M.Sc. ENVIRONMENTAL SCIENCE (Self Financing Course)

(Two Year) Four Semester Programme under Choice Based Credit System

(Applicable for students admitted in July, 2017 & onwards)

Semester I:			**Max Marks**
Paper I:	The Earth and its Environment		100 (04 credits)
Paper II:	Biotic community and Dynamics		100 (04 credits)
Paper III:	Biotic responses - I		100 (04 credits)
Paper IV:	Biotic responses - II		100 (04 credits)
Practical:	Based on Papers I – IV		100 (04 credits)
		Total	500 (20 credits)

Semester II:			
Paper V:	Abiotic Natural resources and agriculture		100 (04 credits)
Paper VI:	Biotechnology and agriculture		100 (04 credits)
Paper VII:	Biotic resources - I		100 (04 credits)
Paper VIII:	Biotic resources - II		100 (04 credits)
Project:			100 (04 credits)
		Total	500 (20 credits)

Semester III:			
Paper I:	Environmental Pollution - I (General concept of pollution and Air pollution)		100 (04 credits)
Paper II:	Environmental Pollution - II (Water and soil pollution)		100 (04 credits)
Paper III:	Environmental pollution – III (Radiation, Noise, Industrial and Thermal pollution)		100 (04 credits)
Paper IV:	Advances in Environmental Management & Biostatistics		100 (04 credits)
Practical:	Based on Papers I – IV & Academic Tour		100 (04 credits)
		Total	500 (20 credits)

Semester IV:			
Paper V:	Environmental toxicology- I		100 (04 credits)
Paper VI:	Environmental toxicology -II		100 (04 credits)
Paper VII:	Environmental policy and management-I		100 (04 credits)
Paper VIII:	Environmental policy and management –II		100 (04 credits)
Project:			100 (04 credits)
		Total	500 (20 credits)

Total Maximum Marks for all 4 Semesters:		2000 (80 credits)
+ 1 Elective Course/ semester: 03 credits - 100 marks		400 (12 credits)
	Total	**2400 (92 credits)**

M.Sc. ENVIRONMENTAL SCIENCE (SEMESTER - I)
PAPER - I
THE EARTH AND ITS ENVIRONMENT: 05 Credits

Total: 48 Hours

Unit - I : 01 Credit	**Hours**
Study of Environmental Science- Definition, principle and relevance of Environmental Science. Biosphere, its resources and diversification	4
Atmosphere : Definition, boundaries and characteristics of troposphere, stratosphere, mesosphere, thermosphere and exosphere	6
Types of winds and inversion	2
Unit - II: 01 Credit	
Lithosphere : Basic concept : Land forms, Rocks and their classes	4
Origin and development and soils , physico –chemical properties of soil	4
Soil profile: **O,A,B,C, R horizons**	4
Unit - III: 01 Credit	
Hydrosphere, Watershed, Snow & Ice, Ground water	4
Definition, structure, Precipitation, precipitation index, Hydrological cycle, run-off formation, flow in channels, lake storage.	4
Physio-chemical properties of fresh water and marine environment.	4
Unit - IV : 01 Credit	
Energy: non-renewable and renewable energy sources National and Global Energy Scenarios, potentials and limitations of conventional energy sources.	4
Energy Conservation: Efficiency in production, transportation and utilization of energy	4
Future sources of Energy : Hydrogen, Alcohol, Biodiesel, Fuel cells	4
Practical based on unit I –IV : 01 Credit	

M.Sc. ENVIRONMENTAL SCIENCE (SEMESTER - I)
PAPER - II
BIOTIC COMMUNITY AND DYNAMICS: 05 Credits

Total: 48 Hours

Unit - I : 01 Credit	**Hours**
Ecosystem: Concept of ecosystem, composition, production, consumption, decomposition, biogeochemical cycles	3
Ecosystem function: Energy flow, energy budget, food chairs & food webs, ecological pyramids and biotic interactions	3
Ecosystem disturbance: resilence, decline	3
Ecosystem Modeling: Concept, basic categories of models their architecture , parameter estimation and sensitivity analysis	3
Unit - II: 01 Credit	
Population Ecology: Definition, population, characteristics (Population size and density, dispersion, age structure, natality, mortality) , population dynamics and population regulation	6
Life Tables: Probability of surviving any particular year of age, remaining life expectancy for people at different ages	6
Unit - III: 01 Credit	
Community Ecology: Definition, structure and its composition	4
Community Organization and characteristics	4
Succession, Types of succession Trends of succession and community retrogression, general process of succession, climax community	4
Unit - IV: 01 Credit	
Ecological Equivalent	4
Ecological Niche	4
Ecotone and concept of Edge effect	4
Practical based on unit I –IV: 01 Credit	

