3 Hours.

Note

1. Nine questions will be set in all.
2. Question No. 1 will be objective covering the entire syllabus & compulsory. The remaining eight questions will be set with two questions from each unit. The candidate will be required to attempt five in total, Question I and four by selecting one from each section.

UNIT - I

Earth processes, Geological cycle, Tectonic cycle, Rock cycle, Hydrological cycle, Biogeochemical cycles, Special problems of time and scale in geology, concept of residence time and rates of natural cycles.

UNIT - II

Catastrophic geological hazards, Prediction and perception of the hazards and adjustment to hazardous activities.

UNIT - III

River flooding- causes, nature and frequency of floods. Landslides- causes, intensity and magnitude. Volcanism nature extent and causes, Volcanism and climate. Avalanches causes and effects.

UNIT - IV

Mineral and human use, geology of mineral resources, EIA of mineral development, recycling of mineral resources.

References

1. Environmental geology- Edward A. Keller
2. Physical geology - C.W. Montgomery.
3. Geology of India - National book trust series.

Foundation Course
ENV-210 Environmental issues and Disasters

Max. Marks : 40
Time : 3 Hours.

Note : 1. Seven questions will be set in all.
2. Question No. 1 will be objective covering the entire syllabus & compulsory. The remaining six questions will be set with three questions from each unit. The candidate will be required to attempt five in total, Question 1 and four by selecting two from each section.

UNIT I

Environmental Issues: Acid rain and its effects on ecosystem (flora, fauna and human beings), Climate change, global warming—causes and impact of global warming, International initiatives to control global warming ,carbon footprinting, clean Development Mechanism, coral reef, Biosafety protocol (1999-2000), Environmental ethics: Issues and possible solutions.

UNIT II

Hazards as Natural processes, Evaluation of Hazards, Human response to hazards, Global climate and Hazards, Population increase, land-use change and natural hazards. Rivers and flooding, Landslides, Snow avalanche, subsidence, Earthquakes and related phenomena Tsunami, Volcanic activity, Coastal hazards- tropical cyclones, tidal floods, Coastal hazards and engineering structures, Human activity and coastal hazards.

Reference Books:

1. Environmental geology by Edward A. Keller.
2. Physical geology by C.W. Montgomery.
3. Botkin, Daniel B. and Keller, Edward A. Environmental Science: Earth as a Living Planet. 6th ed. John Wiley & Sons, USA. 2007.
4. Cunningham, W. P. and Cunningham, M. A. Principles of Environment Science. Enquiry and Applications. 2nd ed. Tata McGraw Hill, New Delhi. 2004.
5. Singh, J.S., Singh, S.P. and Gupta, S.R. Ecology, Environment and Resource Conservation. Anamaya Publishers, New Delhi, India. 2006.
6. World Commission on Environment and Development (WCED): Our Common Future, Oxford University Press, London. 1987

Interdisciplinary
ENV-211 IPR and Biosafety

M.M. : 40
Time : 3 Hrs.

Note

1. Seven questions will be set in all.
2. Question No. 1 will be objective covering the entire syllabus & compulsory. The remaining six questions will be set with three questions from each unit. The candidate will be required to attempt five in total, Question I and four by selecting two from each section.

Unit I

Introduction to Intellectual Property Types of IP: Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications, Protection of GMOs. WIPO Treaties, PCT, Indian Patent Act 1970 & recent amendments

Unit II

Biosafety

Introduction to Biological Safety Cabinets; Biosafety Levels; Biosafety Levels of Specific Microorganisms; Recommended Biosafety Levels for Infectious Agents and Infected Animals; Biosafety guidelines - Government of India; Environmental release of GMOs; Overview of National Regulations and relevant International Agreements including Cartagena Protocol.

References

1. P. Narayanan, Intellectual Property Laws, Eastern Law House.
2. Meenu Paul, Intellectual Property Laws, Allahabad Law Agency.
3. Intellectual Property Law containing Acts and Rules, Universal Law Publication Company.

Semester-III

ENV - 301 Environmental Chemistry

Max. Marks : 80

Time : 3 Hours.

