Department of Environmental Science

B.Sc : Environmental Science

Semester I

S.No	Paper Code	Paper Title	Type of Paper (Theory,Practical Project, Seminar)	Contact Hours		Credits	Max. Marks	Min. Marks
				Per sem	Per week			
1	ENV-101	Fundamentals of Environmental Science	Theory	45	3	3	100	36
2	ENV-102	Environmental Ecology	Theory	45	3	3	100	36
3	ENV-103	Practical	Practical	60	4	2	100	36

Semester II

S.No.	Paper Code	Paper Title	Type of Paper (Theory,Practical Project, Seminar)	Contact Hours		Credits	Max. Marks	Min. Marks
				Per sem	Per week			
1	Env-201	Natural Resource Conservation	Theory	45	3	3	100	36
2	Env-202	Biodiversity and Wildlife	Theory	45	3	3	100	36
3	Env-203	Practical	Practical	60	4	2	100	36

Semester III

S.No.	Paper Code	Paper Title	Type of Paper (Theory,Practical Project, Seminar)	Contact Hours		Credits	Max. Marks	Min. Marks
				Per sem	Per week			
1	ENV-301	Environmental Biotechnology	Theory	45	3	3	100	36
2	ENV-302	Environmental Microbiology	Theory	45	3	3	100	36
3	ENV-303	Practical	Practical	60	4	2	100	36

Semester IV

S.No.	Paper Code	Paper Title	Type of Paper (Theory, Practical Project, Seminar)	Contact Hours		Credits	Max. Marks	Min. Marks
				Per sem	Per week			
1	ENV-401	Environmental Pollution and its Control	Theory	45	3	3	100	36
2	ENV-402	Environmental Impact Assessment	Theory	45	3	3	100	36
3	ENV-403	Practical	Practical	60	4	2	100	36

Semester V

S.No.	Paper Code	Paper Title	Type of Paper (Theory,Practical Project, Seminar)	Contact Hours		Credits	Max. Marks	Min. Marks
				Per sem	Per week			
1	Env-501	Environmental Toxicology	Theory	45	3	3	100	36
2	Env-502	Environmental Problems and Legislations in India	Theory	45	3	3	100	36
3	Env-503	Practical	Practical	60	4	2	100	36

Semester VI

S.No.	Paper Code	Paper Title	Type of Paper (Theory,Practical Project, Seminar	Contact Hours		Credits	Max. Marks	Min. Marks
				Per sem	Per week			
1	ENV-601	Disaster Management	Theory	45	3	3	100	36
2	ENV-602	Remote Sensing and GIS	Theory	45	3	3	100	36
3	ENV-603	Practical	Practical	60	4	2	100	36

B.Sc.Part - 1

FIRST SEMESTER

ENV 101: Fundamentals of Environmental Science

Contact hours/semester: 45 **Contact hours/week:3**

Maximum marks: 100 (Continuous Assessment-30 & Semester End Exam-70)

Credits: 3

Objective of the paper: To acquaint students with the subject and to make them learn the fundamentals of ecology and environmental science.

UNIT 1: Introduction to Environmental Science **08**

- Definition, Scope and Importance of Environmental Science
- Multidisciplinary nature of Environmental Science
- Environment and Its Components

UNIT 2: Physical and Chemical Environment **10**

- Evolution of man with special reference to its role in the Environment
- Ecosphere and its components such as Atmosphere, Hydrosphere, Lithosphere and Biosphere
- Interaction of all the components
- Origin of Life

UNIT 3: Ecological Concepts **10**

- Concept of Ecosystems
- Types of Ecosystems
- Ecosystem structure and functioning
- Energy flow
- Food chains and food webs
- Ecological pyramids

UNIT 4: Ecological Principles **10**

- Liebig's Law of Minimum
- Shelford's Law of Tolerance
- Combined Concept of Limiting Factors

UNIT 5: Biogeochemical cycles **07**

- Definition and importance
- Hydrological
- Carbon
- Oxygen
- Nitrogen
- Phosphorus
- Sulphur