M.Sc. ENVIRONMENTAL SCIENCE (SEMESTER - I)
PAPER - III
BIOTIC RESPONSES – I: 05 Credits

Total: 48 Hours

Unit - I: 01 Credit	**Hours**
Habitat: Definition, classification and types lentic and lotic fresh water and marine habitats including division of sea (Intertidal, pelagie, abyssal, benthic)	4
Physico-chemical characteristics of fresh water and marine habitats	4
Disturbances and its impact on aquatic habitats	4
Unit - II: 02 Credit	
Ecological adaptations in plants: xerophytes, mesophytes, halophytes, psammophytes, oxalophytes	4
Morphological, physiological and anatomical features of aquatic and ecologically modified plants	6
Phytoplanktons of fresh and marine water environment	2
Unit - III: 01 Credit	
Wetlands, major wetlands of India and abroad, flora of wetlands, Ramsar sites	4
Degradation and restoration of wetland Ecosystems	4
Ecological engineering, Biological remediation practices for pollution abatement of wetlands using constructed wetlands.	4
Unit - IV: 01 Credit	
Faunal composition and aquatic habitats (Freshwater, marine and natural wetlands)	6
Nektons, Benthos & Zoo planktons	6
Practical based on unit I –IV: 01 Credit	

M.Sc. ENVIRONMENTAL SCIENCE (SEMESTER - I)
PAPER - IV
BIOTIC RESPONSES – II: 05 Credits

Total: 48 Hours

Unit – I: 01 Credit	**Hours**
Terrestrial habitat and its Characteristics	4
Biogeographical realms.	4
Biomes (Tundra and Antarctica, high altitude and alpine, forests, tropical savana, grasslands and desert).	4
Unit - II: 01 Credit	
Biogeographical distribution of animals : Principles and concepts	4
Wallace line, Allen's rule, Bergmann's rule, Modern application of biography	4
Paleobiogeography	4
Unit - III: 01 Credit	
Phytogeography and vegetational zones	4
Interpretive Phytogeography , principals of plant distribution	4
Important forest types of India	4
Unit - IV: 01 Credit	
Biotic responses to Environmental stress (Drought, salinity, heat, UV, cold, nutrients and pathogens stress)	4
Concept of signaling molecules and mechanism of signal transduction, stress induced heat shock proteins	4
Cellular responses to Heat, Drought & salinity stress responses.	4
Practical based on unit I –IV: 01 Credit	

M.Sc. ENVIRONMENTAL SCIENCE (SEMESTER - II)
PAPER - V
ABIOTIC NATURAL RESOURCES AND AGRICULTURE: 04 Credits

Total: 48 Hours

Unit - I: 01 Credit	**Hours**
Abiotic Natural Resources, status , classification and strategies for sustainable exploitation and development, management of water and land resources	4
Geological and geographical distribution of natural resources	4
Management of water and land resources	4
Unit - II: 01 Credit	
Geological and geographical distribution of mineral resources	2
Mineral types and their importance, major Environmental issues, classification properties of rocks	4
Metallic and nonmetallic mineral deposits	2
Mine waste disposal and related problems, impact of mining activities on health, Restoration of mined area	4
Unit - III: 01 Credit	
Water management strategies	2
Rain water harvesting	2
Artificial recharge of ground waste water	2
Biological treatment of waste water	2
Recycling of domestic and industrial waste waters	2
Water conservation	2
Unit - IV: 01 Credit	
Land Management : Law use classification, degraded lands	4
Soil erosion and factors affecting soil erosion	4
Principles and methodologies for soil conversation and restoration of degraded land	4

