

**SCHEME
OF
STUDIES AND EXAMINATIONS**

**CENTRE OF EXCELLENCE FOR ENERGY AND
ENVIRONMENTAL STUDIES**

M.Sc. (Environmental Science)

(EFFECTIVE FROM SESSION 2018-19)

**DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE &
TECHNOLOGY
MURTHAL (SONEPAT) HARYANA-131039
CEEES**

M.Sc. in Environmental Science (Four –Semester Course)
(Effective from Session 2018-2019)
Semester-I

S. No.	Course Code	Course Title	Teaching Scheme			Examination Marks				Credits	Duration of Exam
			L	P	Total	Marks of Class Work	External Marks		Total		
							Theory	Practical			
1.	ES 101B	FUNDAMENTAL OF ENVIRONMENTAL SCIENCE	4	-	4	25	75	-	100	4	3
2.	ES 103 B	ECOLOGY AND BIODIVERSITY	4	-	4	25	75	-	100	4	3
3.	ES 105 B	ENVIRONMENTAL CHEMISTRY	4	-	4	25	75	-	100	4	3
4.	ES 107 B	ENVIRONMENTAL ISSUES AND AWARENESS	4	-	4	25	75	-	100	4	3
5.	ES 109 B	STATISTICS AND COMPUTER APPLICATIONS	3	-	3	50	--	-	50	3	-
6.	ES 111 B	SEMINAR	2	-	2	50	-	-	50	2	-
7.	ES 113 B	LAB-I (WATER ANALYSIS)	-	8	8	25	-	75	100	4	4
8.	ES 115 B	LAB-II (SOIL ANALYSIS)	-	8	8	25	-	75	100	4	4
TOTAL			21	16	37	250	300	150	700	29	

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CEEES

M.Sc. in Environmental Science (Four –Semester Course)

(Effective from Session 2018-2019)

Semester-II

S. No.	Course Code	Course Title	Teaching Scheme			Examination Marks				Credits	Duration of Exam
			L	P	Total	Marks of Class Work	External Marks		Total		
							Theory	Practical			
1.	ES 102 B	ENVIRONMENTAL IMPACT ASSESSMENT	4	-	4	25	75	-	100	4	3
2.	ES 104 B	NATURAL RESOURCES	4	-	4	25	75	-	100	4	3
3.	ES 106 B	ENVIRONMENTAL POLLUTION	4	-	4	25	75	-	100	4	3
4	ES 108 B	ANALYTICAL TECHNIQUES	4	-	4	25	75	-	100	4	3
5.	ES 110 B	SEMINAR/ SELF STUDY	2	-	2	50	-	-	50	2	-
6.	ES 112 B	LAB-III (WASTEWATER ANALYSIS I)	-	8	8	25	-	75	100	4	4
7.	ES 114 B	LAB-IV (AIR AND NOISE POLLUTION ANALYSIS)	-	8	8	25	-	75	100	4	4
TOTAL			18	16	34	200	300	150	650	26	

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MURTHAL (SONEPAT) HARYANA-131039

CEEES

M.Sc. in Environmental Science (Four –Semester Course)

(Effective from Session 2018-2019)

Semester-III

S. No.	Course Code	Course Title	Teaching Scheme			Examination Marks				Credits	Duration of Exam
			L	P	Total	Marks of Class Work	External Marks		Total		
							Theory	Practical/ Report			
1.	ES 201 B	POLLUTION CONTROL	4	-	4	25	75	-	100	4	3
2.	ES 203 B	SOLID WASTE MANAGEMENT	4	-	4	25	75	-	100	4	3
3.	ES	PE-I	4	-	4	25	75	-	100	4	3
4.	ES	PE-II	4	-	4	25	75	-	100	4	3
5.	ES 205 B	FIELD VISIT	-	2	2	-	-	50	50	2	2
6.	ES 207 B	REPORT WRITING SKILLS	2	-	2	50	-	-	50	2	-
7.	ES 209 B	COMPUTER LAB	-	4	4	50	-	-	50	2	--
8.	ES 211 B	DISSERTATION -I	-	4	4	25	-	75	100	2	4
		TOTAL	18	10	28	175	300	125	650	24	

