

DEPARTMENT OF ENVIRONMENTAL SCIENCES

Faculty of Earth, Environment and Space Sciences



**M.Sc. ENVIRONMENTAL SCIENCE
SCHEME AND SYLLABUS
(Choice Based Credit System-CBCS)**

**INDIRA GANDHI UNIVERSITY
MEERPUR, REWARI**

DEPARTMENT OF ENVIRONMENTAL SCIENCE

Session: 2017-18

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 I.G 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 I.G. University, 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 - II

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

Unit - III

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

Unit- IV

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

References :

1. Environmental chemistry - Sodhi
2. Principals 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 specification, 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

Earths 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, Colorimetry, Microscopy-phase, light and fluorescence microscopes, Scanning and Transmission electron microscopes.

Unit - II

Chromatographic techniques (Paper chromatography, thin layer chromatography, Ion exchange chromatography, Column chromatography, gas liquid chromatography, high pressure chromatography), Atomic absorption spectrophotometry.

Unit - III

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

Unit- IV

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, Meteorological and plume dispersion, Methods of monitoring and control of air pollution, SO₂, NO_x, CO, SPM.

UNIT - II

Water pollution - types sources and consequences of water pollution Characteristics of domestic industrial and agricultural waste and their effects on water bodies, physico-chemical and bacteriological sampling, analysis, water quality parameters, standards, and criteria, sewage and wastewater treatment and recycling.

UNIT - III

Soil pollution and its control, Detrimental effects of soil pollutants, Chemical method of soil analysis- sample preparation and soil analysis. soil microorganism and their functions, Industrial waste effluents and heavy metals, their interaction with soil components, degradation of different insecticides, fungicides and weedicides in soil. Different kinds of synthetic fertilizers (N, P and K) and their interactions with different components of soil.

UNIT - IV

Noise pollution - sources of noise pollution, measurement and indices, Effects of meteorological on noise propagation, noise exposure level and standards, noise control abatement and measures. Impact of noise on human health.

References

1. Air pollution and control - K.V.S.G. Murlikrishan
2. Industrial noise control - Bell&Bell
3. Environmental engineering –Peary
4. Soil Chemistry - Bolt and buggenwer
5. 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 - II

Hazardous Waste Management; Definition, Sources & Classification of Hazardous Waste, Characteristics and transportation of hazardous waste, treatment storage and disposal, Hazardous waste minimization remediation techniques.

Unit - III

Biomedical Waste Management; Introduction & definitions, classification & sources, Transportation and disposal methods. Radiation hazard; introduction effects of radiation on man and environment,

Unit- IV

Disaster Management, Fly ash generation & utilization, material recovery, Primary, secondary, tertiary and 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 largescale 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 - II

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

Unit - III

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

Unit- IV

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, Leslies 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 - II

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

Unit - III

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

Unit- IV

Reclamation & Management of waste lands, soil erosion, soil conservation, rural planning & land use pattern. Sustainable development, urban planning for India, Landuse 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 non-potable 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, PCR, Gene probe technology etc.; 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, Bio-augmentation and Bio-stimulation; 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 foot printing, clean Development Mechanism, coral reef, Biosafety protocol (1999-2000),

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