A Documentary Support

for

Matric No. – 1.1.2

employability/ entrepreneurship/ skill development

under the

Criteria – I

(Curriculum Design and Development)

Key Indicator - 1.1

in

Matric No. – 1.1.2

MASTER OF SCIENCE (ENVIRONMENTAL SCIENCE)

1998

Registrar
Dr. B.R.A. University, Agra

represent Employability CoursesGreen color represent Entrepreneurship CoursesBlue color Skill Development Course

REVISED COURSES AND SYLLABI
OF
M.Sc. ENVIRONMENTAL SCIENCE
Faculty of Life Science
BASED ON CHOICE BASED CREDIT SYSTEM (CBCS)
Department of Environmental Studies,
Dr.BhimraoAmbedkar University, Agra
UNDER NEP-2020

Courses	M. Sc. Environmental Science I semester	Marks		Total 100	Credit
	Course Title	CIE	End Semester Examination		
EnvSc-C101	Ecology and Sustainable Development	25	75	100	4
EnvSc-C102	Environmental Pollution	25	75	100	4
EnvSc-C103	Energy and Environmental Policy	25	75	100	4
EnvSc-C104	Biodiversity and Conservation	25	75	100	4
EnvSc-C105	Practical		100	100	4
	Industrial training/Survey/Research Project				
	Total			**500**	**20**
Courses	**M. Sc. Environmental Science II semester**	**Marks**		**Total**	**Credit**
	Course Title	**CIE**	**End Semester Examination**		
EnvSc-C201	Environmental Chemistry	25	75	100	4
EnvSc-C202	Earth Processes and Soil Sciences	25	75	100	4
EnvSc-C203	Environmental Techniques	25	75	100	4
EnvSc-C204	Environmental Engineering	25	75	100	4
EnvSc-C205	Practical		100	100	4
EnvSc-C206	**Industrial training/Survey/Research Project**		200	**200**	**8**
	Minor (Other Faculty)	25	75	**100**	**4**
	Total			**800**	**32**
Courses	**M. Sc. Environmental Science III semester**	**Marks**		**Total**	**Credit**
	Course Title	**CIE**	**End Semester Examination**		
EnvSc-C301	Water resources and Marine Environment	25	75	100	4
EnvSc-C302	Solid and Hazardous Waste Management	25	75	100	4
EnvSc-C303	Environmental Bio-statistics and Modelling	25	75	100	4
EnvSc-E304	Meteorology: Tools And Techniques	25	75	100	4
EnvSc-E305	Atmosphere And Global Climate Change				
EnvSc-C306	Practical		100	100	4
	Industrial training/Survey/Research Project				
	Total			**500**	**20**
Courses	**M. Sc. Environmental Science IV semester**	**Marks**		**Total**	**Credit**
	Course Title	**CIE**	**End Semester Examination**		
EnvSc-C401	Environmental Impact and Risk Assessment	25	75	100	4
EnvSc-C402	Environmental Management and Laws	25	75	100	4
EnvSc–E403	Environmental Biotechnology	25	75	100	4
EnvSc–E404	Environmental Instrumentation				
EnvSc–E405	Ecotoxicology And Environmental Health	25	75	100	4
EnvSc–E406	Environmental Hazards				
EnvSc-C407	Practical		100	100	4
EnvSc-C408	**Industrial training/Survey/Research Project**		200	**200**	**8**
	Total			**700**	**28**
	Total Marks and Credits			**2500**	**100**

Course mapping to Global needs/Regional Needs/Local needs : Yellow color represents Global needs, Cyan color represents National needs Pink color represents Regional needs Orange Color represents Local needs Red color represent Employability CoursesGreen color represent Entrepreneurship CourseBlue color Skill Development Course

POST- GRADUATE PROGRAM OUTCOMES (POS)

The PG Courses of Environmental Science (Faculty of Life science) will be able:

PO 1	Demonstrate coherent understanding of fundamental concepts, principles and processes underlying the academic field of Environmental Science with its various subfields like Ecology, Biodiversity, Earth Sciences, Pollution and its Control Technology, Environmental Chemistry, Atmospheric Sciences, Environmental Laws, Environmental Impact Assessment, Environmental Biotechnology, Ecotoxicology, Waste Treatment Techniques, Renewable and Non-Renewable Energy, Environmental Statistics, Remote sensing and GIS, Climate Change and Sustainability, etc.
PO 2	Apply knowledge and skills to analyse, evaluate and interpret the causes and effects of various environmental problems at local, regional and global scale and to develop management strategies and use of different tools for the management of energy resources, biodiversity conservation, natural disasters and technical knowhow in environment management
PO 3	To understand the basic concepts of environment and its interactions with the earth and environmental systems and various ecosystems associated with it and obtain interdisciplinary knowledge on the global aspects of climate change, its effects on the environment and its governance.
PO 4	Ability to analyse and determine the magnitude of different kinds of environmental pollution, their sources using environmental analytical techniques, quantitative and computational techniques
PO 5	Capability to use biotechnological methods in water and wastewater treatment technology. Ability to apply appropriate techniques for efficient solid waste management practices and to find the solutions to the pollution problems.
PO 6	In depth knowledge of basic and applied area of Environmental Science will develop the capability of critical thinking based on the contextual knowledge of living and non-living components on environmental basis so as to enable the students to critically analyse everyday problems faced by society. Also enable student to use modern instrumentation techniques to employ critical thinking and efficient problem solving skills in the basic areas of Environmental Science
PO 7	Impart practical training, field's visits and project based training as well as specialization to the students for preparing them for an entrepreneurial thinking and career-oriented approach in research as well as in industries
PO 8	Students will keep themselves updated with the best international practices and latest development in technologies, which will help them to gain a broader global perspective of the subject. Develop awareness of the role and importance of Environmental Science in interdisciplinary research as well as in daily life.
PO 9	Students will be able to recognize the ethical component of complex situations. Acquired with awareness of work ethics and ethical issues in scientific research as well as plagiarism policies

Programme Specific Outcomes (PSOs)

PSO1	Programm provide wide range of knowledge on various aspects of various spheres of the environment viz atmosphere, hydrosphere, lithosphere and biosphere and generate awareness on Environmental Pollution, Solid Waste, toxicology, Climatic Change along with their inter- linkages to human health.
PSO2	To educate students on Environmental Impact Assessment, Monitoring, environmental laws and Policy frameworks their effectivity and their long-term outcome from environmental point of view.
PSO3	Get practical knowledge about various physico-chemical parameters, air monitoring and removal/reduction of air, soil and water pollutants from the environment through different analytical techniques and minimization of waste by waste recycling and reuse. Course also provides knowledge on concepts, tools, modern techniques and instruments for analysis of various components of environment and their management.
PSO4	Programm include training for capacity building, to offer professional and job oriented course curricula, to strengthen research & development and extension activities.
PSO5	To Understand the importance and contribute to Environmental Sustainability and wise use of Natural Resources for benefit of society through education and research on environment with a multidisciplinary and professional approach.

Yellow color represents Global needs, **Cyan color represents National needs**

Pink color represents Regional needs **Orange Color represents Local needs**

Red color represent Employability Course **Green color represent Entrepreneurship Course**

Blue color Skill Development Course

FIRST SEMESTER

Core Course

Code-EnvSc-C101

ECOLOGY AND SUSTAINABLE DEVELOPMENT

Course Description The course provides an introduction into the basics of Ecology. The concepts of the different processes of ecosystem, population ecology and the interaction of different ecological factors with biotic components are laid out.

Topics	Teaching Hours
UNIT-I	
1) Definition, principles and scope of ecology, Human ecology and settlement. 2) Population, Community, biome, limiting factor. 3) Characters of community and concept of habitat. 4) Functional role of ecology and niche, keystone species, ecotone and edge effect.	15
UNIT-II	
1) Population dynamics, model for single and interacting population. 2) Stable points, cycles, chaos competition. 3) Ecological succession, Climax community and their models. 4) Parasitism and prey-predation	15
UNIT-III	
1) Concept of ecosystem: abiotic and biotic concept. 2) Concept of energy, food chain, food web and ecological pyramids. 3) Pattern of primary and secondary production in major ecosystems of world, feedback and control. 4) Ten percent law, Gross and net production.	15
UNIT-IV	
1) The concept of sustainable development, temporal and spatial dimensions. 2) Public participation, education and environmental decision making. 3) Concept of reuse, reduce and recycle (6R) of different type of wastes, Environmental degradation and conservation issues. 4) Ecosystem as social process in Rehabilitation of degraded rural landscape, unbalanced soils and habitats e.g. water bodies and mangroves. Rehabilitation of mined area.	15

Suggested Readings: Clapham Jr., W.B., 1983, Natural Ecosystem: Chapters I, II, III and IV. Macmillan Publishers, London

GadgilMadhav, 2004, Ecological Journeys. The Science and Politics of conservation in India, Permanent black, Delhi.