PE1: ES 213 B Hazardous waste management

ES 215 B GIS and Remote Sensing

PE2: ES 217 B Industrial waste water treatment

ES 219 B Environmental Geology

DEENBANDHU CHHOTU RAM UNIVERSITY OF SCIENCE & TECHNOLOGY**MURTHAL (SONEPAT) HARYANA-131039****CEEES****M.Sc. in Environmental Science (Four –Semester Course)****(Effective from Session 2018-2019)****Semester-IV****Choice Based Credit Scheme w.e.f. 2018-19**

S. No.	Course Code	Course Title	Teaching Scheme			Examination Marks				Credits	Duration of Exam
			L	P	Total	Marks of Class Work	External Marks		Total		
							Theory	Practical			
1.	ES 202 B	ENERGY AND ENVIRONMENT	4	-	4	25	75	-	100	4	3
2.		PE-III	4	-	4	25	75	-	100	4	3
3.		PE-IV	4	-	4	25	-	75	100	4	3
4.	ES 204 B	DISSERTATION-II	-	16	16	100	-	100	200	8	-
		TOTAL	12	16	28	175	150	175	500	20	

Program Elective (PE)-III:**ES 206 B: Environmental Laws****ES 208 B: Natural hazards and disaster management****Program Elective (PE)-IV****ES 210 B: Environment Management and Planning****ES 212 B: Water resource management**

ES-101 B : FUNDAMENTAL OF ENVIRONMENTAL SCIENCE

M. Sc Semester - I (Environmental Science)

L	P	Credits	Class Work	:	25 Marks
4	--	4	Examination	:	75 Marks
			Total	:	100
					Marks
			Duration	of	3 Hours
			Examination		

COURSE OBJECTIVES: The objective of the course is to provide detailed understating of various aspects of environment such as Physico-chemical and Biological factors. The course has been designed to acquaint students with various energy resources and their impacts on the environment. The students are expected to understand basic knowledge of ecological principles and ecosystems.

UNIT-I:

Definition, principles and scope of Environmental Science. Physico-chemical and Biological factors in the Environment. Structure and composition of atmosphere, Structure and composition of hydrosphere, lithosphere and evolution of biosphere.

UNIT-II:

Introduction to energy, laws governing energy flow in ecosystem, importance of energy in human life, energy production (renewable and non-renewable) and its implications on the environment, role of energy in development of nation.

UNIT-III:

Earth, Man and Environment. Ecosystems and its types, Pathways in Ecosystems, Geographical classification and zones. Environmental implication of energy uses, CO₂ emissions, global warming, air and thermal pollution.

UNIT-IV:

Brief introduction to Natural resources their importance and conservation, Environmental issues: local and global scales, Environmental Education: Introduction, principles and scope, Environmental ethics.

COURSE OUTCOMES:

On completion of the course, the students will be able to:

- Develop concepts of basic environmental factors.
- Outline aspects of environmental issues.
- Understand the knowledge of energy resources and their environmental implications

REFERENCES:

1. P.K.Nag, Engineering Thermodynamics, Tata Mc-Graw Hill, New Delhi, 1991.
2. J.B.Jones and R.E.Dugan, Engineering Thermodynamics, PHI, New Delhi, 1996
3. Y.A.Cengel and M.A.Boles, Thermodynamics: An Engineering Approach, Tata McGraw Hill, New Delhi, 1998.
4. Bejan, Advanced Engineering thermodynamics, John Wiley, Toronto, 1988
5. M. W. Zemansky, Heat and Thermodynamics 4th Edn. McGraw Hill, 1968.
6. Ecology of natural resource Ramade
7. Ecology and Environment - P.D. Sharma

NOTE: In the semester examination, the examiner will set eight questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

ES-103 B ECOLOGY AND BIODIVERSITY
M. Sc Semester - I (Environmental Science)

L	P	Credits	Class Work	:	25 Marks
4	--	4	Examination	:	75 Marks
			Total	:	100 Marks
			Duration of Examination	:	3 Hours

COURSE OBJECTIVES:

The students are expected to understand basic knowledge of ecological principles and ecosystems. They will know about different levels of the living world starting with the biology of organisms, then populations and finally the communities. The students will work on case studies related to each level of organization. The course will also provide the understanding of the principles of biodiversity in an ecological and social context. Students learn detailed understating of various aspects of air and soil chemistry.

