THIRUVALLUVAR UNIVERSITY BACHELOR OF SCIENCE B.SC. ENVIRONMENTAL MANAGEMENT

(With effect from 2020 - 2021)

The Course of Study and the Scheme of Examinations

S. No. Part		Study Components		Ins. Hrs	Credit	Title of the Paper	Maximum Marks			
		Course Title		/ week						
		SEMESTER I					CIA	Uni. Exam	Total	
1.	I	Language	Paper-1	6	4	Tamil/Other Languages	25	75	100	
2.	П	English (CE)	Paper-1	6	4	Communicative English I	25	75	100	
3.	Ш	Core Theory	Paper-1	6	4	Basics of Earth Science	25	75	100	
	=	Core Practical	Practical-1	4	0	Basics of Earth Science	0	0	0	
4.	- 111	Allied -1	Paper-1	4	3	Environmental Botany	25	75	100	
		Allied- 1	Practical-1	2	0	Environmental Botany	0	0	0	
5.	III	PE	Paper 1	6	3	Professional English I	25	75	100	
6.	IV	Environmental Studies		2	2	Environmental Studies	25	75	100	
		Sem. Total		36	20		150	450	600	
		SEMESTE	RII				CIA	Uni. Exam	Total	
7.	I	Language	Paper-2	6	4	Tamil/Other Languages	25	75	100	
8.	11	English (CE)	Paper-2	6	4	Communicative English II	25	75	100	
9.	- 111	Core Theory	Paper-2	5	4	Environment and Ecology	25	75	100	
10.	ш	Core Practical	Practical-1	3	2	Basics of Earth Science and Environment and Ecology	25	75	100	
11.		Allied-1	Paper-2	4	3	Environmental Zoology	25	75	100	
12.	ш	Allied-1 Practical	Practical-1	2	2	Environmental Botany and Zoology	25	75	100	
13.	ш	PE	Paper 1	6	3	Professional English II	25	75	100	
14.	IV	Value Education		2	2		25	75	100	
15.	IV	Soft Skill		2	1		25	75	100	
		Sem. Total		36	25		225	675	900	
		SEMESTER	R III				CIA	Uni. Exam	Total	
16.	111	Core Theory	Paper-3	5	4	Environmental Chemistry	25	75	100	
17.	· III .	Core Theory	Paper-4	6	_ 4	Natural Resource Management	25	75	100	
18.	- 111	Core Theory	Paper-5	6	4	Environmental Microbiology	25	75	100	
	· III _	Core Practical	Paper-2	3	-	Environmental Chemistry and Environmental Microbiology	0	0	0	
19.		Allied-2	Paper-3	5	3	Environmental Economics	25	75	100	
20.	IV .	Skill Based Subject	Paper-1	3	2	Remote Sensing and GIS	25	75	. 100	
21.	IV .	Non-Major Elective	Paper-1	2	2	Global Environmental Issues · Management	25	75	. 100	
		Sem.Total		3 0	19	<u> </u>	150	450	600	

		SEMESTE	RIV			-	CIA	Uni. Exam	Total
22.		Core Theory	Paper-6	6	4	Environmental Pollution and Control Measures	25	75	100
23.	111	Core Theory	Paper-7	5	4	Pollution Monitoring and Analytical Techniques	25	75	100
24.	Ш	Core Theory	Paper-8	6	4	Energy and Environment	25	75	100
25.	III [.]	Core Practical	Paper-2	0	3	 Environmental Chemistry and Environmental Microbiology 	25	75	. 100
26.		Core Practical	Paper-3	3	3	Energy and Environment	25	75	100
27.	111	Allied-2	Paper-4	5	[¯] 5	Environment and Eco- Tourism	25	[®] 75	100
28.	IV	Skill Based Subject	Paper-2	3	2	Aquaculture and Environment	25	75	100
29.	IV	Non-Major Elective	Paper-2	2	2	Occupational Safety ,Health and Management	25	75	100
		Sem.Total	•	30	27		200	600	800
				-				-	-
		SEMEST	ER V	6		Waste Management and	2⊑	75	100
30.		Core meory	_Paper-9	_ 0		Recycling	25	_ / >	. 100
31.	- 111	Core Theory	Paper-10	6	5	Environmental Safety, Health and Management	25	75	100
32.	111	Core Theory	Paper-11	6	5	Biostatistics and Instrumentation	25	75	100
		Core Practical	Paper-4	3	0	Biostatistics and Instrumentation and Waste Management	0	0	0
33.		Elective	Paper-1	6	3	Principles of Sustainable Development and Management	25	. 75	100 "
34.	IV	Skill based Subject	Paper-3	3	2	Forest Conservation & Management	25	75	100
		Sem.Total	•	- 30	20		125 .	_" 375	500
		•	•	e	•	e			•
		SEMESTE	R VI						
35.		Core Theory	Paper-12	6	4	Natural Hazard and Disaster Management	25	75	100
36.		Core Theory	Paper-13	5	4	Environmental Impact Assessment	25	75	100
37.		Core Theory	Paper-14	5	4	Environmental Laws, Policies and Treaties	25	75	100
30		Core Practical	Paper-4	0	3	Biostatistics and	25	75	100
50.	•	a	-	-		Management	0	•	•
39.	"	Core Project	Paper – 15	5	· 5	' Group / Individual Project	25	· 75	' 100
40.		Elective	Paper-2	3	3	Climate change and Current issues	25	75	100
41.		Elective	Paper-3	3	3	Environmental Toxicology	25	75	100
	IV	Skill based	Paper-4	3	2	Environmental	25	75	100
42.		subject		3		ьютесппоlogy & Herbal Science	8	•	•

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43.	V	Extension Activities		-	1	100	0	100	
	0	Sem.Total '	a	30	' 29	300	° 600	'900	8
					140			4300	

Part	Subject	Papers	Credit	Total Credits	Marks	Total Marks
Part I	Languages	2	4	8	100	200
Part II	Communicative English	2	4	8	100	200
Part III	Allied (Odd Semester)	2	3	6	100	200
	Allied (Even Semester)	2	5	10	100	200
	Allied Practical	1	2	10	100	100
	Electives	3	3	9	100	300
	Core	14	(3-5)	59	100	1400
	Core practical	4	(2-3)	11	100	400
	Professional English	2	3	6	100	200
	Compulsory Project (Group/Individual Project)	1	5	5	100	100
Part IV	Environmental Science	1	2	2	100	100
	Soft skill	1	1	1	100	100
	Value Education	1	2	2	100	100
	Lang. & Others /NME	2	2	4	100	200
	Skill Based	4	2	8	100	400
Part V	Extension Activities	1	1	1	100	100
	Total	43		140		4300

ENVIRONMENTAL CHEMISTRY

Course Objectives

- 1. To learn about the fundamental of Environmental Chemistry
- 2. To study the atmospheric structure and composition
- 3. To understand the water chemistry and relation with environment
- 4. To learn about soil chemistry and characteristics
- 5. To study the pollutants and their interaction with environment

UNIT - I

FUNDAMENTALS OF ENVIRONMENTAL CHEMISTRY

Fundamental concepts in Environmental Chemistry - Environmental segments -Preparation of Standard Solutions - Molarity, Molality, Normality, Percent and PPM (mg/l) solutions - Acid-base Reactions - pH and pOH and Buffer Solutions - Solubility and Solubility Product - Solubility of Gases in Water - The Carbonate System - Unsaturated and Saturated Hydrocarbons - Radionuclides.

UNIT - II

ATMOSPHERIC CHEMISTRY

Structure and composition of Atmosphere - Particles in the atmosphere - Physical behaviour of particles in the atmosphere - Formation of Inorganic and Organic Particulate Matter - Composition of inorganic particles - Toxic metals - Radioactive particles - The composition of organic particles - Effect of particles - Control of particulate emissions

UNIT - III

WATER CHEMISTRY

Formation of Water - Water Resources - Sources and Types Hydrological Cycle - Unique Properties of Water -Role of Water in the Environment - Physical, Chemical and Biological Water Parameters of -Oxygen - Biochemical Dissolved Oxygen Demand - Chemical Oxygen Demand. Water Pollutants - Distribution of Chemical Species in Water- Organic Matter and Humic Matter in Water.

UNIT - IV

SOIL CHEMISTRY

Formation of soil - Types of soil - Physical and Chemical Properties of Soil: Structure, Texture, Temperature, Bulk Density, Permeability, Moisture, Air, pH, Cation Exchange Capacity, Macro and Micronutrients, Humus and Organic Matter, C/N Ratio.

UNIT - V

POLLUTANT CHEMISTRY

Chemistry of various Organic and Inorganic Compounds - Pesticides -Biochemical effects of Pesticides - Heavy metals - Cadmium - Itai-Itai disease - Mercury- Minamata disease - Lead - Chromium - Zinc - Impact of heavy metals on man and animals - Thalidomide tragedy - Bio-chemical Effects of Carbon monoxide and Sulphur di-oxide.

Course Outcome

- 1. After studied Unit I, the students will be able to know the concepts in Environmental Chemistry.
- 2. After studied Unit II, the students will be able to understand the chemical process in the air, water and soil.
- 3. After studied Unit III, the students will be able to describe the water quality and water pollutants. parameters
- 4. After studied Unit IV, the students will be able to analyze and recognize the properties of soil and water.
- 5. After studied Unit V, the students will be able to understand various types of organic and inorganic pollutants their effects on environment.

Text Books

- 1. De, A.K. (2007) Environmental Chemistry, Seventh Edition, New Age International Publishers.
- 2. Sharma, B.K and H.Kaur. (1994) Environmental Chemistry. Goel Publishing House Ltd., Meerut, UP
- Textbook B. (2007) of Environmental Chemistry. IK international 3. Pani. Publishing House.

Reference

- 1. Girard, J. (2013) Principles of Environmental Chemistry (3rd edition). Jones & Bartlett.
 - 2. De. A.K. (2003) Environmental Chemistry, Wiley Eastern Limited, New Delhi.
- 3. Balram Pani, (2007) Text Book of Environmental I.K. International Chemistry, Publishing House PVT. Ltd.
 - S.E. (2010) Environmental Chemistry, Ninth Edition, CRC Press 4. Manahan,
- 5. Dara, S.S., Mishra, D.D. (2009) A Text Book of Environmental Chemistry and Pollution Control, 10th Edition, S. Chand & Company.