M.Sc. ENVIRONMENTAL SCIENCE (SEMESTER - II)
PAPER - VI
BIOTECHNOLOGY AND AGRICULTURE: 04 Credits

Total: 48 Hours

Unit - I: 01 Credit	**Hours**
Agriculture: Farm produce, kinds, agriculture practices in India, cereal crops of India	4
Cash crops of India	4
Main threats to sustainable agriculture Constrains in agriculture and their suggested remedies	4
Unit - II: 01 Credit	
GM crops, GM crops in India	3
Environmental concerns about GM crops.	3
The regulation of GM crops and products	3
Greener genetic engineering	3
Unit - III: 01 Credit	
Organic farming	4
Bio fertilizers	4
Biopesticides; Slow release fertilizers and pesticides	4
Unit - IV: 01 Credit	
Energy crops & Biofuels	4
Role of tissue culture in agriculture	2
Floriculture	1
Intellectual property rights and Patent	4
Gene pool protection to conserve indigenous species	1

M.Sc. ENVIRONMENTAL SCIENCE (SEMESTER - II)
PAPER - VII
BIOTIC RESOURCES – I: 04 Credits

Total: 48 Hours

Unit - I: 01 Credit	**Hours**
Forest cover (Global & National) and their importance	4
Depletion of forest cover and reasons for reduction in forest area	4
Conservation of forests	2
Role of forests in maintaining Environment	2
Unit - II: 01 Credit	
Forests resources management	4
National Forest policy and forest protection act Social & Agro forestry	4
Afforestation of degraded waste lands and green designing	4
Unit - III: 01 Credit	
Biosphere reserves & National Parks, wild life sanctuaries in India	3
Ecotourism	3
Sustainable and eco -friendly development and exploitation of forest resources	4
Role of sacred grooves in biodiversity conservation	2
Unit - IV: 01 Credit	
Wildlife and its importance, diversity trends and gradients management wild life protection act	4
Mega diversity zones and hot spots , threats to wild life diversity, major causes, extinctions	4
Vulnerability of species to extinction, IUCN threat categories, red data list	2
Earth summit and follow up action and convention on biodiversity	2

M.Sc. ENVIRONMENTAL SCIENCE (SEMESTER - II)
PAPER - VIII
BIOTIC RESOURCES - II: 04 Credits

Total: 48 Hours

Unit - I: 01 Credit	**Hours**
Fishery: Types, problems, Fish farming	3
Aquaculture.	3
Silviculture	3
Bee farming	3
Unit - II: 01 Credit	
Basic concept of sustainable development & Social Environmental issues related to wild life, social factors affecting wild life depletion	4
Tribals and their role in the wild life conservation	4
Cost valuation of biodiversity in Environmental terms	4
Unit - III: 01 Credit	
Concept of eco planning for eco friendly development	4
Community Participation and capacity building programmes for sustainable exploitation of wild life resources and for socio- economic development of tribals.	4
Role of NGOs in wild life management	4
Unit - IV: 01 Credit	
Biodiversity bioinformatics and biodiversity prospecting, biodiversity data bases	4
Rare, endangered, vulnerable, threatened and near-extinct species, conservational efforts.	6
National parks and wildlife sanctuaries of India.	2

Project: 04 Credits

M.Sc. ENVIRONMENTAL SCIENCE (SEMESTER - III)
PAPER - I
ENVIRONMENTAL POLLUTION - I
(GENERAL CONCEPT OF POLLUTION AND AIR POLLUTION): 05 Credits

Total: 48 Hours

Unit - I: 01 Credit	**Hours**
Environmental pollution, basis and challenges of Environmental pollution and control measures	6
Types of Environmental pollutant including new emerging pollutants (Nano materials, antimicrobial agents)	6
Unit - II: 01 Credit	
Air pollutant : Types and sources	2
Particulate air pollutants : Pollution due to Dust, Carbon, Flyash, Asbestos, smog – sources and effects.	3
Management of particulate pollution	2
Non particulate air pollutants (Environmental levels and effects of common non-particulate air pollutants viz, Gases – SO_2 , CO_2 , CO, CH_4 Nitrogen oxides etc.	3
Management of nonparticulate air pollution	2
Unit - III: 01 Credit	
Global warming , climate change, acid rain	3
Green house gases and impact of enhanced green house effect on Environment	3
Ozone layer depletion	3
Vehicular pollutants and their impact on environment	3
Unit - IV : 01 Credit	
Dust and pollen allergies, protection and control measures.	6
Air borne microbes and their health hazards	6
Practical based on Unit 1-IV : 01 Credit	