UNIT-I

Introduction: Definition of Ecology, Aims and scope of ecology, biological levels of organization-genes to biosphere, Population ecology: Characteristics, Population Interaction: Competition, mutualism, parasitism, and predator prey relations, Concept of niche, keystone species and ecotypes.

UNIT-II

Ecosystem: Structural components, ecological pyramids, food webs, trophic levels, biogeochemical cycles, Types and characteristics of ecosystem terrestrial (forest, desert, grassland) and aquatic (pond, marine), wetlands, estuaries, natural and man-made ecosystems, forest types in India.

UNIT-III

Biodiversity: Definition, levels of biodiversity, measurements of biodiversity, values of biodiversity. Hot spots of biodiversity, Biodiversity hotspots of India, threats to biodiversity. Causes of species extinction. Endangered and threatened species, IUCN Categories of threatened species, Red data book, List of threatened flora and fauna in India.

UNIT-IV

Biodiversity conservation: strategies for Biodiversity Conservation, National Parks, Sanctuaries and Biosphere reserves, Ecotourism, legal initiatives for wildlife and forest conservation, International conventions, treaties and protocols for Biodiversity Conservation.

COURSE OUTCOMES:

After completing this course, the students will be able to:

- Describe important ecological processes.
- Demonstrate knowledge of the important ecological principles operating at different levels of organization.
- Develop concepts of basic chemistry associated with toxicology of environmental pollutants.
- Outline fundamental and applied aspects of environmental analytical chemistry.
- Apply analytical tools to determine and measure pollutants in various environmental samples.
- Discuss the method for reducing soil erosion and soil management.

REFERENCES:

1. Terrestrial Ecosystem Ecology: Principles and Applications, Swedish University of Agricultural Sciences, 2012.
2. Day, John W., Kemp W. M., Alejandro Yáñez-Arancibia and Byron C. Crump. Estuarine Ecology (2nd Ed), Wiley-Blackwell Publishers, 2012.
3. Fatik B. Mandal. and Nepal C. Nandi. Biodiversity: Concepts, Conservation and Biofuture, Asian Books, 2013.
4. Jorgensen, Sven Erik. Encyclopedia of Ecology. Vol 1-5. Elsevier Publishers. Netherlands, 2008.

5. Joshi, B.D., Tripathi, C.P.M and Joshi, P.C. Biodiversity and Environmental Management. APH, New Delhi, 2009.
6. Joshi, P.C. and Joshi, N. Biodiversity and conservation. APH Publishing Co-operation, New Delhi, 2009.
7. Kohli, R. K., Jose, S., Singh, H. P. and Batish, D. R. Invasive Plants and Forest Ecosystems. CRC Press / Taylor and Francis, 2009.
8. Lomolino, M.V., Riddle, B.R., Whittaker, R.J. and Brown, J.H. Biogeography (4th Ed). Sinauer Associates, 2010.
9. Odum, E.P., Barrick, M. and Barret, G.W. Fundamentals of Ecology (5th Ed). Thomson Brooks/Cole Publisher, California, 2005.
10. Pandey, B.N. and Jyoti, M.K. Ecology and Environment. APH Publishing Co-operation, New Delhi, 2012.

NOTE: In the semester examination, the examiner will set eight questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

ES 105 B : ENVIRONMENTAL CHEMISTRY
M. Sc Semester - I (Environmental Science)

L	P	Credits	Class Work	:	25 Marks
4	--	4	Examination	:	75 Marks
			Total	:	100
					Marks
			Duration	of :	3 Hours
			Examination		

COURSE OBJECTIVES:

The objective of the course is to provide detailed understating of various aspects of air, water and soil chemistry. The course has been designed to acquaint students with chemical constituents present in the environment, interactions between them and manner in which changes are brought about due to pollution.

UNIT-I: CHEMISTRY FOR ENVIRONMENT

Fundamental Chemistry: Elements, Chemical bonding, chemical reactions and equations, Organic functional groups, classes of organic compounds. Free radical reactions, catalytic processes. Fundamental of environmental chemistry: solubility product, Electrochemistry and redox reactions, Gibbs' free energy; Chemical kinetics and chemical equilibrium. acid-base reactions, Catalysis; Ion exchange; Adsorption.

UNIT-II: AIR CHEMISTRY

Atmospheric chemistry: Composition of air, Chemical speciation, particles, ion and radicals, Formation of particulate matter, Photochemical reactions in the atmosphere, Chemistry of air pollutants, Photochemical smog, Acid rain, Chemistry of Ozone layer depletion, Greenhouse gases and Global warming.