E-Materials

1. http://www.nptel.ac.in/courses/122106030/Pdfs/3 1.pdf

2.http://www.crystal.med.upenn.edu/sharp-lab-pdfs/sharp EncLifeSci.pdf

3.http://www.fao.org/docrep/field/003/AC172E/AC172E04.htm

4.http://www.essentialchemicalindustry.org/materials-and-applications/surfactants.html

5.http://agriinfo.in/?page=topic&superid=5&topicid=174

6. http://www.citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.800.8713&rep=rep1...pdf 7.https://www.onlinebiologynotes.com/chemical-parameters-of-water-quality-

chemicalcharacteristics-of-water/

CORE PAPER - 4

Name of the Course: B.Sc. Environmental Management Semester: Name of the paper: Natural Resource Management Paper type: core Hours of teaching : 6

Ш credits : 4

NATURAL RESOURCE MANAGEMENT

Course Objectives

1. To learn about the natural resource and their importance

- 2. To study the forest resources and its use and conservation
- 3. To study water resources and its management

4. To study the land resources and land degradation and protection

5. To understand values of mineral resources and their impact on Environment UNIT - I

INTRODUCTION NATURAL RESOURCES

Concepts and Approaches of Natural Resources Natural Resources -Conservation - Classification - Renewable Resources, Non-Renewable Resources - Natural Resources of India - Role of Individual in Conservation of Natural Resources. UNIT - II

FOREST RESOURCES MANAGEMENT

Conservation of forest resources -Distribution of forests. Wood production, Forest land use changes in India, Future demand of forest land. Carbon sequestration - Deforestation: Causes impacts -Forest and management tools: Social forestry, Agro-forestry and forestry - Eco Urban development committees, Ecotourism, Climate change reduction. Carbon trading.

UNIT - III

WATER RESOURCES MANAGEMENT

Water Resources - Source. distribution, Over Exploitation and issues management - Conservation and Management - Integrated Water resource of Harvesting - Interlinking of rivers Water - Rain river basin Water and management - Wetland Conservation - Coastal Zone Management Strategies Ecological Significance of Mangroves, Coral reefs and its conservation

UNIT - IV

LAND AND SOIL RESOURCES MANAGEMENT

of Soil resources Distribution - Role of Agricultural Practices in Soil Degradation - Soil erosion - Soil Fertility and Nutrient Management - Diagnosis of Soil Nutrient Deficiencies - Soil Conservation: Benefits Principles, Green Manuring, and Methods of Soil Conservation; Animal Manures and Restoration of Degraded and Wastelands.

UNIT - V

MANAGEMENT MINERAL RESOURCES

Mineral Resources and Reserves - Types, Sources, Distribution and Uses of valuable minerals - Exploration of Mineral Resources from Land and Oceans - Steps in Mineral Exploitation, Impact of Exploitation of Minerals on Environment - Conservation Strategies of Valuable Mineral Resources.

Course Outcomes

- 1. After studied Unit I, the students will be able to know the types of natural resources.
- 2. After studied Unit II, the students will be able to understand the importance of forest resources, uses and their conservation,
- 3. After studied Unit III, the students will be understand the different types of water resources, and how to manage the water resources.
- 4. After studied Unit IV, the students will be able to analyze and recognize the properties of soil and water.
- 5. After studied Unit V, the students will be able to understand various types of organic and inorganic pollutants their effects on environment.

Text Books

- 1. Jha LK (1997) Natural Resource Management. APH Publishing Corporation, New Delhi.
- 2. Sharma, J.P. (2011) Environmental Studies. University Science, Press, New Delhi.

Reference Books

- 1. MaDicken KG and Vergora NT (1990) Agroforestry: Classification & Management. John Wiley & Sons, New York.
- 2. Owen OS & Chiras DD (1995) Natural Resources Conservation. Prentice-Hall India, New Delhi.
- 3. Sarah Fehley (2011) Natural Resource Management, Oriental Enterprises, Dehradun, India.
- 4. Nautiyal S and Kaul AK (1999) Forest Biodiversity & its Conservation Practices in India.
- 5. Taylor, Russel D., Torquebiau, Emmanuel (2011) Natural Resource Management and Local Development, Springer Netherlands.

E-Materials

1.https://www.india.gov.in/topics/environment-forest/natural-resources

- 2.http://cedindia.org/program-areas/natural-resource-and-environment-management/
- 3.http://www.icimod.org/?q=1258
- 4.https://www.sida.se/contentassets/320aedac0f1047daa30a1400af89c7a0/13185.pdf

5.https://www.un.org/esa/agenda21/natlinfo/countr/india/natur.htm

6.https://www.encyclopedia.com/environment/energy-government-and-

defensemagazines/natural-resource-management

CORE PAPER - 5

Name of the Course: B.Sc. Environmental ManagementSemester: IIIName of the Paper: EnvironmentalMicrobiologyCredits: 4Paper Type: CoreHours of Teaching: 6

ENVIRONMENTAL MICROBIOLOGY

Course Objectives

- 1. To impart knowledge about microorganisms, and their growth and reproduction
- 2. To understand the microbial ecology and their interactions with environment
- 3. To learn about the role of microorganims in biogeochemical cycles
- 4. To study the existence and role of microbes water and soil quality
- 5. To study about the role of microbes in environmental bioprocesses.

UNIT - I

INTRODUCTION OF MICROBIOLOGY

History and Discovery of Microorganisms - Louis Pasteur's Contribution and Discoveries and Koch Postulates - Scope of Microbiology - Physical and Chemical Methods of Sterilization Techniques used in Microbiology Media - Isolation of Microorganisms Microbial Culture and Culturing Growth and Reproduction of Bacteria, Virus, and Bacteriophage.

UNIT - II

MICROBIAL ECOLOGY

Concept of Microbial Ecology - Succession and Colonization of Microbes in Environment - Positive and Negative Roles of Microbes in Environment -Environmental factors influencing the Growth and Survival of in Microorganisms _ Microbial interactions Mutualism. Commensalism. _ Competition, Amensalism, Parasitism and Predation. Plant-Microbes Interactions.

UNIT - III

MICROBES AND ENVIRONMENT

Biogeochemical Role of Microbes in Cycles Cycle - Carbon, Nitrogen Ammonification, Nitrification, Denitrification), Sulphur, (Nitrogen Fixation, Iron Rhizosphere - Rhizosphere and Phosphorous Cycles. Microorganisms and their role in Nitrogen Fixation - Anabaena, Azospirillum and Rhizobium

- Nitrogenase - Hydrogenase. Metal Leaching - Phosphate Solubilization. UNIT - IV

WATER AND SOIL MICROBIOLOGY

Microbiological Standards Detection Water Ouality Of Faecal _ Indicator -Detection Virus Microbial Contamination -Organisms of Microbial Indicators of Water Pollution - Water Purification and Recveling Soil Microbiology: Process - Waterborne Diseases. Humus, Microflora of of Lignin Soil, Microbial Degradation and Pesticides. Microbial Composting of Biowastes

UNIT - V ENVIRONMENTAL APPLICATIONS OF MICROBES

Role Microbes in Environmental Processes Biodegradation - Bioremediation - Biomining: Bioleaching, Metal Extraction Biotransformation Microbially Enhanced Oil Recovery - Microorganisms and Sewage Treatment Trickling Filters, Activated Sludge Process, Oxidation Ponds Sludge _ Treatment: Digestion, Microbiological Coal Anaerobic Biogas Production _ Desulfurization.

Course Outcomes

After studied Environmental Microbiology course, the students will be able to

1. Understand the microbial growth, reproduction, and culturing techniques.

2. Understand the interactions of microbes in an ecosystem and their role in biogeochemical cycles.

3. Understand and identify the environmental microbial bioprocess.

4. Gain knowledge in applications of microbes for environment remediation.

5. Develop microbial based environmental treatment processes.

Text Books

1. Sharma, P.D. (2005) Environmental Microbiology, Alpha Science International, Ltd.

2. Dubey and Maheshwari, 1999, A text book of Microbiology, 1/e, Chand publications, New Delhi.

3. Mohapatra P K (2008) Text Book of Environmental Microbiology, I K International Publishing House Limited.

Reference Books

1. Subba Rao NS (2004) Soil Microbiology. 4th Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

2. Subba Rao NS (1995) Biofertilizers in Agriculture and Forestry. 3rd Edition, Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi.

3. Singh DP & SK Dwivedi (2005). Environmental Microbiology and Biotechnology. 1st Edition, New Age International (P) Ltd., Publishers, New Delhi.

4. Brock TD, Madigan MT, Martinko JM and Parker J (1994) Biology of Microorganisms, VII Ed., Prentice-Hall, New Jersy, USA.

5. Ronald M. Atlas, Richard Bartha, (1997) Microbial Ecology, 4/e, Benjamin Cummings Publishing Company, USA.

E-Materials

1.https://microbenotes.com/category/environmental-microbiology/

2.https://microbewiki.kenyon.edu/index.php/MicrobeWiki

3.https://www.onlinebiologynotes.com/sewage-treatment-process-of-wastewater-treatment/

4.https://www.jsps.go.jp/english/e-plaza/e-sdialogue/data/Slide C.pdf

5.https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-89-environmental-microbiology-fall-2004/lecture-notes/

6.https://www.uvi.edu/files/documents/Research_and_Public_Service/WRRI/Introduction_to_Environ mental_Microbiology.PDF

7.https://www.geoengineer.org/education/web-class-projects/cee-549-geoenvironmental-engineering-winter-2013/assignments/bioremediation#applicability-to-soil-and-contaminant-types

8.http://www.pollutionissues.com/A-Bo/Bioremediation.html

9.https://fac.ksu.edu.sa/sites/default/files/lecture_2microbial_interactionsppt.pdf

10.https://www.onlinebiologynotes.com/bioremediation-concept-types-advantages-and-limitations/

11. https://www.onlinebiologynotes.com/microbial-ecology-and-role-of-microorganism-in-ecosystem/

ALLIED PAPER - 3

Name of the Course:B.Sc. Environmental ManagementSemester:IIIName of the Paper:Environmental EconomicsCredits:3Paper Type:Allied-2Hours of Teaching:5

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ENVIRONMENTAL ECONOMICS

Course Objectives

1. Inculcate the knowledge in ecological and economic system

2. Impart principles of ecological economics

3. Understand root cause of environmental issues and means of economic solution

UNIT - I

INTRODUCTION TO ENVIRONMENTAL ECONOMICS

Environmental Economics: environmental policy; Ecological economics; resource economics; positive and normative economics. Important issues in environmental economics.