Heywood, V.H. (Executive Editor), 1995, Global Biodiversity Assessment: Chapters 5 and 6. UNEP, University Press, Cambridge

Jennifer, A., Burch. W.R., Conover, B. and Field, D., 1998. Ecosystem Management: Adaptive strategies for Natural Resources organizations in the 21 st Century. Taylor and Francis, London. Reid, W.V. et al (Ed.), 2005, Ecosystems and Human well-being: Synthesis. P.1-37. Millennium Ecosystem Assessment, World Resource Institute, Island Press, Washington DC.

Samson, B.F, and Knoff, F.L., 1996, Ecosystem Management. Springer-Verlag, New York.

Course Outcome:-

CO1: Students will be well versed with the fundamentals of Ecology.

CO2: Students will have knowledge about population dynamics and the concept of ecological succession.

CO3: Students will have in-depth knowledge about biotic and abiotic factors that are related to ecosystem, productivity, energy flow through natural food webs, and ecosystems dynamics.

CO4: Students will have knowledge about participation of public in environmental management, Concept of 6R and environmental degradation and conservation.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	1	1	-	-	2	-	2	2	3	-	-	-	-
CO2	3	2	3	-	-	-	-	1	-	1	-	-	-	-
CO3	2	1	3	1	-	-	-	1	-	3	-	-	-	2
CO4	1	3	2	3	2	-	-	2	1	2	1	2	-	3

Matching: * 0 to 30% = 1; *30% to 60% = 2; * 60% to 100% =3

Employability and Entrepreneurship Course

FIRST SEMESTER

Core Course

Code-EnvSc-C102

ENVIRONMENTAL POLLUTION

Course Description: This course have been designed to improve the familiarity of the students about different pollution problems in environmental compartments i.e. air, water, noise and soil and their impact on environment and health are dealt with.

Topics	Teaching Hours
UNIT-I	
1) Chemistry of water-Types, sources and consequences of water pollution. 2) Types and characteristics of domestic, industrial and agricultural wastes and their effects on water bodies, animal and human beings. 3) Water quality parameters, Physiochemical and bacteriological sampling. 4) Water quality standards (Drinking Water).	15
UNIT-II	
1) Atmosphere and its fraction; gas laws governing the behavior of pollutants in atmosphere. 2) Natural and Anthropogenic sources of atmospheric pollutants, their effects on animal, human, vegetation and materials and their reaction in the atmosphere. 3) Transport and dispersal of pollutants, effects of meteorological and topographical factors. 4) Sampling of gaseous and particulate matter, their analysis and air quality standards.	15
UNIT-III	
1) Basic properties of sound waves plane and spherical waves, sound pressure and intensity levels, decibel, effects of meteorological parameters on sound propagation measurement and analysis of sound. 2) A weighted sound level, equivalent sound level (leq.) Noise pollution level (NPL), Sound exposure level (SEL), Traffic sound index (TNI), Day night level. 3) Source of noise, noise control and abatement measures, and sound absorption coefficient. 4) Hazards of noise pollution, effects on physiological, circulatory, respiratory, muscular, hearing loss and threshold shifts and noise standards.	15
UNIT-IV	
1) Physico-chemical and bacteriological sampling as analysis of soil quality. 2) Sources of soil pollution, Industrial waste effluents and heavy metals, their interactions with soil components. 3) Soil micro-organisms and their function, degradation of different insecticides/fungicides and weedicides in soil. 4) Different kind of synthetic fertilizers (NP & K) and their interactions with different components of soil.	15

Suggested Readings: Leslie collier, Balows Albert and Sussman Max, Topley and Wilson's Microbiology and Microbial infections. Oxford University Press.

Murray J.F. and Nadel. J.A., 2000, Text book of respiratory medicine, 3 rdEdn.,

W.B. Saunders & Co. Park. J.E. and Park. K., 1994, Text book of preventive and social medicine,

Banarsi Das &Bhanot, Jabalpur.

A.C. Stern, Air Pollution vol. 1 – 7.

Anjaneyulu. Y, 2004, Introduction to Environmental Science. B. S. Publications.

D. Daniel Chiras, 2001, Environmental Science, 6 th Ed., Jones and Bartlett Publishers.

Course Outcome:-

CO1: Develop understanding about the various sources, and fate of different water pollutants with their effects on environment and human.

CO2: Develop understanding on atmosphere fraction, air pollution its sources and its effect on environment and human and transport and dispersal of air pollutant.

CO3: Students are expected to be able to analyze noise pollution and different index of noise and health effect of noise pollution.

CO4: Develop understanding to determine soil pollution and degradation of pesticides in soils and physicochemical and bacteriological sampling of soil.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	-	2	2	2	3	2	1	3	2	3	2	3
CO2	2	3	2	3	1	2	3	2	-	3	2	3	3	2
CO3	2	1	-	2	-	1	-	1	-	2	1	-	-	1
CO4	2	2	-	2	-	1	1	2	1	3	1	3	3	2

Matching: * 0 to 30% = 1; *30% to 60% = 2; * 60% to 100% =3

Skill Development Course

FIRST SEMESTER
Core Course
Code-EnvSc-C103
ENERGY AND ENVIRONMENTAL POLICY

Course Description: The objective of the curriculum is to make the student to understand about different energy forms, importance of renewable and non-renewable energy sources and its consumption pattern in the world and India. It also enables students to learn about principle, generation and applications of different forms of energy and their respective managerial aspects.

Topics	Teaching Hours
UNIT-I	
1) Sun as source of energy: Earth and Sun relationship, nature and its radiation and heat budget of earth. 2) Conventional and non-conventional energy resources: Fossil fuel, coal, oil and natural gas, hydroelectric power, tidal, wind and geothermal energy. 3) Biomass, solar collectors, photovoltaic and solar ponds. 4) Natural energy resources: soil, water, land wood etc.	15
UNIT-II	
1) Resources of energy and their impacts on environment. 2) Minerals Resources-Types, their characteristics and uses. 3) Nature of nuclear energy, history of nuclear energy development, Nuclear Reactors 4) Nuclear Fusion, Breeder Reactors, Nuclear Fission, Nuclear Fuel Cycle.	15
UNIT-III	
1) Energy consumption criteria in different parts of world and conservation of energy. 2) Concept of environmental ethics. 3) Energy and Sustainable development of environment, 4] Strategic analysis of India-multi-dimensional energy crisis.	15
UNIT-IV	
1) Agenda-21 and government policy for natural resources and environment. 2) Land use policy for India, urban planning for India. 3) Environmental education and awareness: formal and non-formal education. 4) Role of UNESCO and Non-governmental organizations in environmental conservation.	15

Suggested Readings: Craig. J.R., Vaughan. D.J., Skinner. B.J., 1996, Resources of the Earth: origin, use, and environmental impact, 2 nd Ed. Prentice Hall, New Jersey. Klee. G.A, 1991, Conservation of natural resources.. Prentice Hall Publ. Co., New Jersey.

Owen. O.S, Chiras. D.D, Reganold. J.P, 1998, Natural resource conservation – management for sustainable future, 7 th Ed., Prentice Hall.

Course Outcome:-

CO1: To learn to apply various technologies for generation of renewable energy from different environmental sources.

CO2: Ability to estimate the extent of pollution due to energy use and about nuclear energy resources.

CO3: Studentswill be able to demonstrate understanding of the global, regional and local initiatives for energy conservation and sustainable development and learn about the different ways to classify energy resources, their consumption pattern.

CO4: Students will be able to understand the role of different agency in the conservation of environment and knowledge about land use policy.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	1	-	3	2	3	1	2	3	1	2	2	1
CO2	3	3	2	3	2	2	3	2	1	3	2	3	1	-
CO3	3	2	3	2	1	2	1	3	2	3	2	3	2	3
CO4	3	3	2	1	1	2	2	3	2	3	-	1	-	1

Matching: * 0 to 30% = 1; *30% to 60% = 2; * 60% to 100% =3

Employability Course

FIRST SEMESTER
Core Course
Code-EnvSc-C104
BIODIVERSITY AND CONSERVATION

Course Description: To impart understanding on the occurrence and distribution of various flora and fauna, their existence, interaction, Importance of biodiversity conservation and understand about Legislation related to conservation.

Topics	Teaching Hours
UNIT-I	
1) Concept: organic evolution through geological time scales. 2) Introduction to biodiversity and its types. 3) Levels and gradients of biodiversity. 4) Ecosystem biodiversity – Biomes, Mangroves, coral reefs, wetlands.	15
UNIT-II	
1) Terrestrial diversity. 2) Threats to biodiversity: Disturbance and pollution, Introduction of exotic species, Extinction of species. 3) Human interventions and biodiversity loss: Global environmental change, land and water use changes. 4) RED data book and related documentations.	15
UNIT-III	
1) Methods of biodiversity conservation – In situ conservation (Biosphere Reserve, National Parks, Wildlife Sanctuaries, Scared Groves). 2) Ex situ conservation (Botanical garden, Zoological garden, Gene Bank, pollen, seed and seedling banks tissue culture and DNA bank. 3) IUCN categorized – endangered, threatened, vulnerable species. 4) International organization related to biodiversity conservation (Traffic, REED, REED +).	15
UNIT-IV	
1) Benefits of conservation. 2) Conservation projects. 3) History of conservation movements. 4) Biodiversity Hotspots and its criteria.	15

Suggested Readings: Daily, G.C., Ed., 1997, Nature's Services: Societal Dependence on Natural Ecosystems. Island Press, Washington, D.C.