UNIT-III: SOIL CHEMISTRY

Chemistry of Soil: Physio-chemical composition of soil, humus, Inorganic and organic components of soil, Reactions in soil solution, Ion exchange (Physiosorption), Ligand exchange (Chemisorption), Complexations, Chelation; Precipitation / dissolution.

UNIT IV: WATER CHEMISTRY

Water Chemistry: Chemistry of water, Concept of DO, BOD, COD, Sedimentation coagulation, filtration, redox potential

COURSE OUTCOMES:

On completion of the course, the students will be able to:

- Develop concepts of basic chemistry associated with toxicology of environmental pollutants.
- Outline fundamental and applied aspects of environmental analytical chemistry.
- Apply analytical tools to determine and measure pollutants in various environmental samples.

REFERENCES:

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

NOTE: In the semester examination, the examiner will set eight questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

ES 107 B: ENVIRONMENTAL ISSUES AND AWARENESS

M. Sc Semester - I (Environmental Science)

L	P	Credits	Class Work	:	25 Marks
4	--	4	Examination	:	75 Marks
			Total	:	100 Marks
			Duration	of	3 Hours
			Examination		

COURSE OBJECTIVES:

The course intends to introduce the students to the vast field of Laws and Policies both at the national and international level relating to environment. The students will be given an insight into major acts and rules applicable for pollution control as well as natural resource conservation. At the end of the course it is expected that the students will be equipped with the skills needed for interpreting laws, policies and judicial decisions about the environment.

UNIT- I

Environmental awareness: Introduction and need, role of media in environmental awareness, Role of NGOs, public participation in environmental movements, role of Government, role of Educational Institutes.

UNIT-II

Current environmental issues, Role International environmental initiatives, Stockholm Declaration, Ramsar convention on wetlands, Outer space treaty, Vienna convention & Montreal Protocol, Kyoto Protocol, Earth Summit, Agenda 21, UNF Convention on Climate Change (UNFCCC).

UNIT-III

Case Studies: Ganga Action Plan, Yamuna Action plan, Love Canal Incidence, Teri Dam, Sardar Sarovar Dam, Chipko movement, Appiko Movement, Global warming, Asian Brown Cloud, Photo-chemical smog, Acid rain, Bhopal gas tragedy, Chernobyl nuclear accident, Minamata accident, Leaded gasoline, Sukinda Valley, Space waste.

UNIT-IV

Introduction to Environmental ethics, ethical theories, Environmental ethics and population, environmental ethics and pollution, animal ethics, biocentrism, ecocentrism, Environment and Poverty, Environmental Education, Concept of Sustainable Development.

COURSE OUTCOMES:

After completing this course, the students will be able to:

- Understand environmental legislation and policies of national and international regime.
- Know regulations applicable to industries and other organizations with significant environmental aspects.
- Apply the legislation concepts for solving the local environmental problems.
- Get knowledge of the legal system operating in India and will be in a position to prepare compliance reports for getting environmental clearance.
- Prepare the environmental management system for an organization.

REFERENCES:

1. Economics and Environment – Good Steie
2. Environmental Planning, Policies & Programmes in India – K.D. Saxena
3. Land – Use and Environment – S.M. Mujtava
4. Environmental Administration and Law- Paras Diwan.

NOTE: In the semester examination, the examiner will set eight questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

ES 109 B : STATISTICS AND COMPUTER APPLICATIONS

M. Sc Semester - I (Environmental Science)

L	P	Credits	Class Work	: 50 Marks
3	--	3	Total	: 50 Marks

COURSE OBJECTIVES:

The course has been designed with the objective to provide the basic knowledge about the Statistics, computer and their applications. The course will help the students in performing various calculations in research to present the results in a more meaningful manner.

UNIT-I:

Fundamentals of Computers, World Wide Web, MS Word, Paint and Notepad.

UNIT-II:

Statistics and its application in environmental data analysis, Sampling, Sampling Techniques, data collection,

UNIT-III:

Introduction to Word Processing and Microsoft Office, Creating and Saving Documents, Text Formatting, Tables, Document Review Option, Mail Merge, Inserting Table of Contents, Reference Management.