Note

1. Nine questions will be set in all.
2. Question No. 1 will be objective covering the entire syllabus & compulsory. The remaining eight questions will be set with two questions from each unit. The candidate will be required to attempt five in total, Question I and four by selecting one from each section.

UNIT - I

Stoichiometry, Gibb's energy, Chemical potential, Chemical equilibria, acid-base reactions. Solubility product, solubility of gases in water, the carbonate system, unsaturated and saturated hydrocarbons, Radio nuclides.

UNIT - II

Classification of elements, chemical speciation, Particles, ions and radicals in the atmosphere. Chemical processes for formation of inorganic and organic particulate matter. Thermochemical and photochemical reactions in the atmosphere.

UNIT - III

First law of thermodynamics, enthalpy, adiabatic transformations, second law of thermodynamics, Carnot's cycle, entropy, Gibb's free energy, chemical potential, phase equilibria, Gibb's Donnan equilibrium, third law of thermodynamics, enzymes catalysis, Michaelis/ Menten equation.

UNIT - IV

Oxygen and ozone chemistry, Chemistry of air pollutants, Photochemical Smog, Chemistry of water, concept of D.O., B.O.D., and C.O.D, water treatment : Sedimentation, Coagulation, Filtration, tertiary and advanced treatment, redox potential. Inorganic and organic components of soil, nitrogen pathways and NPK in soils.

References

1. Environmental Chemistry - G.S. Sodhi
2. Environmental Chemistry - Mannhan
3. Fundamentals of soil science - Henry D. Futh
4. Textbook of limnology - G.A. Cole
5. Environmental Chemistry - Sharma and Kaur

ENV - 302 Remote sensing and Geographical Information

M.M. : 80
Time : 3 Hrs.

Note : 1. Nine questions will be set in all.

2. Question No. 1 will be objective covering the entire syllabus & compulsory. The remaining eight questions will be set with two questions from each unit. The candidate will be required to attempt five in total, Question 1 and four by selecting one from each section.

Unit - I

Definition, Introduction and scope of remote sensing. Electromagnetic radiation, atmosphere window, Platforms, Sensors and type of scanning systems. Basic characteristics of sensors; salient features of sensors used in LANDSAT, SPOT and Indian remote sensing satellites.

Unit - 2

Aerial photography- vantage point, cameras, Filters and types of films. Elements of visual image interpretation. Multispectral Remote sensing, Microwave Remote sensing, Photogrammetry - Introduction, Stereo- scopic vision, Projection types.

Unit - 3

Digital image and image structure, Image restoration and image and image enhancement. Image classification. Remote sensing application in Forestry, Ecology and environment, Land use, Agriculture, soils and geology, Disaster management.

Unit- 4

GIS technology and its uses in environmental science, Hardware and software requirement for GIS. Conceptual model of spatial information, Conceptual model of nonspatial information. GPS.

References :

1. Introduction to Environmental remote sensing - Curtis
2. Principles of Remote sensing - Lily and Kliffner.
3. Remote sensing of the Environment – Jenson

ENV - 303 Elementary Concept of Physical Environment

Max. Marks : 80

Time : 3 Hours.

Note

1. Nine questions will be set in all.
2. Question No. 1 will be objective covering the entire syllabus & compulsory. The remaining eight questions will be set with two questions from each unit. The candidate will be required to attempt five in total, Question I and four by selecting one from each section.

UNIT - I

Definition, Principles and scope of Environmental Science. Earth, Man and Environment, Ecosystem, Pathways in Ecosystems, Physico-chemical and biological factors in the Environment.

UNIT - II

Geographical classification and zones. Structure and composition of Biosphere. General relationship between landscapes, biomes and climates.

UNIT - III

Primary differentiation and formation of core, mantle and crust. Igneous, sedimentary and metamorphic rocks, weathering, erosion, transportation and deposition of earth's material by running water, wind and glaciers.

UNIT - IV

Mass and energy transfer across the various interphases, Material Balance, Heat Transfer processes, scales of Meteorology, various kinds of lapse rates, vertical stability of atmosphere, cloud classification & formation.