Suggested Readings

- Agrawal,K.C.: Fundamentals of Environmental Biology,2001, Bikaner (India): Nidhi Publishers
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA
- Odum E.P.: Fundamentals of Ecology,1996, Dehradun: Natraj Publisher
- Chapman,J.L. & Reiss, M.J.: Ecology: Principles and Applications, 1995, Cambridge University Press
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai,

ENV-102: Environmental Ecology

Contact hours/semester: 45 **Contact hours/week:3**

Maximum marks: 100 (Continuous Assessment-30 & Semester End Exam-70)

Credits: 3

Objective of the paper: To understand the structure, function, and integration of the Ecosystem and its inhabitants and its four major spheres: land, water, living things, and air. To illustrate the interdisciplinary nature and complexity of environmental problems in our local communities

UNIT 1: Community Ecology **10**

- The Biotic community concept
- Characteristics of a community
- Ecotone and edge effect
- Habitat and ecological niche

UNIT 2: Habitat Ecology **09**

Structure of the following ecosystems:

- Aquatic ecosystem
  - Freshwater
  - Marine
  - Estuarine
- Terrestrial ecosystem
  - Desert
  - Grassland
  - Forest

UNIT 3: Population Ecology **10**

- Density
- Natality
- Mortality
- Biotic potential,
- Fluctuations
- Dispersal and growth rate
- Growth curves
- Regulatory factors of population growth-density dependent and independent factors

UNIT 4: Concept of Productivity **10**

- Primary productivity
- Secondary productivity
- Significance of productivity
- Methods of measurement of productivity

UNIT 5: Ecological Succession **06**

- eneral process
- Basic types
- Patterns of Succession-Xerosere, Psammosere, and Hydrosere
- Causes and trends
- Concept of Climax

SUGGESTED READINGS:

- Chapman,J.L. & Reiss, M.J.: Ecology: Principles and Applications, 1995, Cambridge University Press
- Sharma, P.D. : Ecology and Environment,2008, Meerut : Rastogi Publications
- Kormondy: Concepts of Ecology, Prentice Hall
- Cunningham, W.P.& Saigo, B.W.: Environmental Science, 1999, Mc- Graw Hill Book Company
- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
- Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA,
- Odum, E.P. 1983**.** Basic Ecology, Saunders, Philadelphia.
- Smith, R.L. 1996. Ecology and Field Biology, Harper Collins, New York.
- Kumar H.D et. al: General Ecology -, Vikas publishing house Pvt. Ltd. New Delhi (1995)
- Ecology - Culvinvux P, John Wiley and Sons, (1986)
- Ecology - Krebs J, II ed, Harper international

ENV 103: Practicals

- Study of vegetation of local area/college campus and Herbarium preparation
- Study of fauna of local area/college campus
- To find out minimum size and number of the quadrat for vegetation study
- Study of vegetation density, frequency and abundance by quadrat method
- Study of dominance of plant species by quadrat method
- Identification of mammalian species by hair imprinting method.
- To calculate the leaf area index
- Exercises on Shannon –Weiner Index

B.Sc. Part - 1

SECOND SEMESTER

ENV 201: Natural Resource Conservation

Contact hours/semester: 45 **Contact hours/week:3**

Maximum marks: 100 (Continuous Assessment-30 & Semester End Exam-70)

Credits: 3

Objective of the paper: The course lays emphasis on equitable and efficient distribution of natural resources and its management for sustainable development

UNIT 1: **Introduction to Natural Resources** **06**

- Definition
- Classification
- Sustainable Development- Concept and Basic aspects
- Agenda 21

UNIT 2: Land Resources **10**

- Soil profile and classification
- Soil erosion and degradation
- Soil conservation
- Forest resources of India
- Conservation of forest

UNIT 3: Water Resources **10**

- Importance of water
- Properties of water- Physical and Chemical
- Sources of water-Surface and Ground water
- Water conservation