UNIT-IV:

Data representation measures of central tendency: mean, median, mode, geometric mean, harmonic mean, measure of dispersion: moment, matrices, standard deviation, variance and skewness.

COURSE OUTCOMES:

After completing this course, the students will be able to:

- Acquire the basic knowledge of computer and its applications.
- Acquaint with knowledge of statistical application in research.
- Compute the data in a more meaningful manner.

REFERENCES:

1. MS Word for Dummies. Wiley. Gookin, D. (2007)
2. MS Excel for Dummies. Wiley, Harvey, G. (2007)
3. Computer Fundamentals, BPB Publications, Sinha, P.K.
4. Statistics for Environmental Science & Management- Bryar, F.J. Manly
5. Introduction to Statistics- Kapoor & Sanchita.
6. Statistics for earth and environment by Schuenemeyer & Drew

NOTE: Assessment will be done on the basis of internal examination only.

ES 111 B: INDEPENDENT STUDY SEMINAR

M. Sc Semester - I (Environmental Science)

L	P	Credits	Class Work	: 50 Marks
-	2	2	Total	: 50 Marks

The student has to identify from the assign topics from biotechnology and prepare and deliver seminar as it with guidance of the teacher. The student will give presentation to the committee through presentation to demonstrate his/her learning. Teachers associated with evaluation work will be assigned two periods per week load.

ES 113 B: LAB-I (WATER ANALYSIS)
M. Sc. Semester - I (Environmental Science)

L P Credits

Class Work

: 25 Marks

Examination : 75 Marks
Total : 100 Marks
Duration of : 4 Hours
Examination

COURSE OBJECTIVES:

- The primary objectives of this course are to develop the skills to understand the theory and practice of water analytical techniques.
- To provide scientific understanding of analytical techniques and detail interpretation of results.
- Students will be able to understand basic concept, instrumentation and application of analytical techniques used in Environment.

List of Experiments/ Exercises

1. Determination of pH of given water sample.
2. Determination of Total Solids, suspended solids and dissolved solids in a given water sample.
3. Determination of EC of given water sample.
4. Determination of Total hardness, calcium and magnesium hardness in given water sample.
5. Determination of Turbidity in a given water sample.
6. Determination of Dissolved oxygen in a given water sample.
7. Determination of BOD 5 in a given water sample.
8. Determination of COD in a given water sample.
9. Determination of Acidity in a given water sample.
10. Determination of Alkalinity in a given water sample.

COURSE OUTCOMES:

- Hands on experience to strengthen the concepts.
- Able to use selected analytical techniques.

NOTE: The students will be required to perform 08 experiments/ exercises from the above list. Addition and deletion in the list of experiments may be made from time to time by the department depending on the requirement of course.

L P Credits
-- 8 4

Class Work : 25 Marks
Examination : 75 Marks
Total : 100 Marks
Duration of : 4 Hours
Examination

COURSE OBJECTIVES:

The course has been designed to train the students in the laboratory for quantitative analysis of various physical and chemical pollutants in air and soil, and to provide firsthand experience on various instruments.

List of Experiments/Exercises

1. Determination of pH in soil.
2. Determination of EC in soil.
3. Determination of carbonate content in soil.
4. Determination of Total Organic Carbon in soil.
5. Determination of Particle size analysis in soil.
6. Determination of moisture content and water holding capacity of soil.
7. Heavy metals analysis in soil.
8. Mineralogical analysis of soil.
9. Determination of specific gravity of soil.
10. Determination of bulk density in soil.

COURSE OUTCOMES: The students will be able to:

1. Design various experiments for reducing the pollution load from air and soil.
2. Correlate environmental impacts and field processes.

Note: The students will be required to perform 08 experiments/ exercises from the above list. Addition and deletion in the list of experiments may be made from time to time by the department depending on the requirement of course.

L P Credits
4 -- 4

Class Work : 25 Marks
Examination : 75 Marks
Total : 100 Marks
Duration of Examination : 3 Hours

COURSE OBJECTIVES:

The students will acquire a better understanding of theoretical ideas of social impact, cultural and environmental impact due to development. This course will provide the basic knowledge to the students with an insight into environmental impact assessment (EIA) methodologies, environmental settings, prediction, evaluation of impacts and their mitigation plan. The students will also get idea to interpret environmental management plans and EIA documents. A comprehensive understanding of the need and procedures for environmental auditing will be provided to the students.