References

1. Ecology - P.D. Sharma
2. Concepts of physical environment- Savinder Singh
3. The Atmosphere- an Introduction- F.K. Lutgens
4. Atmospheric weather and climate - Navarra.

ENV - 304 Environmental Impact Assessment

M.M. : 80
Time : 3 Hrs.

Note : 1. Nine questions will be set in all.

2. Question No. 1 will be objective covering the entire syllabus & compulsory. The remaining eight questions will be set with two questions from each unit. The candidate will be required to attempt five in total, Question 1 and four by selecting one from each section.

Unit - I

Introduction to environment impact analysis, Environmental impact statement and Environmental management plan, ISO14000, EIA guidelines 1994, Notification of Govt. of India.

Unit - 2

Impact assessment methodologies, Generalized approach to impact analysis. Case study: EIA of some dam, procedure for reviewing Environmental impact analysis and statement.

Unit - 3

Guidelines for Environmental Audit, Baseline information and prediction (land, water, atmosphere, energy), Restoration and rehabilitation technologies.

Unit - 4

Risk analysis - definition of risk, Environmental risk analysis, risk assessment and risk management, Basic steps in risk assessment - hazard identification, dose-response assessment, exposure assessment, Risk characterization.

References :

1. Environmental Impact Assessment- John Glasson.
2. Methods of Environmental Impact Assessment - Morris and the rivel.
3. Environmental Impact Assessment - L. W. Canter.
4. Chemical principles of Environmental pollution - Lalloway and Ayers.
5. Industrial Environment - Assessment and strategy - S.K. Aggarwal

Program Elective
ENV - 306 Environmental Microbiology

Max. Marks : 80

Time : 3 Hours.

Note : 1. Nine questions will be set in all.

2. Question No. 1 will be objective covering the entire syllabus & compulsory. The remaining eight questions will be set with two questions from each unit. The candidate will be required to attempt five in total, Question 1 and four by selecting one from each section.

Unit - I

Microbiology- organisms in nature & their importance, sampling, culture & cultivation of microorganisms, microbes in service of nature & mankind, Batch culture & continuous culture of microbes for commercial use.

Unit - 2

Microbial Reactors, genetically modified microbes & their uses in Environmental management recycling & up gradation technologies, Production of products, energy from waste.

Unit - 3

Biogas technology, plant design, construction, operation, biogas from organic wastes, water weeds, landfills, microbiology of anaerobic fermentation.

Unit - 4

Biotransformation, bioconversion, bioremediation, phytoremediation technology, fermentation technology, development of stress tolerant plants, Environmental problems & Environmental monitoring through microorganism, microbiology of water, air and soil, microbes as pathological agent in plant, animal and man.

References :

Principles of microbiology - Pelzar
Microbial bio technology - A.N. Glazer
Microbial ecology - R.M. Atlas
Molecular biology - H.D. Kumar
Environmental bio Technology - Sayler & Fox

Program Elective
ENV-307 Cell and Molecular Biology

M.M. : 80
Time : 3 Hrs.

Note:1. Nine questions will be set in all.

2. Question No. 1 will be objective covering the entire syllabus & compulsory. The remaining eight questions will be set with two questions from each unit. The candidate will be required to attempt five in total, Question I and four by selecting one from each section.

Unit I

Cell: An introduction, classification of organisms by cell structure, Structure and functions of cellular organelles. Cell Division: Mitosis and Meiosis, Regulation of cell cycle.

Unit II

Organization of bacterial genome. Structure of eucaryotic chromosomes, DNA/RNA as the genetic material, Mitochondria and chloroplast DNA, DNA reassociation kinetics (Cot curve analysis); Repetitive and unique sequences.

DNA Replication in prokaryotes and eukaryotes. DNA repair mechanisms, Recombination: Homologous and non-homologous; Site specific recombination, Transposons.

Unit III

Prokaryotic Transcription: Mechanism of transcription, Promoters- Constitutive and Inducible, Operators; Regulatory elements.