UNIT 4: Mineral Resources **10**

- Definition
- Types of Minerals
- Use and exploitation
- Environmental effects of mining

UNIT 5: Energy Resources **09**

- Introduction
- Non-renewable energy resources: fossil fuels(coal, oil and natural gas)
- Renewable energy resources: Hydroelectric power, Tidal power, wind power, biomass and solar energy

SUGGESTED READINGS:

- Ahmaob, I, and Deloman, J. (1995) Beyond Rio, MacMillan.
- Our Common Future, Report of the OECD (1987) Oxford University Press.
- Khanna, Gopesh Nath (1990) Environment Problems and the United Nations, Ashish Publishing House, New Delhi.
- Agarwal, Anil, Narain, Sunita and Sharma, Anju (Eds.) (1999) Global Environmental Negotiations I: Green Politics, Centre for Science and Environment, New Delhi.
- Field, B. (199ss Encyclopaedia of Environment: Environmental Problems and Policies Vol. I & II, 2005, New Delhi: Anmol Publications
- Owen, S., Natural Resources Conservation]
- Study Material(Handbooks) of Sikkim Manipal University for Science Health and Technology for the Degree of Post Graduation in Ecology and Environment

ENV 202: Biodiversity and Wildlife

Contact hours/semester: 45 **Contact hours/week: 3**

Maximum marks: 100 (Continuous Assessment-30 & Semester End Exam-70)

Credits: 3

Objective of the paper: The course lays emphasis on importance and conservation of biodiversity which will lead to sustain life on earth.

UNIT 1: Introduction to Biodiversity **09**

- Definition and concept
- Types
- Importance
- Hotspots

UNIT 2: Biodiversity Conservation **09**

- Causes of loss of Biodiversity
- Extinction of species
- Basic concepts of Conservation (*in situ* and *ex situ*)
- Role of biotechnology in biodiversity conservation

UNIT 3: Introduction to Wildlife **09**

- Wildlife resources
- Wildlife habitat
- Home range
- Territory
- Factors causing wildlife depletion

UNIT 4: Wildlife Management in India **10**

- Conservation of wildlife
- Project Tiger
- WWF
- IUCN
- Red Data Book

UNIT 5: Legal implementation towards Wildlife and Biodiversity **08**

- Wildlife (Protection) Act,1972
- Wildlife (Protection) Amendment Act ,1991
- Man and Biosphere Programme
- Convention on Biological Diversity (CBD)

SUGGESTED READINGS:

- Kothari, Asish , Understanding Biodiversity, New Delhi: Orient Longman.
- UNESCO,2002. Biosphere Reserves: Special places for people and nature.UNESCO, Paris.
- Glowka, L. et.al., (1994) A Guide to the Convention on Biological Diversity, IUCN Gland and Cambridge.
- Wcmc (1992) Global Biodiversity. Status of the earth's Living Resources.

- IUCN (1999) Resource Material on Biodiversity for General Certificate of Education.
- Agarwal, Anil, Narain, Sunita and Sharma, Anju (Eds.) (1999) Global Environmental Negotiations I: Green Politics, Centre for Science and Environment, New Delhi.
- Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad
- Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
- Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub.
- Hossetti, B.B.:Wildlife management in India

ENV 203: Practicals

Soil Analysis

- Determination of moisture percentage in the soil sample
- Determination of organic carbon in the soil sample
- Determination of pH in the soil sample
- Qualitative estimation of Nitrate-nitrogen
- Qualitative estimation of Phosphate
- Determination of bulk density in the soil sample
- Determination of porosity in the soil sample
- Determination of water holding capacity of soil
- Determination of conductivity of soil
- Determination of alkalinity of soil
- Determination of acidity of soil

PREPARATION OF A RECORD COMPRISING OF THE FOLLOWING TOPICS

- Mineral resources in India
- Major soil types of India
- Deserts of India
- Forests of India
- Major biomes of the world
- Hotspots of Biodiversity in the World
- Important Environmental Organizations (National and International)
- National parks of India
- Sanctuaries of India

B.Sc.Part – 1I

THIRD SEMESTER

ENV 301: Environmental Microbiology

Contact hours/semester: 45 **Contact hours/week:3**

Maximum marks: 100 (Continuous Assessment-30 & Semester End Exam-70)

Credits: 3

Objective of the paper: To discuss the general concepts of microbiology such as growth, metabolism, genetics, and microbial structure and function, and to study the future challenges of microbiology.