UNIT-I:

Introduction to environmental impact assessment, origin and development of EIA, EIA methodologies (project screening, scoping, impact identification, impact prediction, evaluation, monitoring, auditing, and mitigation).

UNIT-II:

EIA guidelines 1994 and 2006 Notification of Government of India, Public participation, review and decision making in EIA, generalized approach to impact analysis Procedure for reviewing statement, Guidelines for Environmental Audit.

UNIT-III:

Introduction to Base line information and prediction (land, water, air, socio economic), restoration and rehabilitation technologies, Environmental management system.

UNIT-IV:

Concept of cleaner technologies: Clean development mechanism, Life cycle analysis, Concept and strategies of sustainable development, Cost-Benefit analysis, Environmental priorities in India and Sustainable development.

COURSE OUTCOMES:

On completion of the course, the candidate will be able to:

- Appreciate the importance of EIA as an integral part of planning process
- Understand the methods and tools of identification, prediction and evaluation of environmental impacts of developmental projects.
- Understand the legal requirements for getting environmental clearance for new projects.
- Know the requirements to become EIA consultant.
- To be a part of EIA team to conduct EIA study for various projects.
- Acquire basic skills to take up environmental auditing and lifecycle analysis at specific industries.

REFERENCES :

1. Environmental Impact Assessment- John Glasson.
2. Methods of Environmental Impact Assessment - Morris and the rivell.
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

NOTE: In the semester examination, the examiner will set eight questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

ES 104 B NATURAL RESOURCES
M. Sc. Semester - II (Environmental Science)

L P Credits
4 -- 4

Class Work : 25 Marks
Examination : 75 Marks
Total : 100 Marks
Duration of : 3 Hours
Examination

COURSE OBJECTIVES:

The course is designed to provide information to the students about the natural resources of the planet Earth and causes of their depletion. The course also fosters an understanding of fundamental environmental issues with a focus on resource conservation and management for future use.

UNIT –I

Resources: Definition, classification of natural resources, natural resource degradation and conservation, Environmental impacts of resource depletion, Human impact on natural resources. Wild life resources and conservation measures .

Human resources – population explosion, urbanization, industrialization, slums, poverty.

UNIT -II

Land resources: Land degradation due to mining, exploration, industrialization, irrigation and natural disasters; Soil Erosion, Loss of soil fertility, Restoration of soil Fertility, Soil Conservation Methods, restoration of degraded land, Organic farming,

Mineral resources: Mineral resources of India – Use and exploitation; mineral exploration, extraction; environmental impacts of extraction; Restoration of mining lands.

UNIT -III

Forest resources : Forests, their importance, types, global distribution; primary and secondary products, forest resources of India. Impact of deforestation; Sustainable forest Forest Management.

UNIT –IV

Water Resources: Surface, ground water, marine and brackish water resources - assessment and utilization, Rivers and Lakes in India, hydrological cycle, Ground water depletion, Water logging and salinity, Water Conservation and management techniques, Rain water harvesting, Eutrophication, Restoration of Lakes, River cleaning, Interlinking of rivers, conflicts over water.

COURSE OUTCOMES:

After completing this course, the students will be able to:

- Apply principles of chemical, biological, and physical systems to address natural resource and environmental issues.
- Demonstrate the ability to draw conclusions and make recommendations based on an interdisciplinary understanding of natural and human systems.
- Able to effectively apply various steps for conservation of natural resource.

REFERENCES:

1. Anderson, David A. (2013) Environmental economics and natural resource management, Taylor and Francis 4th Edition.
2. Gurdev Singh (2007) Land resource management, Oxford publishers.
3. Kathy Wilson Peacock. (2010) Natural resources and sustainable developments. Viva books.
4. Lynch, Daniel R. (2009) Sustainable natural resource management for scientists and engineers. Cambridge University Press.
5. Jaidev, Somesh (2010) Natural resources in 21st century. Oxford Publishers.
6. Mishra, S.P (2010) Essential Environmental Studies, Ane Books.