Dobson, A.P., 1996, Conservation and Biodiversity. Scientific American Library, New York, NY.

Gaston, K J. and J.I. Spicer, 1998, Biodiversity: An Introduction. Blackwell Science, London, UK.

Groom bridge, B., and M. Jenkins, 2000, Global Biodiversity: Earth's Living Resources in the 21 st Century. World Conservation Press, Cambridge, UK.

IUCN, 2004, Red list of threatened species. A global species assessment. IUCN, Gland, Switzerland

Loreau, M., and P. Inchausti, 2002, Biodiversity and Ecosystem functioning: Synthesis and Perspectives. Oxford University Press, Oxford, UK.

Primack, R.B., 2002, Essentials of Conservation Biology, 3 rdEdn.,Sinauer Associates, Sunderland, Ma. USA

Wilson, Edward O., 1993, Diversity of Life. Harvard University Press, Cambridge, MA.

Course Outcome:-

CO1: Students will gain knowledge about the diversity distribution pattern of the enormous number of species and different kind of ecosystems in the world.

CO2: Students will gain knowledge about threat to biodiversity and the loss of biodiversity and the impact to the humankind.

CO3: Students will know about the importance of conservation of biodiversity which serving to the mankind and the ecosystem, and the international organization related to biodiversity conservation.

CO4: Students will learn the benefits of conservation project and history of different conservation movements.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	2	3	2	2	3	2	3	1	2	3	1	2	2	1
CO2	3	3	2	3	2	2	3	2	1	3	2	3	1	-
CO3	1	1	1	2	1	2	1	3	2	3	2	3	2	3
CO4	2	2	-	1	1	2	2	3	2	3	-	1	-	1

Matching: * 0 to 30% = 1; *30% to 60% = 2; * 60% to 100% =3

Skill Development, Employability and Entrepreneurship Course

FIRST SEMESTER
Core Course
Code - EnvSc-C105
Practical

Course Description

The course provides practical exposure to the different biotic and abiotic components of the ecosystem and their analysis.

Course Structure

The following is a detailed syllabus.

1. To determine the minimum size of quadrate by species area curve method.
2. To determine the frequency of plants species present in given area.
3. To determine density of plant species present in the given area by quadrate method.
4. To determine the abundance of plant species in the given area by the quadrate method.
5. To determine the total biomass production in a grassland.
6. To determine acidity of given water sample.
7. To determine alkalinity of given water sample.
8. To determine chloride of given water sample.
9. To determine free CO_2 of given water sample.
10. To determine TS of given water sample.
11. To determine TDS of given water sample.
12. To determine TSS of given water sample.
13. To determine hardness of given water sample.
14. To determine Ca hardness of given water sample.
15. To determine Mg hardness of given water sample.
16. Measurement of noise level in different environments by sound level meter (SLM).
17. To estimate the value of background noise (L90) at a traffic site.
18. To estimate the value of L 50 at a traffic site.
19. To estimate the value of L10 at a traffic site.
20. What is the sound pressure level in dB associated with root mean square?

Suggested Readings: Environmental Biology - Mike Calver, Alan Lymbery, Jennifer McComb and Mike Bamford, Elements of Environmental Chemistry – J. Hussain, APHA, AWWA, WEF (1998). Standard Methods of water and waste water. APHA (20th Edition

Course Outcome

By the end of the course, students are expected to be able to:

- Gain practical knowledge into analysing the effects of ecological factors
- Have practical knowledge of the abiotic-biotic and biotic-biotic interactions

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	3	-	-	2	3	2	2	1	-	1	3	-
CO2	2	2	3	-	-	3	3	2	2	1	-	1	3	-

Matching: * 0 to 30% = 1; *30% to 60% = 2; * 60% to 100% =3

Skill Development Course

SECOND SEMESTER

Core Course

Code-EnvSc-C201

ENVIRONMENTAL CHEMISTRY

Course Description: The objective of the curriculum is to acquaint the student about the chemical composition of the different components of the environment (air, water, soil) and their subsequent interaction with biotic and abiotic components.

Topics	Teaching Hours
UNIT-I	
1) Fundamentals of Environmental Chemistry: Stoichiometry, Gibb's energy, chemical potential, chemical equilibria. 2) Acid base reactions, solubility product, solubility of gases in water. 3) The carbonate system, unsaturated and saturated hydrocarbons, radionuclide's. 4) Energy fundamentals: First and Second law of Thermodynamics.	15
UNIT-II	
1) Chemical composition of air: Classification of elements, chemical speciation, particles, ions and radicals in the atmosphere. 2) Chemical processes for formation of inorganic and organic particulate matter, photochemical reactions in the atmosphere. 3) Oxygen and ozone chemistry: Ozone production, ozone destruction and its effects. 4) Photochemical smog, formation of peroxyacetyl nitrates (PAN) and its effects.	15
UNIT-III	
1) Water chemistry: Chemistry of water, concept of DO, BOD, COD, sedimentation, coagulation, filtration, redox potential. 2) Soil chemistry: Inorganic and organic components of soil, Nitrogen pathways and NPK in soils. 3) Elemental Cycles and their environmental significance (nitrogen cycle, Sulphur cycle, carbon cycle and oxygen cycle) 4) Acid rain: Formation of acid rain and its effects on artifacts, Toxic chemicals in the environment- (water) : Pesticides in water, biochemical aspects of arsenic, cadmium, lead, mercury,	15
UNIT-IV	
1) Toxic chemicals in the environment- (Air): carbon monoxide, ozone, pesticides, insecticides, MIC in the air. 2) Greenhouse gases and their effects, Global warming, Causes andConsequences of Global Climate Change. Role of ocean and forest as carbon sink. 3) Indoor air pollution: indoor/outdoor relationships, personal air pollution exposure, indoor air quality problems, Prevention and control measures. 4) Vehicular Pollution: Automobile emissions, effects, prevention and control of Vehicular pollution, brief description of Euro I, Euro II, Euro III & Euro IV norms for automobiles and urban air quality.	15

Suggested Readings: Manahan. Stanely E, 2000, 7 thEdn., Environmental Chemistry, Lewis Publishers.
Stumm, W.; Morgan, J. J., 1996, Aquatic Chemistry: Chemical Equilibria and Rates in Natural Waters; Wiley Interscience: New York,.
Wayne, R. P., 2000, Chemistry of Atmospheres: An Introduction to the Chemistry of the Atmospheres of Earth, the Planets, and their Satellites (3rd Ed.), Oxford University Press
Williams Ian, 2001, Environmental Chemistry –a modular approach, Willey John & Sons
Williams. R.J.P and Frausto da. J.J.R, 1996, The Natural Selection of the Chemical Elements, Oxford University Press, Oxford, UK /New York, NY
Willard & Others, 1988, Instrumental Methods of Analysis, Wads worth.

Course Outcome:-

CO1: Able to analyze& apply the concept of thermodynamics, laws and heat transformation processes in different spheres of environment.

CO2: Able to explain the chemical nature and interaction of the air and its characteristic features for survival growth of biota.

CO3: Trains on chemical analysis of water and waste water, and the scientific principle of tools and techniques used for chemical analysis.s

CO4: Student will have the ability to understand about Global climate change & its impact of different component of environment.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	2	-	1	1	2	1	1	1	2	1	2	1	-
CO2	3	2	3	3	2	1	-	2	2	3	1	2	1	2
CO3	3	3	3	3	3	2	2	3	2	3	3	3	2	2
CO4	3	3	3	3	2	2	1	2	2	3	1	2	1	3

Matching: * 0 to 30% = 1; *30% to 60% = 2; * 60% to 100% =3

SECOND SEMESTER
Core Course
Code-EnvSc-C202
EARTH PROCESSES AND SOIL SCIENCES

Course Description: The objective of the curriculum is to impart the knowledge on earth processes which are related with weather and climate, soil characteristics and about various natural hazards.

Topics	Teaching Hours
UNIT-I	
1) Primary formation of core, mantle and crust. 2) Magma generation, Formation of igneous rock and sedimentary rock. 3) Glaciers and glaciations: Types of glaciers, surface profile of glaciers, Glaciers and glaciations: Types of glaciers, surface profile of glaciers. 4) Weathering of rocks, Erosion, transportation and deposition of earth's materials by running water, wind and glaciers	15
UNIT-II	
1) Concept of Geological hazards. 2) Study of Floods, landslides, earthquake, volcanism, drought and cyclones. 3) Prediction and perception of hazards and disaster management. 4) Sea floor spreading and mountain building, rock deformation, evolution of continents.	15
UNIT-III	
1) Soil genesis: formation and soil profile development. 2) Classification of soil, chemical and mineralogical composition of soil. 3) Soil organic matter and their sources, composition, microbial decomposition of organic matter. 4) Humus formation: nature and properties of humus, clay-humus complex and significance.	15
UNIT-IV	
1) Soil colloidal system, soil acidity and alkalinity salinity, nature, formation and control. 2) Major soil nutrients and elements, hygroscopic nature of soil, capillary and gravitational forms of soil water. 3) Soil air composition and gaseous exchange between atmosphere and soil air. 4) Soil temperature and loss of heat and thermal conductivity.	15

Suggested Readings: Keller. Edward A, 1996, Introduction to Environmental Geology, Prentice Hall, Upper Saddle River, New Jersey

Kesler, S. F. 1994, Mineral resources, economics and the environment. Upper Saddle River, NJ: Prentice Hall.