M.Sc. ENVIRONMENTAL SCIENCE (SEMESTER - III)
PAPER - II
ENVIRONMENTAL POLLUTION – II: 05 Credits
(WATER & SOIL POLLUTION)

Total: 48 Hours

Unit - I: 01 Credit	**Hours**
Water Pollution: Types (biodegradable and nondegradable), Major Sources, environmental levels, effects on plants and animals.	4
Physico-chemical properties of freshwater and marine water resources	4
Microbial water quality assessment for identifying water borne diseases and their health hazards.	4
Unit - II: 01 Credit	
Water quality standards, water sampling techniques	4
Management of water pollutants: Industrial, domestic, agricultural run off I: Industrial and domestic waste water treatment methods, ETP design and function	4
II: Bioremediation techniques: Phytoremediation, constructed wetlands for management of polluted areas, bacterial degradation of pollutants	4
Unit - III: 01 Credit	
Ground water pollution, major sources its impact on plants and human life.	3
Physico-chemical and microbiologcal properties of ground water	3
Flouride pollution of ground water and its management.	3
Ground water Salinity: Sources, spread and impacts of ground water salinity on humans and agricultural crops.	3
Unit - IV: 01 Credit	
Soil Pollution, Definition and Types of soil pollutants.	4
Bioremdiation of soil pollutants.	4
E -waste and its management	4
Practical based on Unit I to IV: 01 Credit	

M.Sc. ENVIRONMENTAL SCIENCE (SEMESTER - III)
PAPER - III
ENVIRONMENTAL POLLUTION – III: 05 Credits
(RADIATION, NOISE, INDUSTRIAL & THERMAL POLLUTION)

Total: 48 Hours

Unit - I: 01 Credit	**Hours**
Radiation Pollution: Sources, environmental levels and effects of radiation pollution on environment and organisms.	4
Radioactive fall outs. Protective measures.	4
Bio indicators of radio nucleotides and radiation hazards	4
Unit - II: 01 Credit	
Noise pollution: Definition and units of noise, tolerable and hazardous limits of noise.	4
Effects of noise pollution on human health, Control measures.	4
Role of plants in management of noise pollution	4
Unit - III: 01 Credit	
Industrial Pollution, Definition and Types of Industrial Pollutants.	4
Sources and effects of Industrial wastes and its impact on environment.	4
Management of Industrial Pollutions	4
Unit - IV: 01 Credit	
Thermal pollution: Its source simpacts on flora, fauna and human beings, its control measures.	6
Solid waste: types, sources, solid waste disposal, solid waste treatment plant and Management of landfill sites through plantation	6
Practical based on Unit I to IV: 01 Credit	

M.Sc. ENVIRONMENTAL SCIENCE (SEMESTER - III)
PAPER – IV: 05 Credits
ADVANCES IN ENVIRONMENTAL MANAGEMENT & BIOSTATISTICS

Total: 48 Hours

Unit - I: 01 Credit	**Hours**
Remote Sensing: Sensors and plate forms, image geometry, scale and resolution,visual interpretation, principles of digital image processing	4
Application of remote sensing in environmental pollutant identification and environmental quality management	2
Concepts of geographical information system	2
Application of remote sensing in hazards identification for extreme metrological events: wave and tsunami effects, tropical cyclones, landslides and avalanches, forecasting of earthquakes, precipitation, el-nino, melting of ice sheets	4
Unit - II: 01 Credit	
Environmental disasters: Natural disasters and their effects	4
Accidental and Manmade environmental disasters and their effects.	4
Management of natural, manmade and accidental disasters	4
Unit - III : 01 Credit	
Biostatistics and its application in toxicological studies, statistical terms and symbols, samples and sampling, data and data presentation (tabular, graphical and diagrammatic)	3
Measures of Central tendency (mean, mode, median)	2
Measures of dispersion: range, mean deviation, standard deviation, variance	2
Correlation and regression analysis	1
t- test, chi square test, one way and two way Analysis of variance	4
Unit - IV: 01 Credit	
Bioconversion of waste into useful substances: Vermicomposting	4
Biogas generation	4
Paper making from agricultural wastes	4
Practical based on Unit I to IV: 01 Credit	