UNIT 1: Growth and Distribution of microorganisms in the environment **10**

- Introduction to environmental microbiology
- Environmental factors and microbial growth
- Microbial growth curve (Lag phase, acceleration phase , exponential phase, deceleration phase, stationary phase, death phase)
- Distribution of microorganisms in environment

UNIT 2: Microbial Interactions in the Environment **10**

- Interaction among the microbial populations
- Types of symbiosis and functions
- Photosynthetic and non photosynthetic partners

UNIT 3: Microbiology of Water **10**

- Microbial habitat in the aquatic environment
  - -Planktonic environment
  - -Benthic habitat
  - -Microbial mats
  - -Biofilms
- Microbial characteristics of fresh and marine water

UNIT 4: Microbiology of Soil **08**

- Soil habitat (Lithosphere)
- Microbial biogeochemical cycling
  - -Carbon cycle

-Nitrogen cycle
-Sulphur cycle
-Phosphorus

- Rhizosphere

UNIT 5: Applications of Environmental Microbiology 07

- Bioremediation
- Phytoremediation
- Biodegradation of solid waste (composting)
- Sewage treatment(Basic concept)

SUGGESTED READINGS:

- Stanier ,General Microbiology
- Verma, Environmental Biology Meerut publication
- Pelczar, Microbiology
- Atlas, Ronald M. Microbial Ecology: Fundamental and Applications
- Raina M Maier Ian L Pepper Charles P Gerba (2006) Environmental Microbiology Publisher: Elsevier India P Ltd
- Banwari Lal (2009) **Environmental Microbiology** 1st ed. Publisher: Cyber Tech Publications
- Sharma P D (2005) Environmental Microbiology Publisher: Narosa Publishing House
- Patrick K. Jjemba (2004) Environmental Microbiology Principles and Applications Science publishers
- Pradipta K. Mohapatra (2008) , **Textbook of Environmental Microbiology** 1st ed. Publisher: I. K. International Pvt. Ltd.
- M.l. Srivastava Environmental Microbiology, Publisher: Shree Publishers & Distributors
- Stetzenbach L.d . (2003),The Dictionary Of Environmental Microbiology Publisher: Else
- Michael J Pelczar et.al, (1986) Microbiology. Mc.Graw - Hill book. 5th edition.
- Michel J Pelczar et al (1994). Microbiology concepts and applications. Mc. Graw - Hill Inc.
- Martin Alexander (1983). Introduction to soil Microbiology, Wiley Eastern Ltd.
- Powar C.B.and Doginwala. H.F,1985,General Microbiology, Vol. I . and II ed. Himalaya publishing house.
- Pepper W. A.1995. Environmental Microbiology, Pepper W. A.P.publisher
- R.C. Dubey & D.K. Maheshwari, 2001. A textbook of Microbiology, S. Chand & Co. New Delhi.
- Maria csuros & Csaba csuros, 1999. Microbiological examination of Water and wastewater. Lewis Publishers.
- Advances in Microbial ecology, Plenum Press New York and London.