UNIT - II

ENVIRONMENT AND ECONOMIC DEVELOPMENT

Important issues in the Environment-pollution, depletion of nonrenewable, degradation of natural resources-tragedy of commons, climate change, outbreak of new diseases, degraded ecosystem.

UNIT - III

ENVIRONMENTAL REGULATION

Regulatory approach and economic incentives (USA, European Union, the Russian federation). Choices for Environmental protection and cost-Biocentrism, Anthropocentrism and sustainability.

UNIT - IV

BASIC REGULATORY INSTRUMENTS

incentives. Command & control and Economic instruments of environmental instruments-pollution protection: direct charges. tradable pollution permits, permits V charges, other direct economic instruments; indirect instruments-taxes/charges, price reforms.

UNIT - V

ECONOMIC PLANNING AND SUSTAINABLE DEVELOPMENT

Market, Efficiency and market; Externalities. The Coase theorem: single polluter-Pigovian fees; The multiple polluters - The Equimarginal Principle. Benefit cost analysis. Eco efficiency new technologies-valuing and environmental resources, option value and willingness to pay economic.

Course Outcomes

- 1. The linkage between economic activities and environmental quality.
- 2. Impacts of economic activities on Earth's resources.
- 3. Importance of economic instruments in environmental regulation.
- 4. Significance of environmental protection.

Text Books

 Tom Tietenberg and Lewis (2010). Environmental Economics & Policy, Pearson, 6th Edition,
 Field, B.C and Field, M.K. (2006). Environmental Economics: an introduction.

McGraw-Hill Series

3. Charles D.Kolstad (2004).Environmental economics, new York, oxford university press.

Reference Books

1. Ulaganathan (2001) Environment. Sankar Development and the In: Environmental Economics, Oxford India 333-446 pp. 2. Nayudu, G.S. (2008). Economic planning and sustainable Development. In: Environmental Adhyayan Publishers & Distributers, New Delhi. Economics,

E-Material

1. https://globalisation-and-the-environment.blogspot.com/2007/08/top-10-

environmental-economics-blogs.html

2. http://www.planetarc.com

Skill Based subject - 01

Name of the Course: B.Sc. Environmental ManagementSemester: IIIName of the Paper: Remote Sensing and GISCredits: 2Paper Type: skill based subjectHours of Teaching: 3

REMOTE SENSING AND GIS

Objectives

- To facilitate to gain the basic knowledge of distantly sensing devises.
- To give insight on mapping technology
- To grasp the basic principles and applications of RS &GIS

UNIT - I

Introduction to Remote Sensing process

Key concepts and components of Remote sensing (RS), electromagnetic radiation, spectrum and divisions, image characteristics, RS system, photographic sensors.

UNIT - II

Digital data and image processing

Digital Data, data formats, image structure, processing overview, components, and software, image interpretation mage resolution: variables, operating conditions, measurement of resolution

UNIT - III

Image pre-processing and image classification

Feature extraction, geometric correction, Map projection for representing satellite images and ground truthing, image classification, kinds of field data, measurement of accuracy **UNIT - IV**

GeographicalInformation system (GIS)

Basics of GIS,terminologies,concepts and components for GIS,GIS software, data and data entry, spatial query,thematic map,buffer analysis Mobile GIS, Web based GIS

UNIT - V

Application of RS

RS in Air pollution, natural resources monitoring ,Agriculture, Forest management, watershed management, Natural hazards assessment and Health GIS.

Course Outcomes

Ability to interpret the remotely sensed images Basic knowledge of how can RS &GIS be used for environmental management

Text Books

- 1. Kumar, S. (2016) Basics of Remote Sensing and GIS. Laxmi Publications (P)Ltd.
- 2. Chandra, M. and Ghosh, S.K. (2015). Remote Sensing and Geographic Information (2nd ed.) Narosa Publishing House

- 1. Lillesand ,T.M. and Kiefer, R.W.(2015). Remote Sensing and Image Interpretation (7th ed.).New York, John Wiley &Sons.
- 2. Lillesand ,T.M. ,Kiefer, R.W. Chipman,J.W.(2004). Remote Sensing and Image Interpretation (5th h ed.).New York, John Wiley &Sons.
- 3. Longley, P.A. Goodchild, M.F., Manguire, D.J., Rhino, D.W.(eds) Geographical Information System, Volume I: Principal and Technical Issues, John Wiley & Sons

E- Materials

- 1. https://dayinterpreting.com/?gclid=EAIaIQobChMI1MSCodKo6AIV2BwrCh3OQAOBEAAY AyAAEgLEC_D_BwE
- 2. http://rsgislearn.blogspot.com/2007/06/digitization-basics-and-right-methods.html
- 3. https://www.geospatialworld.net/

Non-Major Elective Paper- 01

Name of the Course: B.Sc. Environmental ManagementSemester: IIIName of the Paper: Global Environmental Issues and ManagementCredits: 2Paper type: Non- Major ElectiveHours of teaching : 2

GLOBAL ENVIRONMENTAL ISSUES AND MANAGEMENT

The purpose of this course is to learn about the major global environmental issues including population explosion, biodiversity loss, pollution, energy use, and climate change and how they are managed around the world.

UNIT I

Human Population and Environment

Basic demographic concepts: Growth, fertility, mortality and migration -Population distribution and Urbanization - Poverty, food security and environmental degradation.

UNIT II

Global Atmospheric Changes

Regional and global Air Quality and CO₂ emission - Air pollutants and climate change -Sources of greenhouse gases - Ozone depleting substances - Global warming - El Niño and La Niña UNIT III

Overexploitation of Natural Resources

Overexploitation of natural resources: Ecological footprint - Earth Overshoot Day - Water resources: Status of groundwater quality in India - Soil Resources: Global threats for soil quality - Loss of organic carbon. Biodiversity Resources: Deforestation, Biodiversity Loss.

UNIT IV

Global Disasters

Geological Disasters: Earthquake, Effects of earthquake; Volcanoes: Types of volcanic eruptions - Active volcanic belts in the world; Hydrological hazards: Flash flood - Flood management strategies - Flood prone zones in India - Flood forecasting and warning - Man-made disasters: Oil spills - Forest fire.

UNIT V

Sustainable Environmental Management

Sustainable utilization of renewable energy resources - Solar, Wind, Hydroelectric and Biomass energy resources. Sustainable agricultural practices: Biofertilizers and Biopesticides -National Action Plan on Climate Change - UNDP Sustainable Development Goals 2030 Agenda

Learning Outcomes

After completing this course, students will be able to:

• Clearly identify important global, national, and local issues relating to population, food, and the environment

- Explain the causes and consequences of the issues identified above.
- Communicate environmental issues in a professional manner.

Text Books

- 1. Frances Harris (2012) Global Environmental Issues, 2nd edition, John Wiley & Sons Ltd., UK.
- Stavros G. Poulopoulos and Vassilis J. Inglezakis (2016) Environment and Development: Basic Principles, Human Activities, and Environmental Implications. Elsevier, Netherlands. References
- 1. Donald Hyndman and David (2005) Hyndman Natural Hazards & Disasters, Cengage Learning, USA.
- 2. John V. Walther (2014) Earth's Natural Resources, Jones & Bartlett Learning, USA.
- 3. Prasad Modak (2018) Environmental Management towards Sustainability, CRC Press, FL, USA.
- 4. Prasenjit Mondal and Ajay K. Dalai (2017) Sustainable Utilization of Natural Resources, CRC Press, FL, USA.
- 5. Rajeev Pratap Singh, Anita Singh, Vaibhav Srivastava (2017) Environmental Issues Surrounding Human Overpopulation, IGI Global, USA.
- 6. Raveendranathan D (2018) Development lead to Pollution and Depletion of Natural Resources, Notion Press, Chennai.
- 7. Serge Morand, Claire Lajaunie, Rojchai Satrawaha (2017) Biodiversity Conservation in Southeast Asia: Challenges in a Changing Environment, Earthscan from Routledge, UK.
- 8. Thangavel P and Sridevi G (2015) Environmental Sustainability: Role of Green Technologies, Springer, India.

Web References

- 1. https://www.stateofglobalair.org/sites/default/files/soga-2018-report.pdf
- 2. www.who.int/airpollution/
- 3. https://unfccc.int/
- 4. re.indiaenvironmentportal.org.in/files/part%20II%20groundwater%20CPCB.pdf
- 5. https://www.footprintnetwork.org/our-work/earth-overshoot-day
- 6. https://www.elsevier.com/_data/assets/pdf.../ElsevierDisasterScienceReport-PDF.pdf
- 7. siteresources.worldbank.org/INTDISMGMT/Resources/0821363328.pdf 8.

https://link.springer.com/chapter/10.1007/978-981-10-1866-4_2

- 9. www.ipcc.ch/
- 10. https://climate.nasa.gov/
- 11. https://sdgs.un.org/goals

CORE PRACTICAL PAPER - 2

Name of the course : B.Sc Environmental Managementsemester: I&IIName of the paper : Environmental chemistry & Environmental Microbiologycredits: 1Paper type : core practicalHours of practical : 3

ENVIRONMENTAL CHEMISTRY AND ENVIRONMENTAL MICROBIOLOGY

EXPERIMENTS

1. Estimation of chlorophyll on Normal and pollutant affected leaves .

- 2 .Estimation of LC50 and LD50 with a heavy metal using a suitable organism .
- **3**.Estimation of Afla toxin production .
- 4. Biomagnification of pesticides.
- **5** .Impacts of Toxins of plants.
- 6. Biochemical effects of lead & cadmium
- 7. Preparation of culture media for microorganism
- 8 .Gram staining of Bacteria
- 9. Isolation of microorganism from the soil .

10.Enumeration of Microbes from sewage.

- 11 .Determination of Bacterial growth curve
- 12.Biodegradation of an organic pollutant.