7. Kudrow, Nikolas J (Ed) (2009) Conservation of natural resources, Nora Science, New York.
8. Kumar, H.D. (2001) Forest resources: Conservation and management. Affiliated EastWest Press.
9. Grigg, Neil S. (2009) Water resources management: Principles, regulations, and cases, McGraw Hill Professional.
10. Beckman, Daniel W. (2013) Marine environmental biology and conservation. Jones and Barlett learning.
11. Primak R.B (2014) Essentials of Conservation biology, Sinauer Publishers, 6th edition

NOTE: In the semester examination, the examiner will set eight questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

ES 106 B : ENVIRONMENTAL POLLUTION
M. Sc. Semester - II (Environmental Science)

L	P	Credits		Class Work	: 25 Marks
4	--	4		Examination	: 75 Marks
				Total	: 100
					Marks
				Duration	of : 3 Hours
				Examination	

COURSE OBJECTIVES:

The course has been designed to improve the understanding of the students about water, air and soil pollution and its control. The course will also provide the knowledge about the sources of pollution and

their impacts on environment and health. They will develop the skills to apply remediation techniques to combat pollution.

UNIT-II: AIR POLLUTION

Air pollution – world and Indian scenario, Sources and classification of air pollutants, Air pollutants, effects and consequences. Transport and diffusion of pollutants, gas laws governing the behavior of pollutants in atmosphere, Air quality standards, Acid Rain.

UNIT-II: WATER POLLUTION

Sources, types, Causes and consequences of water pollution, water pollutants, Sampling of water and wastewater, collection and storage, physical analysis of water (colour, alkalinity, TDS, conductivity, temperature, odour, turbidity, hardness) chemical analysis of water (carbonates, bicarbonates, sulphate, chloride and fluoride, heavy metals), biological analysis of water (dissolved oxygen, BOD, COD).

UNIT-III: SOIL POLLUTION

Soil: soil horizon, soil profiles, composition of soil, Physico-chemical and biological properties of soil, sampling and analysis of soil quality.

Soil Pollution: Definition, sources- point and non-point, routes. Soil pollutants – Types, pesticides, heavy metals, Effects and impacts of soil pollution, Effect of modern agriculture on soil.

UNIT-IV: NOISE POLLUTION

Definition, sources, Sound pressure, intensity, decibel, measurement and analysis of sound, Noise Indices, Meteorological effects on Noise propagation, Effects and impacts on human, Noise exposure level and standards.

COURSE OUTCOMES:

On completion of the course, the students will be able to:

- Understand the type and nature of air, water and soil pollutants, their behaviour relevant meteorological determinants influencing the pollutants.
- Discuss the pollution emission standards.

REFERENCES:

1. Environmental Pollution – Peavey and Rowe
2. Environmental Pollution and solution- Asthana and Asthana
3. Environmental Engineering- Peavy, HS, Donald RR & G. Tchobanoglous, MGH Int. Ed. New York, 1985.
4. Water quality & treatment: A handbook on drinking water, Edzwald, James K. (ed.)
5. Air pollution: measurement, modeling and mitigation, Jeremy, C., Tiwary, A. and Colls, J. (2009). 3rd Edition, Crc Press, USA.

NOTE: In the semester examination, the examiner will set eight questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

ES 108 B: ANALYTICAL TECHNIQUES
M. Sc. Semester - II (Environmental Science)

L	P	Credits
4	--	4

Class Work	:	25 Marks
Examination	:	75 Marks
Total	:	100 Marks
Duration	of :	3 Hours
Examination		

COURSE OBJECTIVES:

The objective of the course is to develop sampling and analytical skills of the students which are required

in environmental monitoring. The students will be able to perform quantitative analysis of various physical, chemical and biological pollutants in environment with reference to air, water and soil. The students will acquire knowledge about various standard protocols used in environmental monitoring. The course will also help the students to learn the theory and concepts and develop their practical skills to use the contemporary tools and various techniques required.

UNIT-I

Basic concepts of quantitative analytical chemistry - Buffer solution, common ion effect, , oxidation reduction reactions, preparation of standard solution, primary standard and secondary standard, normality, morality, molality, mole fraction.

UNIT II

Titrimetric methods: Acid base titration, precipitation titration, complexometric titration, oxidation-reduction titration.

UNIT-III

Chromatography- Thin Layer chromatography, Liquid Chromatography, High Pressure Liquid Chromatography, Gas Chromatography, ion chromatography.