Owen., Oliver S, Chiras. Daniel D, Reganold. John P., 2002, Natural Resource Conservation, 7th Ed., Prentice Hall, Upper Saddle River, New Jersey

Skinner, Brian J., Porter, Stephen C., 1995, The Dynamic Earth: An Introduction to Physical Geology, Casebook, 3rd Edition (Paperback), John Wiley, New York

Skinner, B. J., and Porter, S. C., 1995, The Blue Planet, An Introduction to Earth System Science, John Wiley & Sons, Inc.

Slaymake, Olav, (Editor), 2000, Geomorphology, Human Activity and Global Environmental Change. John Wiley, New York.

Course Outcome:-

CO1: Have sound knowledge on the earth's structure,Understanding the Earth system of interacting rock, water, air and life and how these elements have shaped Earth's surface.

CO2: Will be able to understand and differentiate the different types of disasters, analyse the causes and their potential impact on the natural and man-made environments.

CO3: Ability to demonstrate the understanding of the core principles of soil science.

CO4: Ability to describe the process of soil genesis and identify soil orders/groups based on their physico-chemical properties

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	2	-	2	-	2	2	3	1	2	1	3
CO2	3	3	3	3	3	2	2	3	3	3	3	3	2	3
CO3	3	2	3	2	1	2	2	2	2	3	2	2	1	2
CO4	2	1	2	1	2	2	-	1	1	2	1	2	-	2

Matching: * 0 to 30% = 1; *30% to 60% = 2; * 60% to 100% =3

Skill Development, Employability and Entrepreneurship Course

SECOND SEMESTER

Core Course

Code-EnvSc-C203

ENVIRONMENTAL TECHNIQUES

Course Description: The objective of the curriculum is to impart the knowledge about the different analytical technique to measure air and water pollution and to gain understanding about various methods of exposure of toxicants

Topics	Teaching Hours
UNIT-I	
Air Quality Monitoring and Sampling Methods 1) Sulphur di Oxide 2) Oxide of Nitrogen 3) Suspended Particulate Matter 4) RSPM - PM10 and PM2.5	15
UNIT-II	
Water Quality Sampling and Analysis Methods 1) Turbidity, Total Solids 2) DO, BOD,COD 3) Sodium, Potassium, 4) Arsenic, Cadmium, 5) Zinc ,Chromium, 6) Copper, Iron. 7) Biological Analysis: Qualitative and quantitative methods for planktons, MPN in coliforms.	15
UNIT-III	
Biochemical Methods 1) Serum Total Protein, Serum Albumin, 2) Serum Globulin, Albumin-Globulin Ratio, 3) Cholesterol, HDL-Cholesterol, 4) Alkaline Phosphatase, 5) Acid Phosphatase, 6) SGPT, SGOT.	15
UNIT-IV	
Methods of Exposure of Toxicants 1) Dose-Response and Dose-Effect Relationship; 2) Statistical Concept of LC50AndLD50; 3) Bioassays.	15

Suggested Readings: American Public Health Association (APHA), 1998 Standard Methods for the Examination of water and waste water 20th edition

Thimmaiah, S.K., 1999 Standard Methods of Biochemical Analysis,Kalyani Publisher

Abbasi S.A. 1998 Water Quality Sampling and Analysis, Discovery Publishing House, New Delhi

Course Outcome:-

CO1: Evaluate the level of pollutants in soil, water, air and organisms by using analytical instruments.

CO2: Will be able to understand different methods for water quality parameter sampling.

CO3: Student will be able to learn and analyze about different biochemical methods for serum testing.

CO4: Students will be able to evaluate toxicants by different methods of toxicants exposure

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	2	3	2	2	3	2	3	1	2	3	1	2	2	1
CO2	3	3	2	3	2	2	3	2	1	3	2	3	1	-
CO3	1	1	1	2	1	2	1	3	2	3	2	3	2	3
CO4	2	2	-	1	1	2	2	3	2	3	-	1	-	1

Matching: * 0 to 30% = 1; *30% to 60% = 2; * 60% to 100% =3

Employability and Entrepreneurship Course

SECOND SEMESTER

Core Course

Code-EnvSc-C204

ENVIRONMENTAL ENGINNERING

Course Description: The main objectives of this course are to educate the students about the designing of primary, secondary and tertiary treatment systems of waste water and to gain knowledge about air pollution abatement and control methods and about different waste treatment and disposal technique.

Topics	Teaching Hours
UNIT-I	
1) Elimination and minimization of air pollution emission. 2) Selection criteria of a control system. 3) Air pollution Control Equipment's: Cyclone Collector, Filtration and Electrostatic Precipitators. 4) Air pollution Control Equipment's: Scrubbing, Adsorption.	15
UNIT-II	
1) Waste water treatment by aeration, coagulation and flocculation, sedimentation and filtration. 2) Aerobic and anaerobic process of waste water treatment. 3) Waste water treatment process – Primary, Secondary and Tertiary treatment. 4) Sludge treatment and disposal.	15
UNIT-III	
1) Solid waste collection and transportation. 2) Solid waste processing and recovery. 3) Disposal Technique – Landfilling method, its basic aspect and types and Incineration. 4) Energy recovery methods of solid waste disposal: Gasification, Pyrolysis, Plasma pyrolysis.	15
UNIT-IV	
1) Hazardous waste treatment strategies. 2) Treatment of biomedical waste by incineration, Microwave, Autoclave, Hydroclave. 3) Disposal of plastic waste and treatment and disposal of metal sharps. 4) Nuclear waste disposal technique.	15

Suggested Readings: Henry Glya, J. and Heinke, 2004, Gary W. Environmental Science and Engineering. Pearson low priced edition.

Kiely, G., 1998, Environmental Engineering, Irwin McGraw Hill, Boston.

Masters, M.G., 1998, 2nd Edition, Introduction to Environmental Engineering and Science, Prentice Hall, London.

Peavy, H.S., Rowe, D.R. and George, T., 1987, Environmental Engineering, McGraw Hill, New York.

Vesilind, P.A., 1997, Introduction to Environmental Engineering. PWS publishing, Boston

Course Outcome:-

CO1: Gain knowledge about environment air protection and operation of pollution control devices**.**

CO2: Student will understand the engineering concepts of waste water treatment and will know the different analytical methods of waste water treatment and disinfection methods

CO3: Gain knowledge about different method for solid waste disposal and various energy recovery method of waste disposal

CO4: Students will be able to gain understanding about biomedical waste and plastic waste disposal methods.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	2	3	3	3	3	3	3	3	2	3	1	2
CO2	3	3	2	3	3	2	3	3	3	3	1	3	-	1
CO3	3	2	2	3	2	3	2	3	3	3	2	3	-	-
CO4	3	3	3	3	2	-	1	1	-	3	1	3	-	-

Matching: * 0 to 30% = 1; *30% to 60% = 2; * 60% to 100% =3

Skill Development, Employability and Entrepreneurship Course

SECOND SEMESTER

Core Course

Code – EnvSc-C205

Practical

Course Description

The course provides practical exposure to the soil component and their analysis and also provides practical knowledge about the analysis of oxygen demand of water by different method.
Course Structure: The following is a detailed syllabus.

1. To determine the water holding capacity in a given soil sample.
2. To determine the alkalinity in a given soil sample.
3. To determine the chloride ions in a given soil sample.
4. To determine the amount of organic carbon in a given soil sample.
5. To determine the amount of organic matter in a given soil sample.
6. To determine the amount of the humus content in a given soil sample.
7. To determine the amount of exchangeable calcium in the given soil sample.
8. To determine the amount of exchangeable magnesium in the given soil sample.
9. Determination of sodium ion concentration by Flame photometer in waste water.
10. Determination of potassium ion concentration by Flame photometer in waste water.
11. To determine the dissolve oxygen in a given water sample.
12. To determine the biological oxygen demand in a given water sample.
13. To determine the chemical oxygen demand in a given water sample.
14. To determine the oil and grease in a given water sample.
15. Determination of SO2 by PRA method.
16. Determination NOx by spectrophotometric method.
17. Measurement of noise level in different environments by sound level meter (SLM).
18. Determination of particulate matters PM10 and PM2.5 by Fine Particulate sampler.
19. Respirable Suspended Particulate Matter (RSPM) by Respirable suspended particulate matter sampler (RDS APM 460)

Suggested Readings: APHA, AWWA, WEF (1998). Standard Methods of water and waste water. APHA (20th Edition, PatnaikP(1997). Handbook of Environmental Analysis- Lewis Pub, Environment and Water Pollution cause Effect and Control- Noor

Course Outcome

By the end of the course, students are expected to be able to:
CO1: Gain practical knowledge about the analysis of different parameter of soil.
CO2: Have practical knowledge of methods for analyzing COD, BOD and DO in waste water and analysis of different air pollutant.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	1	1	-	3	2	3	3	1	2	2	-	3	3	-
CO2	2	-	-	3	-	3	3	2	2	2	-	3	3	-

Matching: * 0 to 30% = 1; *30% to 60% = 2; * 60% to 100% =3

THIRD SEMESTER
Core Course
Code-EnvSc-C301
WATER RESOURCES AND MARINE ENVIRONMENT

Course Description: The main objectives of this course are to educate the students about the ground water, its type and give in dpeth knowledge about well hydraulic. Student will be able to understand concept of the study of oceans, its chemical properties and geological & geophysical oceanography.