M.Sc. ENVIRONMENTAL SCIENCE (SEMESTER - IV)
PAPER – V
ENVIRONMENTAL TOXICOLOGY – I: 04 Credits

Total: 48 Hours

Unit - I: 01 Credit	**Hours**
Survey and classification of common hazardous chemicals in the environment.	12
Unit - II: 01 Credit	
Principals of transport of xenobiotics across biomembranes.	3
Routes of exposures, biotic and environmental factors influencing absorption.	3
Biotransformation and excretion of xenobiotics.	3
Factors effecting toxicity of xenobiotics.	3
Unit - III: 01 Credit	
Principal of antidotal therapy.	3
Toxicity tests: Acute, subacute, subchronic and chronic toxicity tests. Skin and eye tests; behavioural, neurotoxic, reproductive, mutagenic and carcinogenic tests.	3
Mutagenic and carcinogenic agents (Polynuclear aromatic hydrocarbons and nitrosamines, organic solvents, alcohol, carbon tetra chloride.	3
Anaesthetics (chloroform, ether, xylocaine). Tobacco chewing and smoking.	3
Unit - IV: 01 Credit	
Principals of biotransformation: Sites of biotransformation.	6
Biotransformation enzymes and biotransformation reactions for gaseous toxicants (CO_2, CO SO_2 and nitrogen oxides), chemical contaminants (Dioxins and dibenzofurans).	6

M.Sc. ENVIRONMENTAL SCIENCE (SEMESTER - IV)
PAPER – VI
ENVIRONMENTAL TOXICOLOGY - II: 04 Credits

Total: 48 Hours

Unit - I: 01 Credit	**Hours**
Systemic toxicity I: Neurotoxicity, hepatotoxicity, and immunotoxicity.	12
Unit - II: 01 Credit	
Systemic toxicity II: Cardiovascular toxicity, respiratory dysfunction and hypersensitivity.	12
Unit - III: 01 Credit	
Toxicity of chemical pesticides: Their types, uses and harmful effects to plants and humans	4
Toxicity of heavy metals, Types (Arsenic, Cadmium, Lead, Fluoride & Mercury) their sources and effects on plants and humans, control & measures.	4
Arsenic pollution and its impact on flora and fauna and humans	
Unit - IV: 01 Credit	
Microbes as contaminant of food , biosensors for microbial contamination detection	6
Microbial toxins	6

M.Sc. ENVIRONMENTAL SCIENCE (SEMESTER - IV)
PAPER – VII
ENVIRONMENTAL POLICY & MANAGEMENT - I: 04 Credits

Total: 48 Hours

Unit - I: 01 Credit	**Hours**
Environmental education: Objective and guiding principles of environmental education.	6
Environmental education programmes and public awareness.	6
Unit - II: 01 Credit	
Environmental organization and agencies.	6
Environmental quality awareness.	6
Unit - III: 01 Credit	
Environmental Law I: International Environmental protection laws.	6
Environmental Law II: Environmental protection laws in India and their enforcement	6
Unit - IV: 01 Credit	
Environment impact assessment :State environmental appraisal committee and state environmental Assessment authority and their role in environmental clearance of projects	6
Powers and functions of central and state pollution control boards	3
Eco audit	3

M.Sc. ENVIRONMENTAL SCIENCE (SEMESTER - IV)
PAPER – VIII
ENVIRONMENTAL POLICY & MANAGEMENT - II: 04 Credits

Total: 48 Hours

Unit - I: 01 Credit	**Hours**
Environmental planning and management for sustainable development.	12
Unit – II: 01 Credit	
Environmental priorities in India. waste management, treatment of waste water etc.	12
Unit - III: 01 Credit	
Recent National and International efforts for Environmental management.	12
Unit - IV: 01 Credit	
Introduction to environmental impact analysis: Environmental Impact Statement and Environmental Management Plan. EIA guidelines 1994	12

Project: 04 Credits