CORE PAPER - 6

Name of the Course:B.Sc. Environmental ManagementSemester:IVName of the Paper:EnvironmentalPollution andCredits: 4Control MeasuresPaper Type:CoreHours of Teaching: 6

ENVIRONMENTAL POLLUTION AND CONTROL MEASURES

Course Objectives

1.To learn about major air pollutants and their sources and control methods

2. To study about water pollutant and control measures

3. To study about soil pollution and soil remediation.

4. To understand the noise pollution and its control measures

5. To know about thermal and radioactive pollution and their effects

UNIT - I

AIR POLLUTION & CONTROL

Natural & Anthropogenic Sources of Air Pollution. Primary Pollutants - Hydrocarbon. CO, SO2, Lead, Aerosols - Secondary Pollutants- PAN, Photochemical Smog and Ozone, Acid Rain - Greenhouse Effect - Global Warming - Ozone Depletion. Air Pollution Control & Management- Ambient air Quality Standards of CPCB.

UNIT - II

WATER POLLUTION

Physical, Chemical & Biological Characteristics of Waste Water - Water Pollutants - Sources & Effects of Water Pollution - Waterborne Diseases - Eutrophication - Waste Water Treatment - Primary - Secondary - Tertiary - Pollution in River Ganges - River Cleaning -Namami Gange Programme.

UNIT - III

SOIL POLLUTION

Soil Pollutants- Biodegradable- Non-Biodegradable-Causes of Soil Pollution- Impacts of Soil Pollution- Pesticides in Soil Environment and their Effects - Soil Degradation-Need for Soil Conservation and Restoration of Soil Fertility- Control of Soil Pollution. UNIT - IV

NOISE POLLUTION

Natural and Manmade Sources of Noise Pollution - Types of Noise - Industrial Noise - Transport Noise - Neighborhood Noise- Effects of Noise Pollution on Human Health - Working Efficiency. Physical & Mental Health - Noise Exposure Levels and Standards- Noise Pollution Control and Abatement Measures.

UNIT - V

THERMAL AND RADIOACTIVE POLLUTION

Thermal Pollution: Definition - Sources - Chemical and Biological Effects - Thermal Pollution from Power Plants and their Control Measures - Radioactive Pollution: Definition, Sources, Radioactive Decay, Units of Radioactivity and Radiation Dose - Effects of Radiation on Environment.

Course outcomes:

- 1. After studied Unit I, the students will be able to understand and explain the air pollution, sources, and control methods.
- 2. After studied Unit II, the students will be able to understand and analyze the impact of water pollution on environment, and explain the treatment of waste water.
- 3. After studied Unit III, the students will be able to recognize the sources of soil pollution, soil degradation, and realize restoration of soil fertility.
- 4. After studied Unit IV, the students will be able to understand Noise pollution & their impact on human health & take steps to reduce noise pollution.
- 5. After studied Unit V, the students will be able to gain knowledge about thermal and radioactive pollution and take precaution measures.

Text Books

- 1. B.K.Sharma & H. Kaur, 1999, Air pollution, Goel Publishing House, Meerut. 2. V. P. Kudesia, 1985, water pollution, Pragati Prakashan, Meerut.
- 3. S. S. Dara, 2001, Environmental Chemistry & Pollution control, S.chand & company, Ramnagar, New Delhi.

4. De. A. K, Environmental Chemistry, Wiley Eastern Ltd, New Delhi.

5. S. A. Abbasi, 1998, Environmental & its control, Congent publication(p) Limited, New Delhi

Reference

- 1. Bhatia H. S, 1998, Environmental Pollution & its control, Golgotia publications (p) limited, New Delhi.
- 2. Khopkar, S. M, 1993, Environmental pollution Analysis, Wiley Eastern limited, New York.
- 3. Down to earth, center for science & Environment.
- 4. Rao M. N & H. V. N. Rao, 1989, Air pollution, Tata Mc Graw Hill publishing co ltd, New Delhi.

E-MATERIALS

1.https://www.nrdc.org.

2.https://www.epa.gov.

- 3.https://data.gov.in.
- 4.https://orfonline.org.
- 5. <u>https://www.ncbi.nim.nih.govpmc</u>

CORE PAPER - 7

Name Manage	of emen	the t	Course:	B.Sc.	. Environm	ental Management	Semester: Credits: 4		IV
Name	of tl	ne l	Paper: Pollu Tech	tion nique	Monitoring s	and Analytical	Hours Teaching:	5	of

Paper Type: Core

POLLUTION MONITORING AND ANALYTICAL TECHNIQUES

Course Objectives

- 1. To impart knowledge about pollution monitoring methods
- 2. To learn about the water and wastewater quality analytical methods
- 3. To study the soil quality parameters and analytical methods
- 4. To learn the air sample collection and quality analyses methods
- 5. To understand the principles and methods of analytic instruments

UNIT - I

INTRODUCTION TO POLLUTION MONITORING

Environmental Quality - Definition - Pollution Monitoring - Water Sampling
Collection of Water Samples - Handling and Preservation - Analytical Devices
Methods for Sampling Particulates and Gaseous Emission - Measurement of Noise
National Environmental Standards.

UNIT - II

WATER QUALITY ANALYSIS

Physical Parameters - Colour - Temperature - Turbidity. Chemical ParameterspH- Electrical Conductivity - Total Solids - Dissolved Oxygen - Total Alkalinity - Iron - Nitrate - Biochemical Oxygen Demand - Chemical Oxygen Demand. Biological Parameters - MPN (Most Probable Number) and MFT (Membrane Filter Techniques) - SPC (Standard Plate Count) - National Water and Water Quality Standards.

UNIT - III

SOIL QUALITY ANALYSIS

Collection of Soil Samples - Physico-Chemical Analysis of Soil - Density - Specific gravity - Texture - pH - Electrical Conductivity - Chlorides - Nitrate - Phosphate - Organic matter - Standard Soil Quality Standards.

UNIT – IV

AIR QUALITY ANALYSIS

Environmental Standards - Ambient Air Quality Standards - Drinking Water Quality Standards - Effluent Standards for Land Disposal - Disposal on Inland Water-Noise Level Standards.

UNIT - V

POLLUTION ANALYTICAL EQUIPMENTS

Colorimetric - pH meter- Electrical Conductivity Meter - Nephlometer - High Pressure Liquid Chromatography (HPLC) - Gas Chromatography with Mass Spectroscopy - Flame Atomic Absorption Spectrometry - Chemiluminiscence - Bioluminescence Test - Sound Level Meter - X-ray Diffraction.

Course Outcomes

- 1. After studied Unit I, the students will be able to understand the air, water, soil sample collection methods for pollution monitoring.
- 2. After studied Unit II, the students will be able to understand and analyze the water quality parameters and methods of analysis.
- 3. After studied Unit III, the students will be able to handle the quality analysis and determine polluted soil.
- 4. After studied Unit IV, the students will be able to understand air sampling methods and analysis of air pollution methods.
- 5. After studied Unit V, the students will be able to gain knowledge about thermal and radioactive pollution and take precaution measures.

Text Books

- 1. Krishnan Kannan, K., 1997. Fundamentals of Environmental Pollution, S. Chand Company, New Delhi.
- 2. Murali Krishna, K.V.S.G. (2015) Air Pollution and Control, University Science Press.
- 3. Goel, P.K. (2006) Water Pollution Causes, Effects and Control, New Age International Publishers.

Reference Books

- 1. Dara, S.S., 2000. A text book of environmental chemistry and pollution control. S. Chand Company, New Delhi.
- 2. Christian GD (2001), Analytical Chemistry, 5th edition, John Wiley and Sons Inc., India
- 3. Wilson, K, Walker, J (2010) Principles and Techniques of Biochemistry and Molecular Biology, 7th edition, Cambridge University Press.

CORE PAPER - 8

Name of the Course:B.Sc.EnvironmentalManagementSemester:IVName of the Paper:Energy and EnvironmentCredits:4PaperType:CoreHours of Teaching:6

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ENERGY AND ENVIRONMENT

Course Objectives

1. To understand the conventional energy resources

2. To understand the sustainable use of energy resources

3. To learn the present energy scenario and the need for energy conservation 4. To explain the concept of alternative energy resources

5. To analyze the environmental aspects of renewable energy resources UNIT - I

ENERGY SOURCES

Introduction to Nexus between Energy, Environment and Sustainable Development; Energy transformation from source to services; Energy sources, sun as the source of energy; biological processes - photosynthesis - Classification of energy sources - Conventional, Non-conventional energy Resources - Fossil fuel reserves - estimates, duration; theory of renewability, renewable resources.

UNIT - II

NON-RENEWABLE ENERGY SOURCES

First and second laws of thermodynamics - Energy Conversion - Global Energy Crisis - Non- Renewable Energy Sources: Fossil fuels - Composition and Classification of coal, Crude Oil and Natural Gas - Consumption and Demands of Coal, Crude Oil and natural gas - Environmental Impacts of Fossil Fuel Consumption - Atomic energy sources.

UNIT - III

ENVIRONMENTAL EFFECTS OF NON-RENEWABLE ENERGY SOURCES

Environmental Pollution from Energy Sources - Causes and Effects - Air Pollution, Water Pollution, Solid, Soil/land Pollution, Noise Pollution, Radioactive Pollution and Thermal Pollution.

UNIT-IV

RENEWABLE ENERGY SOURCES

Alternative Energy Sources - Solar Energy, Geothermal, Tidal, Wind Energy, Hydro-Electric Power - Ocean Thermal Energy Conversion - Biomass Energy Resources - Types of biomass Energy - Physicochemical characteristics of biomass as Fuel - Biomass conversion routes - Biomethanation, Biofuels, Biohydrogen, and Bioelectricity.

UNIT - V

RENEWABLE ENERGY AND SUSTAINABLE DEVELOPMENT

Renewable energy services and their implications for sustainable development -Economy - Environmental - Human Health - Energy and Economy - Emission Reduction - International Conventions on Energy and Sustainability - United Nations Framework Convention on Climate Change (UNFCC) - UN sustainable Development Goals.

Course Outcome

- 1. After studied Unit I, the students will be able to know the major sources and uses for energy and their advantages and disadvantages.
- 2. After studied Unit II, the students will be able to explain various non-renewable energy sources.
- 3. After studied Unit III, the students will be able to know the impacts of fossil fuels on environment and human health.
- 4. After studied Unit IV, the students will be able to understand and justify the need of renewable energy sources alternative to the fossil fuels.
- 5. After studied Unit V, the students will be able to understand the concept of renewable energy and sustainable development.