Topics	Teaching Hours
UNIT-I	
1) Ground Water: Origin, types, importance, occurrence, reservoirs, basins and movement. Hydrologic cycle and its balance. 2) Hydrologic properties of rocks: porosity, permeability, specific yield, specific retention, hydraulic conductivity, transmissivity, storage coefficient. 3) Darcy's law and experiment. 4) Well hydraulics: Confined, semi-confined and unconfined aquifer. Time variations of levels, fluctuations due to evapotranspiration, urbanization, Meteorological phenomena and land subsidence. 5) Ground water quality, measurement of water quality, Ground water contamination and pollutants: Problem of arsenic and fluoride.	15
UNIT-II	
1) Surface water; Atmospheric aspects of the hydrologic cycle: weather and climate, evaporation, evaporation and transpiration, Evapotranspiration. 2) Precipitation and run off: Conditions for precipitation occurrence, forms of precipitation, average basin precipitation, rainfall and run off. 3) Stream flow: Measurement of stream flow, Interaction of surface water and ground water. 4) Rainwater harvesting, eutrophication restoration of Indian lakes and wetland conservation,National Water policy	15
UNIT-III	
1) Origin and composition of sea water. 2) Physical properties of marine water: temperature, density, optics, currents, wave generation, thermo-hyaline turbidity currents (gravity), gyres. 3) Chemical properties of marine water: Salinity and its determination and distribution, causes of salinity variations. 4) Dissolved gases and carbonate chemistry of ocean water, residence time, biochemical reactions and their distributions.	15
UNIT-IV	
1) Biological Oceanography: Division of the marine environment benthic, pelagic, bathyal, littoral, ocean water as biological environment. 2) Ocean pollution by toxic wastes and its effect. 3) Geological and Geophysical Oceanography: History of ocean basin, geophysical and geological processes, ocean basin rocks and sediments. 4) Beach and beach processes, littoral sediment transport, coastal erosion- causes and protection, resources of ocean, renewable and non-renewable.	15

Suggested Readings: Aggarwal, A., 1991, Floods, Floodplains and Environmental Myths. Centre for Science and Environment, New Delhi.
Andrew D. Ward and Stanley Trimble, 2004, 2 nd Ed., Environmental Hydrology, Lewis Publishers.
Karanth, K.R.C., 1988, Ground Water: Exploration, Assessment and Development. Tata-Mcgraw Hill, New Delhi.
Mahajan, G., 1989, Evaluation and Development of Groundwater. Ashish Publishing House, New Delhi.
Rao, K.L., 1982, India's water wealth. Orient Longman, Delhi.
Subramaniam V., 2002, Text Book of Environmental Science, Narosa Publishing House, Delhi.
Timothy, Davie, 2003, Fundamentals of Hydrology. Rowledge, Taylor and Francis Group, U.K.
Todd, D.K., 2004, Groundwater Hydrology, John Wiley & Sons Inc.
Vijay P. Singh, 1995, Environmental Hydrology. Kluwer Academic Publications, The Netherlands.
Wright. R.T and Nebel. B.J., 2002, Environmental Science: toward a sustainable future, Prentice Hall India Ltd, 8 th Edition.

Course Outcome:-

CO1: Gain knowledge about types and origin of ground water, different hydrological properties of rocks and well hydraulics

CO2: Student will be able to understand atmospheric aspects of the hydrologic cycle, rainwaterharvesting, eutrophication and wetland conservation,

CO3: Will be able to understand Origin and composition of marine water and its physico-chemical properties.

CO4:.Able to understand biological Oceanography and will have depth knowledge about history and origin ofocean .

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	2	-	1	3	2	2	2	1	-	3	-	3	-	2
CO2	2	-	2	-	-	1	1	-	-	2	-	-	-	2
CO3	3	-	1	-	-	-	-	1	1	-	-	-	-	1
CO4	2	2	-	2	-	-	1	1	1	3	-	2	1	1

Matching: * 0 to 30% = 1; *30% to 60% = 2; * 60% to 100% =3

Employability Course

THIRD SEMESTER

Core Course

Code-EnvSc-C302

SOLID AND HAZARDOUS WASTE MANAGEMENT

Course Description: objective of this course is to develop an understanding of management generation treatment and disposal different type of waste viz., hazardous, solid, bio medical and radioactive waste.

Topics	Teaching Hours
UNIT-I	
1) Definition and Classification Hazardous waste, ignitability, corrosivity, reactivity, toxicity, radioactivity. 2) Hazardous waste: Sources, effects, storage and handling. 3) Management of Hazardous wastes: Pollution, prevention, waste minimization, recycling of wastes, land disposal. 4) Risk assessment: Carcinogens, dose response assessment, risk exposure assessment.	15
UNIT-II	
1) Radioactive pollution, biological effects of ionizing radiation. 2) Radiation exposure, radiation protection, radioactive waste. 3) E- Waste&it's effect and Plastic waste and It's effect. 4) Fly ash and its utilization.	15
UNIT-III	
1) Solid Waste : Definition, Source and types 2) Generation and Effects of solid waste. 3) Physical and chemical composition of solid waste. 4) General characterization and classification of solid waste	15
UNIT-IV	
1) Different methods of solid waste management. 2) Recycling of solid waste material. 3) Environmental concern of landfilling of municipal solid waste. 4) Biomedical Waste: Definition, Sources of generation, categories, colour coding system for segregation, transportation specifications.	15

Suggested Readings:

Henry Glya, J. and Heinke, 2004, Gary W. Environmental Science and Engineering. Pearson low priced edition.
Kiely, G., 1998, Environmental Engineering, Irwin McGraw Hill, Boston.

Course Outcome:-

CO1: Students will be able to understand about the characteristics of different type of hazardous waste and their treatment and management

CO2: Gain knowledge about the generation and type and disposal of radioactive waste

CO3: Ability to demonstrate sound understanding of the waste generation process and characteristics of different types of solid wastes.

CO4:. Ability to address the waste management processes through cradle-to-grave perspectives.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	2	-	2	3	-	2	2	-	-	3	2	3	2	-
CO2	3	2	2	3	1	2	-	1	1	3	-	-	-	1
CO3	2	2	-	1	-	1	-	1	-	3	3	2	1	-
CO4	2	3	1	2	-	2	2	2	1	3	2	-	-	-

Matching: * 0 to 30% = 1; *30% to 60% = 2; * 60% to 100% =3

Employability and Entrepreneurship Course

THIRD SEMESTER

Core Course

Code-EnvSc-C303

ENVIRONMENTAL BIOSTATISTICS AND MODELLING

Course Description: The aim of the course is to develop skills on various operating systems, application software, statistical tool and technique and their utility in the field of environmental research and industrial organizations.

Topics	Teaching Hours
UNIT-I	
1) Sampling techniques and data representation 2) Measures of central tendency 3) Measures of dispersion. 4) Distribution.	15
UNIT-II	
1) Probability and Chi-square test. 2) Correlation and linear regression. 3) Tests of significance. 4) Experimental design and analysis of variance.	15
UNIT-III	
1) Computer fundamentals and operating system-function/need of operating system 2) Permanent storage of data, number systems, decimal to binary and vice-versa, binary coded decimal numbers. 3) Low and high level languages. 4) Basic concept of algorithms and flow charting.	15
UNIT-IV	
1) Programming in 'C' and C++ : Introductory concepts. 2) Word Processing: MS- word, Excel and their application. 3) Internet: History, Application, Service provider, computer and ethics-hacking, viruses, abuses. 4) Application of computers in Environmental Science.	15

Suggested Readings: Gallager R., 1996, Discrete Stochastic Processes, Kluwer Academic Publishers. Grant, W.E., Pederson, E.K. and Sendra, L.M., 1997, Ecology and Natural Resource Management: Systems Analysis and Simulation, John Wiley, New York.

Jorgensen, S.E. Miller, F., (Ed.), 2000, Hand Book of Ecosystem Theories and Management, Section-I and 11.4 of Section II. CRC press, Florida.

Recknagal, F., (Ed.), 2003, Ecological Informatics, chapters I, II, III and IV. Springer, Germany.

Wainwright, John (Editor), Mulligan, Mark (Editor), 2004, Environmental Modelling: Finding Simplicity in Complexity. John Wiley, New York

Zannetti, P., 1990, Air pollution modeling, theories computational methods and available softwares. Van NostrandRheinhold, New York.