ENV 302: Environmental Biotechnology

Contact hours/semester: 45 Contact hours/week:3

Maximum marks: 100 (Continuous Assessment-30 & Semester End Exam-70)

Credits: 3

UNIT 1: **Introduction to Environmental Biotechnology** 07

- Definition of Environmental Biotechnology
- Scope of Environmental Biotechnology
- Concept of Recombinant technology

UNIT2: Biological Treatment of wastewater **10**

- Introduction
- Microbial processes in wastewater treatment
- Primary Treatment
- Secondary Treatment Systems
  - -Conventional biofilters
  - - High rate biofilters
  - -Rotating biological contactors
  - -Activated sludge

UNIT 3: Biotechnology for solid waste management **10**

- Introduction
- Biological processes in sanitary landfilling
- Aerobic treatment of solid waste
  - -Composting
  - -Vermiculture
- Anaerobic treatment of solid waste and biogas generation

UNIT 4: Biotechnological approach for industrial pollution control **10**

- Dye industry
  - Sources and origin of dyes
  - Characterization of waste effluents
  - Environmental impact of dyes and its intermediates
  - Treatment technologies of dyes

UNIT 5: Applications of Biotechnology (Basic concepts) 08

- Biomining and bioleaching
- Biofuels and Bio fossil fuels(Bioethanol,Biodisels)
- Bioremediation
- Biomethanation
- Biofertilizers and biopesticides

SUGGESTED READINGS:

- Nester, Microbiology: A Human Perspective
- Allsopp,Dennis Introduction to Biodeterioration
- Borem, Aluizio Understanding Biotechnology
- Chatterji, A.K Introduction to Environmental Biotechnology

- Indu S. Thakur, Environmental Biotechnology: Basic concept and Applications. I.K. international Pvt. Ltd.
- Kurt Konhauser, Introduction to Geomicrobiology. Blackwell Publication USA.
- P.K. Mohapatra, Text book of Environmental Biotechnology.I.K. International pvt. Ltd.

ENV 303: Practicals

- Preparation of culture media
- Isolation of microorganisms from soil sample
- Isolation of microorganisms from water sample
- Isolation of microorganisms from air sample
- To study the gram staining of bacteria culture
- Thin layer chromatography
- Paper chromatography
- Preparation of green file
- MPN

B.Sc.Part – 1I

FOURTH SEMESTER

ENV401: Environmental pollution and control

Contact hours/semester: 45 **Contact hours/week:3**

Maximum marks: 100 (Continuous Assessment-30 & Semester End Exam-70)

Credits: 3

UNIT 1: Introduction to Environmental pollution **10**

- Definition
- Types
- Pollutants and their types
  -biodegradable and non biodegradable
  -Primary and secondary
  -Inorganic and organic

UNIT 2: Air pollution and its control **10**

- Definition
- Sources
- Types of air pollutants and their characteristics
- Effects of major air pollutants(SOx, NOx, CO,PAN) on living and nonliving components
- Basic methods of air pollution control (Reduction at source, change of process and names of the equipments used to control air pollution)

UNIT 3: Water pollution and its control **08**

- Definition
- Major sources
- Types of water pollutants(Inorganic,organic,O2 demanding, disease causing agents, thermal, radioactive)
- Effects of water pollutants on surface and ground water
- Control of water pollution (basic idea of waste water treatment)

UNIT 4: Soil/Land pollution and its control **07**

- Definition
- Major sources
- Types of soil pollutants (domestic and municipal waste, industrial and mining waste, agricultural waste, radioactive and chemical waste)
- Control of soil pollution

UNIT 5: Noise pollution and its control **10**

- Definition
- Major sources
- Effects of noise pollution of human health
- Control of noise pollution

SUGGESTED READINGS:

- Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press.
- Survey of the Environment, The Hindu (M)
- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Jaipur:Techno-Science Publication
- Agarwal, S.K.: Pollution Management: Volume I-V, Delhi: A.P. H. Publishing Corporation
- Rowe, P.V., Introduction to Environmental Pollution.