Text Books

- 1. Boyle GF (2004) Renewable Energy Power for a Sustainable Future, Second edition, Oxford University Press, UK.
- 2. Dhupper, R. (2015) Textbook on Energy Resources and Management. CBS Publication.

Reference Books

- 1. Robert A. Ristinen, Jack J. Kraushaar (2015) Energy and the Environment, 3rd Edition. Wiley Publications.
- 2. Kothari, D.P., Singal, K.C., Rnajan, R. (2011) Renewable Energy Sources and Emerging Technologies, Prentice Hall India Learning Private Limited.
- 3. John Andrews and Nick Jelly (2007) Energy Science: Principle, Technologies, and Impacts Oxford University Press, UK.

E-Materials

- 1.http://www.indiaenvironmentportal.org.in
- 2.http://www.cpcb.nic.in
- 3. http://www.gpcb.gov.in

ALLIED PAPER - 4

Name of the Course:B.Sc. Environmental ManagementSemester:IVName of the Paper:Environmentand EcotourismCredits:5Paper Type:Allied-2Hours of Teaching:5

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ENVIRONMENT AND ECOTOURISM

Course Objectives

1. To understand the ill effects of tourism on environment

- 2. To give insight on ecological tourism
- 3. To highlight the areas of employment opportunities in ecotourism
- 4. To evoke ecological tourism

UNIT - I

INTRODUCTION TO TOURISM

Tourism: Meaning, etymology, history, types of tourism in India, Socio, Economic and environmental benefits and drawbacks of tourism industry in India and need for ecofriendly tourism

UNIT - II

ECOTOURISM

Ecotourism: definition, history, principles (as per World Wide Fund for Nature), elements and goals, importance of ecotourism, positive impact of eco development projects on ecotourism

UNIT - III

RESOURCES FOR ECOTOURISM

Biosphere reserves, national parks, sanctuaries, wetlands, coastal and freshwater, mangroves, coral reefs, deserts, mountains and forests including unique flora and fauna.

UNIT - IV

ECOTOURISM PLACES IN INDIA

Major Ecotourism places in India: Kerala, Sunderban, Goa, Himalayas, Andaman, Coorg, Sikim, Shimla, Kodaikanal, States promoting ecotourism in India

UNIT - V

PROMOTION OF ECOTOURISM

Eco-Tourism in India: Some Major Issues and challenges India's initiatives National Eco-Tourism Policy and Guidelines of the Ministry of Tourism, Government of India Nature Conservation Foundation, Centre for Responsible Travel (CREST), Equitable Tourism Options (EQUATIONS), responsible travel awards

SKILL BASED SUBJECT-2

Semester: IV Name of the Course: B.Sc. Environmental Management Name of the Paper: Aquaculture and Environment Credits: 2 Paper Type: Skill Based Hours of Teaching: 3

..... **AQUACULTURE AND ENVIRONMENT**

UNIT I

Culture System - Fresh Water - Brackish Water - Extensive - Intensive - Semi Intensive - Pokkali - Cage - Pen Culture - Mono - Monosex - Poly - Paddy cum Fish -Fish cum Poultry - Fish cum Dairy Fish cum Pig - Fish cum Duck - Fish Ponds -Breeding - Nursery - Rearing - Stocking - Dry and Wet Bunth - Construction and Maintenance of Fish Farm.

UNIT II

Induced Breeding - Hypophysation - Definition - Principles Hypophysation -Procedure of Hypophysation - Collection - Preparation - Injection - Mechanism of Pituitary Action - Advantages of Hypophysation - Seed Collection - Collection from Natural Habitat – Bundh Breeding – Hypophysation – Transport of Fish Seed – Open System – Closed System.

UNIT III

Preservation of Fishes - Fish Spoilage - Chemical Action - Autolysis - Microbial Action - Principles of Fish Preservation - Cleaning - Low Temperature - High Temperature – Dehydration – Salts – Methods of Preservation – Curing – Drying – Freezing - Fish diseases - White Spot Diseases - Costiasis - Whirling Diseases - Knot Diseases - Gill Rot - Pin Head - Rickets - Causes - Symptoms - Treatment.

UNIT IV

Pearl culture-Definition-Types-Composition of pearl-Pearl producing animals-Cultivable species-Biology of pearl oysters-Pearl formation-Culture of pearls-Fresh water pearl culture.

UNIT V

Sewage fed fish culture- Definition- Harmful effects of sewage-Beneficial effects of sewage- Sewage treatment for fish culture- suitable fishes for sewage fed fish culture-Production in sewage fed fish culture.

REFERENCE

1. Jhingaran, C.G. 1981. Fish and Fisheries of India, Hindustan Publishing Corporation.

2. Pillay, T.V.R. 1990. Aquaculture. Principles and Practices. Blackwell Publishing, Oxford.

3. Srinivasalu Reddy, M. and K.R.S SambasivaRao. 2004. A Textbook of Aqua Culture. Discovery Publishing House, NewDelhi.

4. Talwar, P.K. and Jhingaram, A.G. 1991. Inland Fisheries of India and adjacent countries, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

5. N. Arumugam. 2008. Aquaculture, Saras Publications, Nagercoil, Tamilnadu

NON-MAJOR ELECTIVEPAPER – 2

Name of the course : B.Sc Environmental Management Name of the paper : occupational safety health and management Paper type : Non major elective . semester : IV credits : 2 Hours of teaching : 2

OCCUPATIONAL SAFETY HEALTH AND MANAGEMENT

UNIT-I

Occupational Hazards- Types of Occupational Hazards – Health – Definition – Need for Good Health – Factors Affecting Health – Malnutrition – Deficiency Diseases-Balanced diet-Food adulterants-Personal Hygiene.

UNIT II

Health problems due to Air and Water Pollution - Communicable Disease - Mode of transmission (Epidemic and Endemic diseases)-Water borne - Air borne - Food borne Diseases.

UNIT III

Occupational health hazards-Physical-Chemical and Biological hazards-Occupational diseases – Silicosis - Asbestosis - Byssinosis-Hearing loss-Prevention and Control of Occupational diseases.

UNIT IV

Industrial safety standards- Causes of Accidents-Definition-Accident Reporting System - First aid – Frequency rate-Prevention and Control-Health education-Safety awareness.

UNIT V

3

Environmental Management System (EMS)-ISO14000 and ISO14001-OSHA-The Public Liability Insurance Rules, 1991. Compensation Act.

REFERENCE

1. Scoot, R, M, 1997 concepts of industrial hygine, lewis publisher, New York.

2. Diberardins L.J., 1998. Hand Book of Occupational safety and health, john Willey, New York.

3. Park J.E, and Park Preventive and social medicine.

4. Schilling R.S.E 1973. Occupational health practices, Buffer Worth, London,

5. Gurjar, B.R., Molina, L.T. & Ojha C.S.P. 2010. Air Pollution: Health and

Environmental Impacts. CRC Press, Taylor & Francis.

CORE PRACTICAL PAPER -3

Name of the course : B.Sc Environmental Management Name of the paper : core practical -3 Paper type : core Practical .

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semester : IV credits : 3 Hours of practical : 3

ENERGY AND ENVIRONMENT

EXPERIMENTS

Estimation of Total solids and Dissolved solids
 Estimation of Turbidity
 Estimation of chloride
 Estimation of Dissolved Oxygen .
 Estimation of Total Alkalinity .
 Estimation of Total Hardness
 Estimation of phosphate .
 Pollution Indicators
 Demonstration of pH and conductivity meter
 Demonstration of AAS .

11.Demonstration of Noise level meter.

12.Demonstration of Renewable Energy Sources.

CORE PAPER - 09

Name of the Course:B.Sc EnvironmentalManagementSemester:VName of the Paper:Waste Management and RecyclingCredits:5Credits:5Paper Type:CoreHours of Teaching:6

WASTE MANAGEMENT AND RECYCLING

Course Objectives

1. To learn about different types of solid wastes and their problems

2. To impart knowledge about solid waste collection and disposal

3. To learn the processes of solid waste treatment and recycling

4. To study about the hazardous waste and management

5. To learn about biomedical waste and handling.

UNIT - I

MUNICIPAL SOLID WASTE

Definition of Solid Waste - Types and sources of solid waste -Domestic, Municipal, Agricultural, Industrial, and Mining - Physico- Chemical Characteristics of Solid Waste - Solid Waste Generation - Problem and Impact of Municipal Solid Waste - Methane Gas Emission due to MSW.

UNIT - II

SOLID WASTE COLLECTION AND DISPOSAL

Disposal of Solid Waste - Collection Process of Collection - Segregation of Waste - The Role of Rag Pickers - Biodegradable - Non-biodegradable - Reusable -Recyclable- Non-Recyclable-Combustible- Noncombustible-Hazardous- Solid Waste Management (SWM) Rules, 2016 - Swachh Bharat Abhiyan.

UNIT - III

WASTE PROCESSING AND RECYCLING

Solid Waste Processing Technologies - Recycling, Recovery of Materials for Recycling - Open Dumping - Incineration - Types of Incinerators - Waste to Energy - Sewage Sludge Onsite Incinerators – Pyrolysis - Landfill-Landfill Regulation-Emission ,Leachate and Monitoring - Composting-Aerobic Composting -Anaerobic Composting - VermiComposting.

UNIT - IV

HAZARDOUS WASTE

'Hazardous Waste- Definition, Types, Characteristics and Health Impacts, Waste Dumping Site, Storage, Transport - Handling of Wastes- Packing, Labelling and Transport, Disposal - Import and Export of Hazardous Waste, Treatment Meth - Neutralization, Oxidation Reduction Precipitation, Solidification, Stabilization, Incineration and Final Disposal. Hazardous Waste (management and handling) Rule 2016.

UNIT - V

BIOMEDICAL WASTE

Biomedical Waste: Definition - Collection, Packing, Transportation and Storage - Categories of Biomedical waste - Colour Coding and Types of Container for Disposal of Biomedical Waste (Management and Handling) Rule 2020.