Course Outcome:-

CO1: Understand the concept of data analysis measures of dispersion and to collect, manage and represent the data via different types of tables and graphs

CO2: Know the aspects and use of probability and distributions and test of significance.

CO3: To describe the basics of computer, different types of operating system and various application software used in the field of environmental sciences.

CO4:. Will get the understanding about the application of computers in environmental science.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	-	-	1	-	1	-	2	-	-	1	1	1	-
CO2	3	-	1	-	-	1	-	2	1	-	1	1	1	-
CO3	3	1	-	2	-	-	-	2	2	-	-	-	-	-
CO4	3	-	-	-	-	-	1	2	2	-	1	1	1	-

Matching: * 0 to 30% = 1; *30% to 60% = 2; * 60% to 100% =3

Skill Development, Employability and Entrepreneurship Course

THIRD SEMESTER

Elective Course

Code-EnvSc-E304

METEOROLOGY: TOOLS AND TECHNIQUES

Course Description: The aim of the course is to give in depth knowledge about various meteorological parameter. To understand the extraction, isolation and characterization of different environmental samples through different analytical technique

Topics	Teaching Hours
UNIT-I	
1) Meteorological Parameters: Pressure, Atmospheric Pressure belts, temperature, wind and wind roses humidity, precipitation and radiation. Atmospheric stability, inversions, mixing heights. 2) Scales of Meteorology. 3) Dew, Fog, Frost, Haze, Clouds: Cloud development and classification of Clouds. Cloud Bursting and its consequences 4) Air masses and Fronts.	15
UNIT-II	
1) World Climates: Elements of climate, Climatic controls, Classification of climate, Preliminary concept of climate change. 2) Indian climate, seasons in India. Spatial and temporal patterns of climatic parameters in India, Weather Forecasting. 3) Elements of Agro climatology. and EL Nino, Southern Oscillations. 4) Human and animal bio-climatology.	15
UNIT-III	
1) Basic Principle, instrumentation and application of spectroscopy, colorimetry and Flame photometer. 2) Spectroscopy: Basic principle, instrumentation and applications of atomic absorption and emission spectroscopy. 3) Chromatography: Principle, types and application of Gas Chromatography, Gas- liquid chromatography and HPLC. 4) Centrifugation: Basic Principle, Types and instrumentation and application.	15
UNIT-IV	
1) Nephlometer: Principles and Applications. 2) High Volume Sampler, Respirable Dust Sampler, Fine Particulate Sampler: Principle, instrumentation and applications. 3) Titrimetry and Gravimetry. 4) X- ray diffraction.	15

Suggested Readings: Barry, R. G., 2003. Atmosphere, weather and climate. Routledge Press, UK

Critchfield, Howard J., 1998, General climatology, Prentice Hall India Pvt. Ltd., New Delhi,

C. Donald Ahrens, Meteorology Toady Seventh edition .

Course Outcome:-

CO1: Students will gain knowledge about different meteorological parameter and how tomeasured.

CO2: Ability to demonstrate sound understanding of the atmosphere and climate as integral part of the physical environment.

CO3: Execute quantitative and qualitative analyses of various environmental samples through instrumentation techniques

CO4:.Ability to demonstrate sound understanding of analytical techniques applied in environmental analyses.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	2	2	3	-	-	-	1	2	2	3	2	2	-	-
CO2	3	2	2	-	-	2	1	1	1	3	-	1	-	-
CO3	1	-	-	3	3	3	2	2	1	-	3	3	3	2
CO4	1	-	-	2	3	3	1	1	-	-	3	3	3	-

Matching: * 0 to 30% = 1; *30% to 60% = 2; * 60% to 100% =3

THIRD SEMESTER
Elective Course
Code-EnvSc-E305
ATMOSPHERE AND GLOBAL CLIMATE CHANGE

Course Description: This course provides information about the two main physical realms of the environment, i.e. atmosphere and hydrosphere, along with their interactions and phenomenon, emphasis has been given to impart knowledge on climate change, weather, climate change and global warming, climate change vulnerability, adaptation etc. common for all. It will also give ideas of national and international response on climate change scenario

Topics	Teaching Hours
UNIT-I	
1) Earth systems: Atmosphere, hydrosphere, lithosphere, biosphere and their linkage. 2) Earth's geological history and development and evolution of atmosphere. 3) Fractions of atmosphere. 4) Atmospheric composition.	15
UNIT-II	
1) Ocean: general circulation pattern, air- sea interaction. 2) Wind, Stability and turbulence. 3) EL Nino, Southern Oscillations. 4) Energy Balance of atmosphere.	15
UNIT-III	
1) Natural Climate Change: Records of climate change (Glacial cycle, Ocean sediments, corals, tree rings). 2) Causes and Consequences of Global Climate Change. 3) Role of ocean and forest as carbon sink. 4) Ozone depletion - Stratospheric ozone shield.	15
UNIT-IV	
1) Impact of climate change on human, ecosystem, species distribution, spread of diseases. 2) Extinction risk of temperate- sensitive species. 3) UV effects on human, animal and plants. 4) Policy for climate change: Kyoto, carbon trading, carbon sequestration, carbon footprint, carbon credit and clean development mechanism.	15

Suggested Readings: Barry, R. G., 2003. Atmosphere, weather and climate. Routledge Press, UK

Critchfield, Howard J., 1998, General climatology, Prentice Hall India Pvt. Ltd., New Delhi.

Firor, J., and J. E. Jacobsen, 2002. The crowded greenhouse: population, climate change and creating a sustainable world. Yale University Press.

Glantz, M. H., 2003. Climate Affairs: a primer. Island Press.

Harvey D., 2000, Climate and Global Climate Change, Prentice Hall.

Kump, L. R., Kasting, J.F., and Carne, R. G., 2004. The Earth System. 3 rd Ed. Prentice-Hall

Course Outcome:-

CO1: Ability to understand about different earth system and their link with each other and about atmospheric composition and fraction of atmosphere

CO2: Gain knowledge about energy balance of atmosphere, El Nino, ENSO and ocean circulation.

CO3: Student will learn about the history of climate and consequences of climate change.

CO4:. . Student will gain knowledge about Global and regional trends in green house gas emissions, sea level rise, role of ocean and forest as carbon sink.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	-	-	2	-	3	2	3	-	-	-	2
CO2	3	3	2	-	-	3	-	2	2	3	-	-	-	-
CO3	3	3	3	1	-	-	-	3	3	3	2	1	-	-
CO4	3	3	3	2	-	-	-	3	3	3	2	-	-	-

Matching: * 0 to 30% = 1; *30% to 60% = 2; * 60% to 100% =3

Skill Development, Employability and Entrepreneurship Course

Third Semester

Core Course

Code- EnvSc-C306

Course Description

The course provides practical exposure to analyze different property of solid waste and also give understanding about the statistical method for data computing.

Course Structure

The following is a detailed syllabus.

1 To determine the moisture content in the given solid waste material.
2 To determine the amount of organic matter in the given solid waste material.
3 To determine the amount of organic carbon in the given solid waste material.
4 To determine the pH of the given solid waste material.
5 Determination of sodium ion concentration by Flame photometer in waste water.
6 Determination of potassium ion concentration by Flame photometer in waste water.
7 Determination of heavy metal concentration by atomic absorption spectroscopy.
8 To calculate the mean, mode median of the given data sample.
9 Calculate variance, standard deviation and coefficient of variation for grouped and ungrouped data.
10 Calculate regression and plot scatter diagram and regression of the given data sample.
11 Compute correlation coefficient and test its significance for grouped and ungrouped data.
12 By applying the paired t test compare the mean of two independent variable of given data sample.
13 Calculate one and two way analysis of variance in the given data sample.
14 Convert the given number into their given respective basses.

Suggested readings: 1. Solid Waste Management - V.K. Prabhakar, Solid Waste Management - Hari Mohan Singh,Manly (2001) Statistics for environmental science and management, Chapman and Hall / CRC Press,Met calf and Eddy (2003) Waste water engineering, Mc Graw Hill International

Course Outcome

By the end of the course, students are expected to be able to:

CO1: Gain practical knowledge about the different property of solid waste.

CO2: Gain practical understanding about the statistical method use in the data modeling.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	1	-	-	1	-	2	3	2	1	3	-	1	3	-
CO2	-	-	-	-	-	2	-	3	3	-	-	2	3	-

Matching: * 0 to 30% = 1; *30% to 60% = 2; * 60% to 100% =3

Employability and Entrepreneurship Course

FOURTH SEMESTER

Core Course

Code-EnvSc-C401

ENVIRONMENTAL IMPACT AND RISK ASSESSMENT

Course Description: The objective of the curriculum is to impart knowledge on basic understanding about Environmental Impact Assessment its process and methodology, get knowledge about the case studies of different development projects and their risk assessment aspect. The students will be enabling to know about how to apply concepts of EIA in environmental planning.