Eucaryotic transcription: Mechanism of transcription. Post-transcriptional modifications of various RNA species. Transcription in mitochondria and chloroplast.

The Operon: Positive and negative control of transcription, repressor-inducer complex, catabolite repression and attenuation.

Unit IV

Genetic Code, Properties of genetic code, Wobble hypothesis.

Protein Synthesis: Structure of prokaryotic and eukaryotic ribosomes and their role in protein synthesis. Regulation of translation in prokaryotes and eukaryotes. Post translational modifications of proteins.

References

1. Cell Biology- Smith and Wood by Chapman and Hall.
2. Cell Biology: Organelle structure and function, Sadava, D E.(2004) Panima pub., New Delhi.
3. David Freifelder, Essentials of Molecular Biology, Narosa Publishing House.
4. George M. Malacinski, Essentials of Molecular Biology, Jones and Bartlett Publishers.
5. Harvey Lodish, Arnold Berk, Paul Matsudaira, Chris-A. Kaiser, Monty Krieger, Mathew P. Scott, S.Lawrence Zipursky, James Darnell, Molecular Cell Biology (Fifth edition), W.H.Freeman and company New York.
6. Genes VII, Lewin, Benjamin (2002) OUP, Oxford.
7. Genomes, 2nd ed, Brown, T. A.(2002) John Wiley and sons ,Oxford

Semester-IV

ENV - 401 Environmental Laws

Max. Marks : 80
Time : 3 Hours.

Note

1. Nine questions will be set in all.
2. Question No. 1 will be objective covering the entire syllabus & compulsory. The remaining eight questions will be set with two questions from each unit. The candidate will be required to attempt five in total, Question I and four by selecting one from each section.

UNIT - I

Scheme of labelling of environmentally friendly products (ecomark). Public liability Insurance Act, 1991. Provision of constitution of India regarding environment (article 48A & 58A).

UNIT – II

Environmental policy resolution, legislation, public policy strategies in pollution control. Wild life protection act, 1972 amended 2002. Forest conservation act, 1980. Indian forest act 1927.

UNIT - III

Air (prevention & control of pollution) Act 1981 as amended by amendment 1987 & rule 1982. Motor vehicle act, 1988, The environment (protection) Act, 1986, rules 1986.

UNIT – IV

The water (prevention & control of pollution) Act, 1974 as amended by amendment 1978 & rules 1975. Environment protection issues & problems, international & national efforts for environment protection.

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References

1. Environmental administration & law - Paras Diwaa.
2. Environmental planning, policies & programs in India - K.D. Saxena.

ENV –402 Environmental Management and Planning

Max. Marks : 80

Time : 3 Hours.

Note

1. Nine questions will be set in all.
2. Question No. 1 will be objective covering the entire syllabus & compulsory. The remaining eight questions will be set with two questions from each unit. The candidate will be required to attempt five in total, Question I and four by selecting one from each section.

UNIT - I

Role of NGO's public participation in environmental movements, Concepts of Environmental education and awareness International environmental initiatives - the club of Rome report, Stockholm Declaration, environmental ethics.

UNIT - II

Vehicular pollution and urban air quality, Fly ash utilization, Eutrophication and restoration of Indian lakes, Wet land conservation, Water crisis-conservation of water. Narmada dam, Tehri dam, Almetti dam.

UNIT - III

Basic concepts of environmental planning, Environmental priorities in India, Land use planning : The land use plan (India). Soil surveys in relation to land use planning. Methods of site selection and evaluation, global imperatives, soil erosion, Formation and reclamation of Usar, alkaline and saline soil, waste lands and their reclamation, Desertification and its control.

UNIT - IV

Urban planning and rural planning for India. Sustainable development- principles and practices in relation to economics and ecology. Cost-benefit analysis- its relevance. Ramsar convention on wetlands, Vienna convention and Montreal Protocol, Kyoto protocol, Earth Summit, Agenda-21.

References

1. Natural Resource Conservation Owen and Chiras.
2. Environmental planning, policies and programs in India- K.D. Saxena.
3. Conservation Ecology- G.W.Cox.
4. Global Biodiversity - W.R. L. IUCN