Course Outcomes

- 1. After studied Unit I, the students will be able to understand the different types of solid wastes and their sources and characteristics.
- 2. After studied Unit II the students will be able to recognize different types of waste collection, transport method and follow proper disposal method.
- 3. After studied Unit III, the students will be able to explain various waste recycling methods.
- 4. After studied Unit IV the students will be able to distinguish hazardous wastes and
- 5. After studied Unit V, the students will be able to gain knowledge about thermal and radioactive pollution and take precaution measures. **Text Books**
- 1. Kinnaman, T.C and Takeuchi, K. (2014). Handbook on Waste Management, Edward Elgar Publishing, UK.
- 2. Ramesha Chandrappa and Jeff Brown, (2012). Solid Waste Management: Principles and Practice, Springer Science and Business Media Publishers. Reference Books

1. Asnani, P. U. 2006. Solid waste management. India Infrastructure Report 570.

2. Bagchi, A. 2004. Design of Landfills and Integrated Solid Waste Management. John Wiley & Sons.

- 3. Blackman, W.C. 2001. Basic Hazardous Waste Management. CRC Press.
- 4. McDougall, F. R., White, P. R., Franke, M. & Hindle, P. 2008. Integrated Solid Waste Management: A Life Cycle Inventory. John Wiley & Sons.

5. US EPA. 1999. Guide for Industrial Waste Management. Washington D.C.

E-Material

1.http://mohua.gov.in/upload/uploadfiles/files/Part2.pdf

2.https://globalrec.org/wp-content/uploads/2014/03/Hazardous-Wastes-ManagementandHandling-Rules-1989.pdf

3.http://www.hp.gov.in/dhsrhp/pdf/Biomedical_waste.pdf

4.http://www.cpeo.org/techtree/ttdescript/pyrols.html

5.www.satavic.org/vermicomposting.html

6.http://web.mit.edu/urbanupgrading/urbanenvironment/sectors/solid-waste-landfills.html

 $7.www.cement.org/waste/wt_apps_radioactive.asp$

8. www.ipma.co.in/recycle.asp

CORE PAPER - 10

Name of the Course:B.Sc.EnvironmentalManagementSemester:VName of the Paper:Environmental Safety, Health and managementCredits:5Paper Type:CoreHours of Teaching:6

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Environmental Safety, Health and management

Course Objectives

- 1. To know the concept and importance of environmental safety and health
- 2. To study and understand about communicable diseases
- 3. To understand the occupational diseases and their causes
- 4. To know the safety measures to be taken at occupation sites
- 5. To impart knowledge on environment management system

UNIT - I

ENVIRONMENTAL HEALTH

Environmental Health- Concept and Scope -Need for good health -Factors affecting health-Malnutrition-Deficiency diseases-Kwashiorkor-Marasmus - Balanced diet-Food adulterants.

UNIT - II

PUBLIC HEALTH

Public Health - Communicable diseases - Mode of transmission (Epidemic and Endemic diseases) Bacterial diseases - Tuberculosis - Typhoid-Filariasis -Viral diseases-Hepatitis - AIDS - Rabies - Waterborne and Airborne diseases.

UNIT - III

OCCUPATIONAL HAZARDS

Occupational Health Hazard - Concepts and Scope - Occupational Hazard -Physical- Chemical and Biological hazards - Occupational Diseases - Pneumoconiosis - Silicosis - Anthracosis - Byssinosis - Farmer's lungs - Lead poisoning-Skin Diseases-Prevention and Control of Occupational Diseases.

UNIT - IV

OCCUPATIONAL SAFETY

Industrial Safety and Management Techniques - Accidents - Causes - First aid - Prevention and Control - Risk analysis and assessment - Health education - Safety Measures in Industry.

UNIT - V

ENVIRONMENT MANAGEMENT SYSTEM

Environmental Management System (EMS) - ISO 14000 and ISO 14001- Compensation Act-Public Liability Insurance Act - Health Organization

- NIOH (National Institute of Occupational Health) AIHPH (All India Institute of Hygiene and Public Health) NHO (National Health Organization) WTO (World Trade Organization) OSHA (Occupational Safety and Health Administration) - Standards.

Course Outcome

- 1. After studied Unit I, the students will be able to understand the concept and scope of Environmental Health.
- 2. After studied Unit II, the students will be able to recognize different types of public health issues.
- 3. After studied Unit III, the students will be able to undemand occupational health hazards, and take steps to control measures.
- 4. After studied Unit IV, the students will be able to identify the suitable safety measures to prevent industrial occupational hazards.
- 5. After studied Unit V, the students will be able to utilize the environmental management system.

Text Books

- 1. Shaw, J. Chadwick (1998) Principles of Environmental Toxicology, Taylor& Francis Ltd.
- 2. Annalee Yassi, Tord Kjellstr"om, Theo de Kok, Tee Guidotti (2001). Basic Environmental Health, Oxford University Press.

Reference Books

1. Scoot, R, M, (1997) concepts of industrial hygine, lewis publisher, New York.

2. Diberardins L.J., (1998). Hand Book of Occupational safety and health, john Willey, New York.

3. Park J.E, and Park Preventive and social medicine.

4. Schilling R.S.E (1973). Occupational health practices, Buffer Worth, London,

5. Gurjar, B.R., Molina, L.T., Ojha C.S.P. (2010). Air Pollution: Health and Environmental Impacts. CRC Press, Taylor & Francis.

6. Monroe T. Morgan (2003) Environmental Health, Third Edition, Thomson/Wadsworth Publishers.

7. Koren, H. (2002). Handbook of Environmental Health and Safety - Principle and Practices, Fourth Edition, Lewis Publishers, CRC Press.

E-Material

1.https://dgfasli.gov.in/sites/default/files/service_file/Nat-OSH-India-Draft%281%29.pdf 2.www.ehs.ucsb.edu/

3.http://safety.ucanr.edu/Safety_Notes/

4.https://doresearch.stanford.edu/policies/research-policy-handbook/environmental-health-andsafety/health-and-safety-principles

5.https://www.cdc.gov/niosh/docs/98145/pdfs/98145.pdf?id=10.26616/NIOSHPUB98145 6.https://www.gooduniversitiesguide.com.au/careers-guide/occupational-health-and-safety-officer

7.https://doresearch.stanford.edu/policies/research-policy-handbook/environmental-health-andsafety/health-and-safety-principles

CORE PAPER - 11

Name of the Course: B.Sc. Environmental Management Name of the Paper: Biostatistics and Instrumentation Paper Type: Core Semester: V Credits: 5 Hours of Teaching: 6

BIOSTATISTICS AND INSTRUMENTATION

Course Objectives

1. To help students understand the basic concept about computer and computer Programmes, hardware and softwares.

2. To impart knowledge on statistical data analysis with context of environmental studies.

3. To apply Biostatistical tools in environmental problems.

UNIT - I

BASICS OF COMPUTER

Introduction and Basic Concepts of Computer, Parts of Computer, Types of Computer Number System. Computer Organization, Software, Computer Virus Language and its Application.

UNIT - II

BASIC COMPUTER PROGRAMMES

Basic principles of a digital computer. Compression of hardware and software. Computer operating systems - WINDOWS - MS Word, Excel- power point. Network- Internet, World Wide Web, Search Engines, E- mail. Applications of Computer in Environmental Science; use of Computer in Environmental Modelling.

UNIT - III

DATA AND DATA COLLECTION

Data - Methods of Collection - Classification - Tabulation - Types of tables. Diagrammatic and Graphical representation.

UNIT - IV

DATA ANALYSIS

Measures of Central Tendency - Calculation of Mean, Median and Mode, Moments, Skewness and Kurtosis. Measures of Dispersion - Range and Deviation, Mean Deviation, Standard Deviation and Standard Error. UNIT - V

MATHEMATICAL MODELLING IN ENVIRONMENT

Mathematical Ecology - Classification of Mathematical Modelling - Process of Modelling Population Growth Model - Population Interaction -Lotka and Voltera Prey Predator System, Point Source Stream Pollution Model, Box Model Energy Flow in Multi Ecosystem.

Course Outcome

- 1. After studied Unit I, the students will be able to learn the function of computers, hardware's and softwares.
- 2. After studied Unit II, the students will be able to get computer operation skills and document processing.
- 3. After studied Unit III, the students will be able to distinguish the data types and collect the data.
- 4. After studied Unit IV, the students will be able to analyze the data through various statistical methods.
- 5. After studied Unit V, the students will be able to apply the statistical modeling to environment and ecosystem studies.

Text Books

- 1. Palanisamy. M (1989) A Text book of statistics, paramount publication, palani.
- 2. Vittal, R.R(1986) Business Mathematics and Statistics, Murugan Publications.
- 3. Sanjay saxena (2003) A First Course in computers, Vikas publishing house Pvt. Ltd, New Delhi

Reference Books

- 1. Arumugam. N. (2015) Basic concepts of Biostatistics, Saras Publication.
- 2. Gurumani. N. (2010) An Introduction to Biostatistics, M. J. Publishers.
- 3. Marden, M. P. (2011) Research Methods for Science I Edition.
- 4. McKillup, S. (2006) Statistics Explained. An Introductory Guide for Life Scientists.
- 5. Cambridge University Press, Cambridge, UK.
- 6. Zar, J. H. (1998) Biostatistical Analysis. Prentice Hall, N.J.

E-Material

1.www.stat.cmu.edu/~brian/701/notes/paper-structure.pdf

- 2.www.cengage.com/resource_uploads/downloads/1133629601_397200.pdf
- 3. https://www.scribd.com/document/.../Statistical-Analysis-of-Data-with-report-writing

MAJOR ELECTIVE PAPER -01

Name of the course : B.Sc. Environmental Management	semester : V
Name of the paper : Principles of Sustainable Development	
and Management	credits :3
Paper type : Major Elective	Hours of teaching : 6

PRINCIPLES OF SUSTAINABLE DEVELOPMENT AND MANAGEMENT UNIT – I

Function of Management – Planning Organizing and Controlling, Systems approach to Management, Patterns of Analysis, Economic, Social Political and Ethical factors affecting Management practice.

Unit – II

Steps in the Planning Process Management.By objectives, Programme Budgeting, Capital budgeting, Economic Analysis – Marginal Analysis, Benefit / Cost Analysis etc. Decision Analysis – Risk and Uncertainty decision tress, Strategy and Policy Analysis, Limitation of Planning.