Topics	Teaching Hours
UNIT-I	
1) Principles and procedures: Nature and purpose of environmental impact assessment (EIA), Worldwide spread of EIA. 2) Environmental impact assessment process, Screening, Scoping and Terms ofReferences (TOR) 3) Impact assessment methodologies. 4) Baseline information, Generalized approaches to impact analysis and prediction	15
UNIT-II	
1) Identification of impacts, mitigation measures and comparison of alternatives. 2) Environmental impact assessment evaluation of proposed action 3) Environmental management plan and Environmental Impact statements 4) Procedure for reviewing, environmental impact analysis and statement.	15
UNIT-III	
1) Case study: River valley projects, thermal Power Plants, mining projects. 2) EIA guidelines 1994, notification of Government of India. 3) Guidelines of environmental monitoring audits. 4) Applications of geographic information system (G.I.S.) in environmental management.	15
UNIT-IV	
1) Risk assessment-Hazard analysis, hazards identification, vulnerability analysis, risk analysis. 2) Risk assessment and comparisons-risk and uncertainty, risks of new technologies, comparison of risks, contrasting risks. 3) Risk consequences: Impacts of serious accidents, uncertainty costs, signal incidents and risk probabilities: Human factors, organizational factors and external social factors. 4) Remote sensing: Principle and applications of remote sensing in environmental science.	15

Suggested Readings: Glasson J., Therivel R., Chadwick. A., 1994, Introduction to environmental impact assessment- Principles and procedures, process, Practice and prospects. Research Press, Delhi.

Morris. P. &Therivel. R., 2001, Methods of environmental impact assessment, 2 nd Ed. Spon Press, New York,

With a chapter on GIS and EIA by A.R. Bachiller& G. Wood, p. 381-401. Petts Judith, 1999, Handbook of environmental impact assessment. Vol. 1, Blackwell Science

Course Outcome:-

CO1: Apply analytical tools like EIA processes and methodologies to determine and measure environmental impacts due to planning of developmental activities/projects.

CO2: Ability to critically examine development actions with the fundamentals understanding of EIA and sustainable development

CO3: Bring in to light the procedure of EIA for various category projects and guidelines of environmental monitoring audit

CO4:.Able to examine environmental risk by its analysis, assessment and management by understanding the steps involved.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	3	3	3	2	3	2	3	3	2	2	3	2	2	2
CO2	3	3	2	3	3	2	2	2	2	-	3	2	2	3
CO3	3	2	2	-	2	2	1	2	2	-	3	3	2	2
CO4	3	2	2	-	-	2	-	2	1	2	2	-	-	1

Matching: * 0 to 30% = 1; *30% to 60% = 2; * 60% to 100% =3

Skill Development Course

FOURTH SEMESTER

Core Course

Code-EnvSc-C402

ENVIRONMENTAL MANAGEMENT AND LAWS

Course Description: The aim of this course is to developed understanding for various environment policies, planning and legal aspects for environmental conservation and protection in India.

Topics	Teaching Hours
UNIT-I	
1) Environmental management: fundamentals and goals, standards, monitoring, Environmental auditing, types and general methodology of audit. 2) Modelling, And Environmental Management Systems, public participation forenvironmental management. 3) Environmental management and economics: greening of economics, evaluating the environment and natural resources, cost benefit analysis, green taxes, green funding, 4) Debt, structural adjustment and environment, trade and environmental management.	15
UNIT-II	
1) International Standardization Organization (ISO),EMS Certification, ISO 14000 Series, and. ISO-14001 requirements, Difference Between ISO 14000 and ISO14001 Environmental Policy, and Relationship between ISO-9001 and ISO-14001. 2) Environmental protection: Issues and problems, national and international conventions: Stockholm conference 1972, Earth Summit 1992. Montreal Protocol 1987. 3) Policy for climate change: Kyoto, carbon trading, carbon sequestration, carbon footprint, carbon credit and clean development mechanism. Provision ofConstitution of India regarding environment [Article 48 A and 51-A(g)]. 4) Municipal Solid Wastes (Management and Handling) Rules, 2000. Hazardous waste management and handling rules, 1989.Biomedical Waste (Management And Handling) Rules, 1998 and amendment 2016.	15
UNIT-III	
1) The Environmental (Protection) Act, 1986 and rules 1986. 2) Air (Prevention and Control of Pollution) Act, 1981 as amended by 1987 and rule 1982. 3) The Water (Prevention and Control of Pollution) Act, 1974 as amended upto 1988 and rules 1975. 4) The Wildlife Protection Act 1972, amendment bill 1991.	15
UNIT-IV	
1) The Indian Forest Act, 1927 and Forest conservation Act, 1980. 2) The Public Liability Insurance Act, 1991 and rules 1991. 3) Scheme of labelling of environmental friendly products (Ecomark). 4) Motor Vehicle Act, 1988 and Vehicular exhaust emission standards, 1990.	15

Suggested Readings: Bell Stuart &McGillvrayDonal, 2001, Environmental Law, Universal Law Publishing Co.

DiwanShyam and Rosencranz Armin, 2002, Environmental Law and Policy. Hughes David, 1992, Environmental Law, Butterworths.

Jariwala C.M., 2004, Environmental Justice, APH Publishing Corporation, N. Delhi
Leelakrishnan. P, 2004, Environmental Law Case Book , Lexis Nexis, ButterworthsMohanty. S. K., 2004, Environment and Pollution Law, Universal Law Publishing Co. Pvt. Ltd.
Singh Gurdip, 2004, Environmental Law in India, Mcmillan& Co.
Singh Gurdip, 2003, International Environmental Law, Macmillan.
Shastri. S. C., 2005, Environmental Law, Eastern Book Company.

Course Outcome:-

CO1: Understand the importance of environmental planning in environmental management.
CO2: Student will gain in depth knowledge about ISO related to environment and will also know about summits related to environmental conservation
CO3: Learns the important provisions ofdifferent environmental laws in India
CO4:.To explain various environmental legislations for the protection of wildlife and forest in India.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	-	3	2	-	2	2	-	2	2	-	2	1	1	-
CO2	2	2	1	-	2	1	-	2	2	-	2	-	-	-
CO3	3	2	-	2	-	-	-	2	-	-	3	2	-	2
CO4	3	3	-	1	-	-	-	2	1	-	3	2	-	3

Matching: * 0 to 30% = 1; *30% to 60% = 2; * 60% to 100% =3

Employability and Entrepreneurship Course

FOURTH SEMESTER

Elective Course

Code-EnvSc-E403

ENVIRONMENTAL BIOTECHNOLOGY

Course Descriptation: The objective of the curriculum is to acquaint the students about the basic concepts and application of Biotechnology Environmental management

Topics	Teaching Hours
UNIT-I	
1) Natural environmental of microorganisms, the terrestrial environment, aquatic and extreme environment. 2) General characters and basic classification of microorganisms. 3) Structure and growth of microorganisms as related to the environment. 4) Major groups of microorganisms.	15
UNIT-II	
1) Biotechnology for pollution abatement. 2) Use of microorganism in waste treatment and waste management. 3) Bioremediation: Remediation of degraded ecosystem. 4) Role of microorganisms in degradation of pesticides, chemicals, petroleum products and plastics.	15
UNIT-III	
1) Vermiculture technology. 2) Bio fertilizer technology. 3) Role of microorganism in alcohol and acetic acid production, fermentation technology. 4) Composting and Biomethanation.	15
UNIT-IV	
1) Bio toxicity assays to evaluate Effectiveness of Bt spores against pest and beneficial insects. 2) Biological indicators and biosensors. 3) Bioenergy and biofuels. 4) Bio pesticides and bio fertilizers	15

Suggested Readings: Gardner, Simmonds, Snustad, 1991, Principles of Genetics. John Wiley, Eighth Edition.
Mohapatra. P. K., 2006, Text Book of Environmental Biotechnology. I K International. Olguin, E., Sanchez, G. and Hernandez, E., 1999, Environmental biotechnology and cleaner bioprocesses, Taylor & Francis, London.
Rittman, B. E., and McCarty, P. L., 2001, Environmental Biotechnology. Principles and applications. McGraw-Hill, New York.
Scragg, A. H., 2005, Environmental Biotechnology. Oxford University of Press. Wainwright, M., 1999, An introduction to environmental biotechnology. Springer Verlag, New York

Course Outcome:-

CO1: Student will understand and describe the type of microorganisms in the environment

CO2: Aware about the innovative practices bioleaching, bioabsorption and bioremediation and use of biotechnology for industrial pollution control

CO3: Gain knowledge about vermiculture biotechnology waste management, biofertilizers and role of microorganism in fermentation technology

CO4:.Student will get in depth information about bio indicator, biosensor and bio energy generation

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	1	-	-	-	-	2	-	3	2	3	-	1	-	2
CO2	3	3	-	-	3	2	3	2	2	3	2	2	1	-
CO3	-	-	2	3	3	2	2	2	2	-	-	2	-	-
CO4	3	2	2	-	-	-	1	2	2	2	-	2	-	1

Matching: * 0 to 30% = 1; *30% to 60% = 2; * 60% to 100% =3

Skill Development, Employability and Entrepreneurship Course

FOURTH SEMESTER

Elective Course

Code-EnvSc-E404

ENVIRONMENTAL INSTRUMENTATION

Course Descriptation: The aim of this course is to develop understanding about the various environmental technique for sample analysis of soil, air and water by various technique.