ENV 402: Environmental impact assessment

Contact hours/semester: 45 **Contact hours/week:3**

Maximum marks: 100 (Continuous Assessment-30 & Semester End Exam-70)

Credits: 3

UNIT1: Introduction to EIA **10**

- Definition of EIA
- EIA and sustainable development
- Need for EIA

UNIT 2: Process of EIA **06**

- Major Steps of EIA
- Screening
- Scoping
- Identification

UNIT 3: Methods used in EIA **10**

- Adhoc approach
- Overlay method
- Questionnaire method
- Checklist method

UNIT 4: Preparation of Environmental Impact Statement **10**

- Major components of EIS including socio economic components
- Writing an EIS

UNIT 5: Environmental Auditing **09**

- Objectives of Environmental auditing
- Importance of Environmental auditing
- Steps of EA (outline)

SUGGESTED READINGS:

- Lang, Winfried (Ed.) (1995) Sustainable Development and International Law,
- London: Grahm and Tort.
- Mahhub ul Haq (2002) Human Development Centre, Human Development in South Asia, Oxford University Press.
- Smith, Keith (1996) Environmental Hazards- Assessing risk and reducing disaster, 2nd Edition, London & New York.
- Study Material(Handbooks) of Sikkim Manipal University for Science Health and Technology for the Degree of Post Graduation in Ecology and Environment
- Rao, P.K. (2000) Sustainable Development, Massachusetts: Blackwell Publishers
- Warthen, Peter, Introduction to Environmental Impact Assessment
- Canter,L.W., Environmental Impact Assessment
- Khan, T.I., Environmental Impact Assessment
- Study Material(Handbooks) of Sikkim Manipal University for Science Health and Technology for the Degree of Post Graduation in Ecology and Environment

ENV 403: Practicals

- Estimation of pH in the water sample
- Estimation of Acidity in the water sample
- Estimation of Alkalinity in the water sample
- Estimation of Chloride in the water sample
- Estimation of Free CO2 in the water sample

- Estimation of Residual chlorine in the water sample
- Estimation of Dissolved oxygen in the water sample
- Estimation of Biological oxygen demand in the water sample
- Qualitative estimation of Nitrate
- Qualitative estimation of Phosphate

ENVIRONMENTAL SCIENCE

B.Sc.Part – III

FIFTH SEMESTER

ENV 501: ENVIRONMENTAL TOXICOLOGY

Contact hours/semester: 45 **Contact hours/week:3**

Maximum marks: 100 (Continuous Assessment-30 & Semester End Exam-70)

Credits: 3

UNIT 1: Introduction, Scope and Importance of Toxicology 10

- Introduction
- Definition
- Principle Divisions and Branches
- Scope and importance

UNIT 2: **Basic concept of Toxicology** **10**

- Dose of Toxicants
- Effect and response -[acute effects, chronic effects, reversible and irreversible effects and local and systemic effects]
- Dose response relationship – [graded and quantal response]
- Absorption, Distribution and Excretion(Basic concept)

UNIT 3: Toxicants **09**

- Definition
- Introduction of Toxicants into ecosystem
- Survey of Toxicants in
  - -Air
  - -Water
  - -Food

UNIT 4: Toxicity of Metals **08**

- Sources and toxic effects on humans of
  - -Arsenic
  - - Lead
  - -Cadmium
  - -Mercury
- Toxicity of Pesticides

UNIT 5: Toxicity of Food Additives **08**

- Definition
- Incidental or indirect additives
- Intentional or direct additives
  - -Antioxidants
  - -Emulsifiers
  - -Flavouring Agents
  - -Colour and preservatives

SUGGESTED READINGS:

- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd.
- Casserett and Doull's Toxicology: The basic source of Poisons. (VI Edition)
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press.
- Study Material (Handbooks) of Sikkim Manipal University for Science Health and Technology for the Degree of Post Graduation in Ecology and Environment
- Smith, Keith (1996) Environmental Hazards- Assessing risk and reducing disaster, 2nd Edition, London & New York.
- Wisnr B., Adams, J. (Ed.) (2002) WHOEnvironmental Health in Emergencies and Disaster- A practical guide, World Health Organisations.
- Conner, David (1994) Managing the environment with rapid Industrialisation- Lessions from the East Asian Experience, OECD, Paris.
- Khanna, Gopesh Nath (1990) Environment Problems and the United Nations, Ashish Publishing House, New Delhi.
- Sharma P.D., Environmental Biology and Toxicology, Meerut: Rastogi Publications
- Study Material (Handbooks) of Sikkim Manipal University for Science Health and Technology for the Degree of Post Graduation in Ecology and Environment
- Sharma,B.K. Environmental Chemistry. Meerut publication
- Pandey, Shukla, Trivedi, Fundamentals of Toxicology. New Central book agency