Unit – III

Organizational Structure, Formal and Informal Organization, Line and Staff relations, relations with the public, Principles of delegation, Performance appraisal motivation, Communication and leadership aspect, Theories of Organization.

Unit – IV

Green buildings – History of Green buildings – Need and Relevance of Green buildings – Associated cost and benefits –Outlined examples of Green buildings – LEED certified building - Eco mark certification – Establishment of Eco mark in India, Its importance and implementation.

Unit – V

Public transportation for Sustainable development – Green belts – Introduction to UNEP's – Green Economy Initiative, inclusive Economic growth of the society – REDD+ initiative and cap and trade concept – Green banking – Setting environmental goals, resource mobilization use of Natural resource and Environmental indicators, Output budgeting, Monitoring and Evaluating Environmental Programme.

REFERENCE

1. Sharma ,R.D.(1976), Organizational Management, Light and life publishers, New Delhi

2. Chakraborthy. S.K (1976) Management by objection Macmillan Co .of India Ltd, New Delhi

3. Varma and Agarwal, theory & practice of Management Forward Book Depot, New Delhi.

4. Anastas, P.T. & Warner, J.C. 1998. Green Chemistry: Theory & Practice. Oxford University Press.

5. Arceivala, S.L. 2014. Green Technologies: For a Better Future. Mc-Graw

SKILL BASED SUBJECT PAPER -3

Name of the course : B.Sc Environmental management Name of paper :Forest conservation & management Paper type: skill based subject semester : V credits : 2 hours of teaching : 3

FOREST CONSERVATION AND MANAGEMENT

UNIT 1

Forest-Types-Moist Deciduous-Dry Deciduous-Evergreen – Semi green- Grassland- Thorny Forest - mangrove forest -utilization of forest products-Timber, firewood, pulp, fodder and medicinal plants.

UNIT II

Sacred groves-Values- Scared groves in Tamil Nadu - Shrines of symbols-Character of deities-festivals-Beliefs, Taboos associated with sacred groves-key stone species-ethical dilemma in sacred groves-conservation.

UNIT III

Forest movement-and Peoples participation - Tribal community symbiotic relationship between tribal and Forest, community participation - Chipko movement, Apiko movement. India's bishnoi community and their conservation practices.

UNIT IV

Social forestry, Afforestation, Ecological significance of Forests, plant indicators, Forests as carbon sinks.

UNIT V

Forest conservation-Protection from fire, Prevention of Fire, Protection from wild animals-Raise of awareness, through tourism, Role of government in forest conservation, Forest conservation ACT 1980.

REFERENCE

1. Kormondy, E.J. 2005. Concepts of Ecology. Prentice hall of India Pvt Ltd. New Delhi

2. Calrke, G.L.1954. Elements ecology, John Wiley and Sons, New York.

3. Champman, R.N.1928. The Quantitative analysis of environmental factors Ecology 9:111-122

4. Champion H.G &seth, 1965 A revised Survey of the forest types of India, Manager of publishers New Delhi.

5. S. Karthikeyan and A.C. Thangavelou 2011. Journey through Sacred Grooves. Bio-Science Research Foundation, Pondicherry, India.

CORE PRACTICAL PAPER -4

Name of the course : B.Sc . Environmental Mana	agement	semester : V
Name of the paper : Biostatistics & Instrumentat	tion and	
Waste Management		
Paper type: core practical	Hours	of practical : 3

BIOSTATISTICS & INSTRUMENTATION AND WASTE MANAGEMENT EXPERIMENTS

- 1. Identification of Different Types of Solid wastes
- 2 .Segregation of Municipal Waste .
- **3**.Demonstration of waste collection methods
- 4. Demonstration of waste disposal- land fill
- 5. Characterization of land fill leachate
- 6. Demonstration of waste recycling methods
- 7. Preparation of vermicompost kitchen waste
- 8 .Computing Mean, Median and Mode in MS –Excel
- 9. Computing Mean Deviaion and standard deviation using MS-Excel.
- 10 .Creation of pie chart and bar chart in MS-Excel
- 11. Demonstration of occupational health issues
- 12. Demonstration of first aid procedures

COREPAPER-12

Name of the Course:B.Sc.Environmental ManagementSemester:VIName of the Paper:Natural Hazard and Disaster ManagementCredits:4Paper Type: CoreHours Of Teaching:6

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NATURAL HAZARD AND DISASTER MANAGEMENT

Objectives

To know about the natural and anthropogenic hazards, their impacts on environment & mitigation strategies and to train the people for their preparedness to face disaster.

UNIT- I

NATURAL HAZARDS

Natural Hazards-Types of Natural Hazards- Hydrological- Atmospheric- Geological Hazard-Earthquake- Causes, Impacts on Environment- Control Measures- Tsunami- Cyclones -Landslides-Causes, Impacts on Environment- Preventive Measures.

UNIT- II

ANTHROPOGENIC HAZARDS

Anthropogenic Hazards- Impacts of Anthropogenic Activities – Rapid Urbanization –Injudious Ground water Extraction –Sand Mining From River Bank -Deforestation -Mangroves Destruction- Warfare- Chemical Weapons -Biological Weapons -Major Accidents From Industries-Lov Canal Disaster-London Smog-Chernobyl Accident-Bhopal Gas Tragedy.

UNIT-III

DISASTER

Disaster- Definition of Hazard ,Natural, Technological Hazard, Concept of Risk & Vulnerability –Reasons of Vulnerability- Industrial Accidents –Two Components of Risk-Likelihood And Consequences, Qualitative Likelihood, Measurement Index(LMI)-Categories of Direct Losses, Indirect Losses, Tangible Losses & Intangible Losses-Applications of Geoinformatics in Hazard ,Risks And Vulnerability Assessment.

UNIT- IV

DISASTER MANAGEMENT SYSTEM

Disaster Impacts & Response- Identification of Dead- Search Rescue- Fist Aid- Relief Phase-Vaccination ,Basic Sanitation and Personal Hygiene- Environmental Disaster -Assessment-Planning- Resettlement – Rehabilitation –Role of NGOs And GOs -ReliefCamp-Psychotherapy-Simplified Yoga and Meditation- Stress Management.

UNIT- V

DISASTER MANAGEMENT IN INDIA

Policy For Disaster Reduction –Disaster Management Act 2005 –National Guidelines and Plans on Disaster Management –National Disaster Management Authority (NDMA) –NIDM (National Institute of Disaster Management) – State Disaste Management Authorities-National Disaster Response force.

Course Outcomes

1. The students will be able to differentiate vulnerability, risk & hazard.

2.To gainknowledge about the different types of Natural Disasters.

3. To impart knowledge on anthropogenic hazards & its impacton environment.

4. To know about the national & international agencies, NGOs for major role in disaster management.

5.Knowledge gained will enable the students to volunteer themselves in disaster management programs thus helping affected community.

Text Books

1. Natural hazards, Edwards B(2005), Cambridge University Press, UK.

2. Natural Disaster, Sharma R.K&Sharma G.(2005), A.P.HPublishing Corporation, NewDelhi.

3.Disaster Management: A Disaster Manager's Hand book ,Carter ,N.W .(1992), Asian Development Bank ,Manila.

4.A Manual On Disaster Management, Diwan, P.(2010), Pentagon Earth, NewDelhi. 5.Early Warning Systems For Natural Disaster Reduction, Zschau, Jand Kuppers, N.(2003), Springer-Verlag, Berlin, Heidelberg.

Reference Books

- 1.Natural Hazards & Disaster Management-Vulnerability & mitigation, SinghR.B,(2006), Rawat Publications.
- 2. Disaster Planning: The Preservation of Life & Property ,Foster ,H.D,(1980) ,SpringerVerlay ,NewYork.
- 3. Disaster Management, SinghS.K,S.C .& SinghS (1998) Mittal Publications ,NewDelhi.
- 4.Natural Disaster Reduction ,Mishra G.K&Mathur G.C,(1993), Reliance Publishing House, NewDelhi.

E-Materials

1.https://www.GIS.Development.net

2.https://iirs.nrsa.org

3. https://quake.usgs.gov

CORE PAPER-13

Name of the Course: B.Sc.Environmental Management Name of the Paper: Environmental Impact Assessment Paper Type :Core Hours

Semester: VI Credits:4 Hours of teaching : 5

ENVIRONMENTAL IMPACT ASSESSMENT

Course Objectives:

1.To impart knowledge about Environmental Impact Assessment

2.To identify methods and parameters to be included to EIA

3.To learn about the methods and steps involved in EIA

4. To repot the EIA study report and post EIN management system

5.To access the case studies of major developmental projects

UNIT- I

INTRODUCTION TO EIA

EIA- Introduction – Concept of EIA- Scope and objectives of EIA-EMP-Historical perspectives of EIA –Organization responsible for EIA- Pre-project analysis-Site selection and Area classification –Sitting and Setting Criteria for EIA Projects.

UNIT- II

EIA ASSESSMENT PARAMETERS

Environmental Indicators – Abiotic and Biotic factors – Socio and Economic aspects -Environmental quality- Air, Water, Soil, Flora and Fauna -Field survey anddata collection-Environmental auditing.

UNIT -III

EIA METHODLOGIES

Various Steps of EIA – Content of EIA – Analytical and Integrated Approach Assessment Methodology-Adhoc,Overlay Network ,Matrix and Checklist-Environmental Values and Technique – Cost benefit Analysis –Environmental Clearance.

UNIT- IV

ENVIRONMENTAL IMPACT STATEMENT

Environmenta Impact Statement(EIS) and Environmental Management Plan(EMP) Environmental Management System Standards (ISO14000series). EIA Notification ,2006 and 2020 amendments. Eco-labeling schemes.

UNIT- V

EIA CASE STUDIES

Case Studies for Major Developmental Projects :Hydro electric and Thermal PowerPlants ,Mining ,Highway Roads, Airport, Cement Industries.

Course outcomes

1.After studied UnitI, the students will be able to explain the importance and principles of EIA

processes.

- 2. After studied UnitII, the students will be able to identify and list out the parameter to be evaluated fo rEIA.
- 3. After studied UnitIII, the students will be able to understand follow the methods of EIA .
- 4.After studied UnitIV, the students will be able to summarize the EIA report and appropriate environmental management plan.
- 5.After studied UnitV, the students will be able to access and analyze EIA cases studies report of different developmental projects.