Topics	Teaching Hours
UNIT-I	
Spectroscopy 1) Emission spectroscopy. 2) Atomic absorption spectroscopy 3) Flame photometry 4) Circular Dichroism Spectroscopy	15
UNIT-II	
Centrifugations 1) Principle 2) Types of centrifuges 3) Types of centrifugation 4) Ultra-centrifugation **Air Monitoring Sampler** 5) High Volume Sampler 6) Respirable Dust Sampler 7) Fine Particulate Sampler 8) Gravimetry and titrimetry	15
UNIT-III	
Chromatography 1) Paper chromatography, TLC 2) Column chromatography 3) GLC 4) HPLC	15
UNIT-IV	
1) pH meter 2) Photometry 3) Spectrophotometry 4) Nephalometry 5) Conductivity meter	15

Suggested Readings: Chatwal, Gurdeep R., Sham, Anand, K. 2016 Instrumental method of chemical analysis, Himalaya Publishing Comapany.
Chatwal, Gurdeep R, Sham, Anand, K 2016 Spectroscopy Himalaya Publishing Comapany

Course Outcome:-

CO1: Gain knowledge on how to use different type of spectroscopy in analysis of various samples of air water and soil.

CO2: Student will be able to understand about different type of centrifuge andair monitoring samplers

CO3: Ability to apply the use of chromatography in sample analysis

CO4: Student will gain in depth knowledge about nephalometry, photometry and spectrophotmetery in various sample analysis.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	2	2	-	3	3	3	3	2	1	-	-	3	1	2
CO2	2	3	-	3	3	3	2	1	-	-	-	2	-	-
CO3	3	2	-	2	3	2	3	-	2	-	2	-	-	2
CO4	2	3	1	2	3	1	2	-	1	-	2	-	-	1

Matching: * 0 to 30% = 1; *30% to 60% = 2; * 60% to 100% =3

Employability and Entrepreneurship Course

FOURTH SEMESTER

Elective Course

Code-EnvSc-E405

ECOTOXICOLOY AND ENVIRONMENTAL HEALTH

Course Descriptation: The objective of the curriculum is to acquaint the students about the Occupational hazards, Xenobiotic compoundsas pollutants and disease-causing microbial agents affecting human health.

Topics	Teaching Hours
UNIT-I	
1) Principles in toxicology, aquatic and animal toxicity tests. 2) Statistical concept of LD50 and LC50. 3) Dose response and Dose effect relationship, Dose response curve. 4) Biological, chemical and ecological factors that influence toxicity.	15
UNIT-II	
1) Major classes of environmental pollutants – Heavy Metals, Gases, Pesticides and Fertilizers. 2) Biotransformation and it's processes. 3) Bioaccumulation and Bio magnification. 4) Toxicants effects – Cellular, Organismic, Population and Ecosystem level.	15
UNIT-III	
1) Biochemical teratogenicity and it's effect. 2) Carcinogenicity of environmental pollutants. 3) Environmental toxins and human health. 4) Microbial toxins.	15
UNIT-IV	
1) Water borne diseases, air borne diseases. 2) Vector transmitted diseases. 3) Food – borne diseases. 4) Occupational Health.	15

Suggested readings: Newman, M.C, Lawrence, C.A., and Unger. M.A., 2002. Ecotoxicology: Fundamentals of Ecotoxicology, 2 nd Ed., CRC Press, Boca Raton, Florida.

Walker, C.H., Hopkin, S.P., Sibly, R.M., and Peakall, D.B. 2001. Principles of Ecotoxicology. 2 nd Ed. Taylor & Francis, London.

Moore, G.S., 2002, Living with the Earth: concepts in Environmental Health Science (2 nd Ed.), Lewis publishers, Michigan.

Selinus, Alloway, Centeno, Finkelman, Fuge, Lindh, Smedley; 2005, Essential of Medical Geology; Elsevier Academic Press.

Course Outcome:-

CO1:knowing about the principles of toxicology, Know the dose response relationship and factors that influence toxicity.

CO2: Moreover, the students would acquire knowledge about the toxicants and their route of entry to the environment and its consequences.

CO3: Understand the fate of toxicants and transport of toxicants in food chain

CO4:.to know the occupational health hazards associated with different occupations and occurrence of industrial disasters.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	**3**	**-**	**-**	**2**	**-**	**2**	**-**	**3**	**1**	**3**	**-**	**-**	**1**	**2**
CO2	**3**	**3**	**2**	**3**	**-**	**2**	**-**	**2**	**1**	**3**	**-**	**-**	**-**	**-**
CO3	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**2**	**-**	**3**	**-**	**-**	**-**	**1**
CO4	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**2**	**-**	**3**	**-**	**-**	**-**	**-**

Matching: * 0 to 30% = 1; *30% to 60% = 2; * 60% to 100% =3

FOURTH SEMESTER
Elective Course
Code-EnvSc-E406
ENVIRONMENTAL HAZARDS

Course Description: The objective of the curriculum is to acquaint the students about the concept of various geological hazards and their prediction and mitigation.

Topics	Teaching Hours
UNIT-I	
1) Concept of geological hazards – continental drift theory. 2) Plate – tectonic theory. 3) Distinction between natural hazards and anthropogenic hazards. 4) Prediction and perception of hazards.	15
UNIT-II	
1) Geological Hazard :Earthquake, Earthquake destruction and prediction 2) Geological Hazard :Volcanism, Volcanic activity, Igneous activity and Material Extruded during eruption 3) Geological Hazard : Mass – movement, Landslide and its prediction 4) Geological Hazard: Tsunami. And its consequences, Mitigation measures and early warning	15
UNIT-III	
1) Hydrological Hazard: Floods and its types, River topography ,causes and its prediction 2) Hydrological Hazard: Drought and its types 3) Hydrological Hazard: Tropical Cyclones and Anticyclone, Hurricanes, Tornedo 4) Atmospheric climatic hazards.	15
UNIT-IV	
1) Technological hazards: Bhopal, Three Mile Island and Chernobyl disasters. 2) Biophysical Hazard – frost, Epidemics. 3) Cloud Bursting and its consequences 4) Disaster management.	15

Suggested Readings: Bell. F.G, E & FN Spon, 1999, Geological Hazards: Their Assessment, Avoidance and Mitigation, e Books der ULB Darmstadt.

Burton. I, Kates. R.W and White. G.F, 1993, Environment as Hazard Guilford Press. Casale. R and Margottini. C. (Ed.), Springer, 2004, Natural Disasters and Sustainable Development

Hewitt. K., 1997, Regions of risk, Longman Press.

Henrry J.G. and Heinke , G.W., 2004, Environmental Science and engineering, Pearson education, Delhi, India.

Keller. Edward A, 1996, Introduction to Environmental Geology, Prentice Hall, Upper Saddle River, New Jersey

Smith Keith, 2001, Environmental Hazards: Assessing Risk and Reducing Disaster, Routledge.

Course Outcome:-

CO1: Understand the geophysical processes as the drivers of different types of hazards.
CO2: Will be able to understand and differentiate the different types of disasters, analyse the causes and their potential impact on the natural and man-made environments
CO3: Gain knowledge about different hydrological hazard, their occurrence and their types.
CO4:.Aware the different Strategies for mitigation disaster management and knowledge about different technological hazards.

Course Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	2	3	2	-	3	3	2	3	2	2	3	2	1	-
CO2	2	3	3	-	2	3	-	3	-	2	2	2	-	-
CO3	3	3	1	-	2	2	1	2	-	2	2	3	-	-
CO4	3	3	-	3	2	-	-	2	2	-	3	2	-	2

Matching: * 0 to 30% = 1; *30% to 60% = 2; * 60% to 100% =3

Skill Development, Employability and Entrepreneurship Course

Fourth semester

Core Course

Code - EnvSc-C407

Practical

Course Description

The course provides practical exposure to biochemical estimation of different parameters in blood serum and gives understanding about structure of microorganism.

Course Structure:

The following is a detailed syllabus.

Biochemical estimation of different parameters in serum and blood viz.

1 total protein.
2 Serum albumin
3 Serum globulin
4 Albumin to Globulin ratio

Serum lipids

5.Serum cholesterol
6.High Density Lipoprotein
7.Low Density Lipoprotien
8.Triglyceride
9.Very Low Density Lipoprotien
10.To study the bacteria present in a curd sample.
11.To identify the microorganism which spoil the food material.
12. To understand the morphological structure of various microorganism.
Volvox
Zygnema
Yeast
Fucus
Penicillium
Ustilago
Amoeba
Paramecium
Euglena
13. Case Study: Environmental Impact assessment

Suggested Reading: Barthwal R.R. (2002): Environmental Impact Assessment, New Age International (P)Ltd . Pub New Delhi, Environmental Microbiology - Ralph Mitchell and Ji-Dong Gu, Environmental Microbiology: A Laboratory Manual - Ian L. Pepper and Charles P. Gerba

Course Outcome

By the end of the course, students are expected to be able to:

CO1: Gain practical knowledge about estimation of different biochemical parameter in blood serum.

CO2: Gain practical understanding about the structure of different microorganism and slide preparation.

Course Mapping