ENV 502: Environmental problems and legislations in india

Contact hours/semester: 45 **Contact hours/week:3**

Maximum marks: 100 (Continuous Assessment-30 & Semester End Exam-70)
Credits: 3

UNIT 1 Global Environmental Issues **10**

- Ozone layer depletion
- Green House Effect
- Acid rain
- Smog
- Deforestation
- Desertification

UNIT 2 Legal provisions for Environmental Protection in India **10**

- Introduction
- Environment and constitution of India
- Environmental Protection Act, 1986
-

UNIT 3Control of water pollution **08**

- **S**tandard quality parameters of potable water
- The Water (Prevention and Control of Pollution) Act, 1974
- Salient features

UNIT 4 Control of air pollution **10**

- **S**tandard quality parameters of potable water
- The Air (Prevention and Control of Pollution) Act, 1981
- Salient features

UNIT 5 Protection of Forest and Wildlife **07**

- The National Forest Policy,1988
- Wildlife (Protection) Act, 1972

SUGGESTED READINGS:

- Study Material (Handbooks) of Sikkim Manipal University for Science Health and Technology for the Degree of Post Graduation in Ecology and Environment
- IUCN,UNEP and WWF (1991). Caring for the Earth: A strategy for sustainability. International Union for Conservation of Nature, Gland
- Agarwal, K.C.: Environmental Laws-Indian Perspective.
- Defense preparedness in India - Jain N.K.,Joint assistance center, Adhyatma Sadhana Kendra Mehrauli, New Delhi
- Environmental Law and Policy in India, Divan.S and Rosencranz. A, Oxford University Press, 2nd edition (2001)
- Pollution control Legislation, Vol. I and II, Tamilnadu Pollution Control Board, Chennai (1999)
- Environmental education - Nanda. A.N. (1996)
- A text book of Environment - Agarwal.K.M. Sikdar.P.K. and Deb.S.C, MacMiller India Ltd., Calcutta (2002)
- Living in the Environment - Principles, Connections and Solutions - Tyler Miller Jr.G, Wadsworth Publishing Co. New York (1996)

ENV 503: Practicals

- Estimation of pH in waste water
- Estimation of acidity in waste water
- Estimation of alkalinity in waste water
- Estimation of chloride in waste water
- Estimation of Free CO2 in waste water
- Estimation of residual chlorine in waste water
- Estimation of dissolved oxygen in waste water
- Estimation of biological Oxygen Demand in waste water
- Qualitative estimation of nitrate in waste water
- Qualitative estimation of phosphate in waste water
- Qualitative estimation of phytoplankton in waste water
- Qualitative estimation of zooplankton in waste water

ENVIRONMENTAL SCIENCE

B.Sc.Part – 1II

SIXTH SEMESTER

ENV 601: Disaster Management

Contact hours/semester: 45 **Contact hours/week: 3**

Maximum marks: 100 (Continuous Assessment-30 & Semester End Exam-70)

Credits: 3

UNIT I Introduction **10**

- Meaning
- Distinction between Disaster and hazard
- Terminology used in disaster management
- Alternatives and suggestions

UNIT II Types of disaster **07**

- Natural
- Anthropogenic
-

UNIT III Natural Disasters **08**

Causes, Impacts and management of;

- Earthquakes
- Floods
- Cyclones
- Drought and famines
- Landslides

UNIT IV Anthropogenic Disasters **10**

- Desertification
- Land degradation
- Deforestation

UNIT V Case Studies **10**

- Tsunami in Southern Asia
- Bhopal Gas tragedy
- Chernobyl Nuclear accident

SUGGESTED READINGS:

- Goel,S.L. *Disaster Administration and Management*. Deep And Deep Publications Pvt. Ltd.
- G.K. Ghosh . *Disaster Management* A.P.H. Publishing Corporation