UNIT IV

Spectroscopy- General Principle, Atomic Absorption spectroscopy- Theory, Instrumentation, graphite furnace techniques, hydride generation, monochromators, Detectors, Atomic emission spectroscopy- Flame emission spectroscopy, Plasma emission spectrometry, Inductively coupled plasma, ICP instrumentation. Spectrophotometer, X – ray diffraction- principles.

COURSE OUTCOMES:

On completion of the course, the students will be:

- Trained in analytical and conceptual skills required for environmental chemistry research.
- Able to design and carry out a method of environmental chemical analysis, including instrumental analysis.

REFERENCES:

1. Environmental chemistry by Mannahan.
2. Environmental chemistry by A K De.
3. Introduction to environmental science and engineering by Gilbert M. Masters
4. Chemistry for Environmental Engineering Clair N. Sawyer & McCarty, TATA McGraw Hill International Publication III rd Edition.1986
5. Vogel's Textbook of quantitative chemical analysis, J. Mendham, R c Denney, J D Barnes, M J Thomas, Pearson, Education.
6. Environmental Soil Chemistry by Donald L. Sparks.
7. Fundamentals of Analytical chemistry by Skoog, West & Holler.

8. Environmental Pollution – principles, Analysis and control, by P. Narayanan.

NOTE: In the semester examination, the examiner will set eight questions in all, selecting two from each unit. The candidates will be required to attempt five questions in all selecting at least one from each unit. All questions will carry equal marks.

L	P	Credits
-	2	2

Class Work	: 50Marks
Total	: 50 Marks

The student has to identify from the assign topics from environment and prepare and deliver seminar as it with guidance of the teacher. The student will give presentation to the committee through presentation to demonstrate his/her learning. Teachers associated with evaluation work will be assigned two periods per week load.

L P Credits
-- 8 4

Class Work : 25 Marks
Examination : 75 Marks
Total : 100
Marks
Duration of : 4 Hours
Examination

COURSE OBJECTIVES:

- The primary objectives of this course are to develop the skills to understand the theory and practice of waste water analytical techniques.
- To provide scientific understanding of analytical techniques and detail interpretation of results.
- Students will be able to understand basic concept, instrumentation and application of analytical techniques used in Environment.

List of experiments:

1. Determination of pH of given wastewater sample.
2. Determination of Total Solids, suspended solids and dissolved solids in a given wastewater sample.
3. Determination of EC of given wastewater sample.
4. Determination of Total hardness, calcium and magnesium hardness in given wastewater sample.
5. Determination of turbidity in a given wastewater sample.
6. Determination of Dissolved oxygen in a given wastewater sample.
7. Determination of BOD 5 in a given wastewater sample.
8. Determination of COD in a given wastewater sample.
9. Determination of Acidity in a given wastewater sample.
10. Determination of Alkalinity in a given wastewater sample.

COURSE OUTCOMES:

On completion of the course, the students will be:

- Hands on experience to strengthen the concepts.
- Able to use selected analytical techniques.

NOTE: The students will be required to perform 08 experiments/ exercises from the above list. Addition and deletion in the list of experiments may be made from time to time by the department depending on the requirement of course.

M. Sc. Semester - II (Environmental Science)

L	P	Credits	Class Work	:	25 Marks
--	8	4	Examination	:	75 Marks
			Total	:	100
					Marks
			Duration	of	: 4 Hours
			Examination		

Course Objectives:

- The primary objectives of this course are to develop the skills to understand the theory and practical handling of air pollutants.
- To provide scientific understanding of analytical techniques and detail interpretation of results.
- Students will be able to understand basic concept, instrumentation and application of analytical techniques used in noise monitoring.

List of Experiments

1. Determination of suspended particulate matter using high volume air sampler in residential areas.
2. Determination of suspended particulate matter using high volume air sampler in institutional.
3. Determination of SO_x in ambient air.
4. Determination of NO_x in ambient air.
5. Determination of Ozone in ambient air.
6. Estimation of atmospheric dust fall.
7. Estimation of noise in residential areas.
8. Estimation of noise in commercial areas.
9. Estimation of noise in institutional areas.
10. Estimation of noise in silence zone.

COURSE OUTCOMES:

On completion of the experiments, the students will be to:

- Measure air quality index
- Measure noise pollution

NOTE: The students will be required to perform 08 experiments/ exercises from the above list. Addition and deletion in the list of experiments may be made from time to time by the department depending on the requirement of course.