- R.B. Singh. *Disaster Management.* Rawat Publications
- Ayaz Ahmad. *Disaster Management: Through the New Millennium* Anmol Publications
- B Narayan .*Disaster Management* .A.P.H. Publishing Corporation
- B C Bose .*Modern Encyclopaedia of Disaster and Hazard Management* Rajat Publications
- Nikuj Kumar .*Disaster Management* .Alfa Publications
- Arvind Kumar. *Disaster Management - Recent Approaches* .Anmol Publications
- Industrial Hazards and Safety, King. R.W. and Magic J, Handbook, Butterworth (1982)
- Introduction of Safety Science, Khulman A, TUV Rheinland, (1986)
- Explosion Hazards & Evaluation, Barkey, W.E. Elsevier, Amsterdam (1983)
- Management of Disasters and How to prevent them, Wharband O.P. and Stallworthy, E.A. (1986)
- Disaster Management - Shailendera, K Singh, Subash. C Kundu and Shobu Singh, Mittal Publications, New Delhi (1998)
- Disaster Management - Induprakash, Rasthra Prahari Prakashan, Gaziabad (1994)
- Disaster Prepardness in India - Narendrakumar Jain, Adhytma Sadhan Kendra Mehrauli, New Delhi.

ENV 602: Remote Sensing

Contact hours/ semester :45 **contact hours/week: 3**
Maximum marks: 100 (Continuous assessment-30 & Semester end exam -70)
Credits:3

Unit 1: Introduction to Remote Sensing and Aerial Photo-interpretation 10

- Definitions
- Introduction.
- Comparison of advantages of aerial photo-interpretation and remote sensing.

Unit 2: Basic Principles of Remote Sensing 10

- Electromagnetic radiation and EM spectrum
- Atmospheric windows
- Interaction of EM spectrum with ground objects

Unit 3: Remote Sensing Platforms and Sensors 09

- Multiple imaging sensor System
- Landsat
- SPOT
- IRS

Unit 4: Interpretation of Data Products 10

- Photographic and digital data
- False colour composits
- Spatial resolution
- Elements of interpretation of satellite imagery

Unit 5: Application of Remote Sensing 06

- Preparation of geomorphological maps
- Preparation of land use/land coveer maps
- Forest management
- Watershed management
- Wildlife managment

SUGGESTED READINGS:

- M. Anji Reddy: Textbook of remote sensing and GIS, Hyderabad: B.S. Publications
- Study Material (Handbooks) of Sikkim Manipal University for Science Health and Technology for the Degree of Post Graduation in Ecotourism.
- A.N. Patel and Surendra Singh. Remote Sensing : Principles and ApplicationsJodhpur, Scientific, 2004
- S M Rashid B S Sokhi. Remote Sensing Of Urban Environment(1999) Manak Publications
- P.Nag and M.Kudrat. Digital remote sensing .Publisher Concept
- Remote Sensing a better view - Rudd.R.D. (1974)
- Remote sensing techniques for Environmental Analysis, Estes. J.E. and Senger.L.W
- Remote sensing of of Environment - Lintz.J and Simonnet.D.S (1976)
- Remote Sensing and GIS for Environmental Planning - Murli Krishna.I.V. (1995)
- Geographic Information system - Spatial Modeling and Policy evaluation - Fischer.M.M and Nijkamp.P (1993)

ENV 603: Practicals

REMOTE SENSING

Interpretation of Satellite imagery for

- Identification of water resources
- Urban Planning
- Classification and identification of vegetation cover

PREPARATION OF A RECORD COMPRISING OF THE FOLLOWING TOPICS

- Mineral resources in India
- Major soil types of India
- Deserts of India
- Forests of India
- Major biomes of the World
- Hotspots of Biodiversity in the World
- Important Environmental Organizations (National and International)
- National parks of India
- Sanctuaries of India
- List of natural Disasters in the world
- List of anthropogenic Disasters in the world

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