Text Books

1.EIA Manual (2001) Ministry of Environment, Forest and Climate Change ,NewDelhi.

- 2.Barthwal ,R.R. (2012) EnvironmentalImpact Assessment,New Age Internationa Publishers.
- 3.Khandeshwar, S.R.,Raman,N.S. ,Gajbhiye,A.R.(2019) Environmental Impact Assessment ,I.K.International Publishing HousePvt.Ltd.

ReferenceBooks

1.Barrow, C.J.(2000)Social Impact Assessment: An Introduction.Oxford UniversityPress.

- 2.Glasson, J., TheRivel, R., Chadwick, A. (1994) Introduction to Environmental Impact Assessment. London, Research Press, UK.
- 3.Judith, P.(1999) Hand book of Environmental Impact Assessment.Black well Science.
- 4.Marriott,B.(1997) Environmental Impact Assessment:A Practical Guide .McGraw .Hill,NewYork,USA.
- 5. Canter, L.W. (1997) Environmental Impact Assessment. McGraw-Hill, NewYork.
- 6.Peter Wathern(2015) Environmental Impact Assessment: Theory and Practice, Taylor &Francis, London.

E-Materials

1.http://environmentclearance.nic.in/

- $2.http://environmentclearance.nic.in/writereaddata/Draft_EIA_2020.pdf$
- 3.www.fao.org/docrep/V8350E/v8350e06.htm

4.http://www.moef.nic.in/division/eia-manual

5.http://www.moef.nic.in/circulars

6.https://www.adb.org/documents/adb-environmental-assessment-guidelines

7.https://www.iaia.org/eia-index-of-websites.php

8.https://www.csaocean.com/services/environmental-impact-assessment-eia

9. https://www.elaw.org/files/mining-eia-guidebook/Chapter2.pdf

CORE PAPER-14

Name of the Course : B.Sc. Environmental ManagementSemester:VIName of the Paper : Environmental Laws, Policies and TreatiesCredits:4Paper Type :CoreHours of Teaching:5

ENVIRONMENTAL LAWS ,POLICIES AND TREATIES

Course Objectives

To impart knowledge about Environmental Laws, regulations ,policies and treaties of India and International.

UNIT-I

INTRODUCTION TO ENVIRONMENTAL LAW

Fundamental Rights-Evolution and Development of Environment Laws with Reference to Stockholm Conference 1972 – Environmental Legislation – Legal Definition _Article 48A – Article 51G-National Green Tribunal- Environmental Ethics- Principle -Importance.

UNIT-II

LEGISLATION FOR ENVIRONMENTAL PROTECTION

The Wildlife (Protection) Act,1972 – The Water (Prevention and Control of Pollution) Act,1974 -The Air (Prevention and Control of Pollution) Act, 1981-The Environment (Protection) Act, 1986 - The Forest (Conservation) Act, 1980 –The Noise pollution (Regulation and Control) Rules2000-The Biological Diversity Act, 2002-The National Green TribunalAct,2010-Solid Waste(Management and Handling) Rules, 2000 –Biomedical Waste (Management and Handling) Rules1998- Solid Waste Management Act2016.

UNIT-III

RULES FOR ENVIRONMENTAL PROTECTION IN INDIA

Bio-Medical Waste (Management & Handling) Rules,1998; Recycled Plastics Manufacture and Usage Rules, 1999; Noise Pollution (Regulation and Control) Rules,2000 ;Municipal Solid Waste (Management and Handling Rules)2000; The Hazardous Wastes(Management, Handling and Transboundary Movement) Rules,2008; Wetland Rules2009; Coastal Regulation Zones(CRZ)Rules2011;E-waste Management and Handling Rules2011 ;Plastics Manufacture ,Saleand Usage Rules,2011

UNIT-IV

ENVIRONMENTAL POLICY

Definition –Benefits of developing an Environmental Policy- International Agreements-Montreal Protocol 1987 –Kyoto Protocol 1997- Copenhagen –Pairssummits Conventionon Climate Change –Carbon Credit and Carbon Trading .The National Forest Policy,1998-Policy Statement for the Abatement of Pollution 1992.

UNIT-V

ENVIRONMENTAL TREATIES

United Nations Conference of Environment and Development 1992- Rio-de-Janerio (RioDeclaration, Agenda 21) Scheme and Labelling of Environment Friendly Products-Indus Water Treaty- Ganges Water Treaty -Vienna Convention for the Protection of Ozone Layer 1985.

Course Outcomes:

- 1.To know about the constitution of India environmental legislation and Environmental ethics.
- 2. To impart knowledge on legislation for environmental protections.
- 3. To knowabout the National Green Tribunal Act and bio medical waste management rules.
 - 4. To understand about the environmental policies and internationa lagreements.
 - 5.To gain knowledge about environmental treaties.

Text Books

- 1. TNPCB Pollution Control Legislation TNPCB, Vol-1&2, Chennai, 1999.
- 2. Agarwal VK 2005, Environmental Laws in India ,Challenges for Enforcement, Bulletin of The National Institute of Ecology.
- 3.JadhavH&BhosaleY.M,1995 ,Environmental Protection & Laws ,Himalayan Publications ,NewDelhi.
- 4.DiwanS&RosencranzA ,2002 ,Environmental Law and Policy in India ,Cases ,Materials & Statues ,Oxford University Press.

Reference

- 1. Nandithakrishna, Environmental Laws of India-AIntroduction , C.P.R. environmental Education Center, Chennai, 1998.
- 2.Center for Science & Environment, The State of India's environment, The Second Citizen, Report, C.S.E NewDelhi, 2018.
- 3. Abraham, C.M, 1999, Environmental juris prudence in India, Kluwer Law International.

E-Materials

- 1.https://www.sciencedirect.com
- 2.https://www.epd.gov.hk.
- 3.https://www.gsa.gov.
- 4.https://www.iced.cag.gov.in.
- 5. https://www.unece.org.

Elective Paper 02

Name of the Course: B.Sc. Environmental ManagementSemester: IIIName of the Paper: Climate Change and Current IssuesCredits: 3Paper Type: ElectiveHours of Teaching:3

CLIMATE CHANGE AND CURRENT ISSUES

Course Objectives:

The purpose of this course is to focus on improving understanding of the climate system and climate science and the impacts of climate change, mitigation and/or adaptation to climate change and related issues.

UNIT I

Meteorological Elements for Climate Change

Structure of atmosphere: Vertical structure of atmosphere - Atmospheric stability: Adiabatic process – Air Temperature, Humidity, Condensation: Dew and Frost, Fog, and clouds – Clouds: Classification of clouds - Precipitation processes: Collison and Co-alescence process and Ice-crystal or Bergeron process – Cloud seeding – Precipitation types.

UNIT II

Atmospheric Circulation, Air masses and Fronts

Atmospheric circulation: Hadley circulation – Intertropical Convergence Zone (ITCZ) – Jet streams - Global wind patterns: Trade winds, Westerlies and Polar Easterlies - Air masses: Classification and characteristics of air masses – Types of air masses – Fronts: Type of fronts: Stationary fronts, cold fronts, warm fronts, occluded fronts

UNIT III

Air Quality and Consequences of Climate Change

Global Air Quality and CO2 concentration scenario - Role of air pollutants in climate change – Sources of greenhouse gases: Coal burning, Transportation sectors (vehicle, railways, shipping and aviation) - Ozone depleting substances – Facts and figures of current global warming scenarios in the world – Extreme events of climate change.

UNIT IV

Climate Classification, Measurement of Climate

Classification of climate: Koppen's and Thornthwaite' scheme - The measurement of climate change: Tree rings, ice cores, ocean sediments, pollen records, Boreholes and other proxy measurements.

UNIT V

Global/National Action Plans to Combat Climate

Key steps taken by UNFCCC to combat climate change: Kyoto Protocol – Copenhagen Accord 2009 - Cancun Agreements 2010 to establish Green Climate Funds – Paris Climate Agreement 2015 – Montreal Protocol for ODS, Kigali Amendment 2016 to phase out hydrofluorocarbons (HFC) – Green climate funds – Clean Development Mechanism (CDM).

Text Books

- 1. Donald Ahrens C and Robert Henson (2016) Meteorology Today: An Introduction to Weather, Climate, and the Environment. Eleventh Edition, Brooks/Cole, Cengage Learning, USA.
- Galvin JFP (2016) An Introduction to the Meteorology and Climate of the Tropics. John Wiley & Sons Ltd., UK.

Reference Books

- 1. Alberto Troccoli, Laurent Dubus and Sue Ellen Haupt (2014) Weather Matters for Energy. Springer, New York.
- 2. Cowie J (2007) Climate Change: Biological and Human Aspects, Cambridge University Press, UK. 32
- 3. Dogra N and Srivastava S (2012) Climate Change and Disease Dynamics in India, TERI, New Delhi.
- 4. Filho WL (2012) Climate Change and the Sustainable Use of Water Resources, Springer-Verlag, Berlin, Heidelberg.
- 5. Friel S (2019) Climate Change and the People's Health (Vol. 2). Small Books Big Ideas in Popul.
- 6. Lawrence A. Palinkas (2020) Global Climate Change, Population Displacement, and Public Health. The Next Wave of Migration. Springer Nature Switzerland.
- 7. Newman J, Anand M, Henry H, Hunt S and Gedalof Z (2011) Climate Change Biology, CAB International, Cambridge, MA, USA.
- 8. Marselle MR, Stadler J, Korn H, Irvine KN & Bonn A (2019) Biodiversity and health in the face of climate change (p. 481). Springer Nature.

Web References

- 1. http://www.un-redd.org/
- 2. http://unfccc.int/
- 3. https://www.ipcc.ch
- 4. https://www.co2.earth/
- 5. http://www.climatecentral.org/
- 6. http://climate.nasa.gov/
- 7. http://www.who.int/mediacentre/news/
- 8. http://aqicn.org/map/

Elective Paper 03

Name of the Course: B.Sc. Environmental Management Semester: VI Name of the Paper: Environmental Toxicology **Paper Type: Elective**

Credits: 3 Hours of Teaching: 3

ENVIRONMENTAL TOXICOLOGY

Course Objectives:

The objective of this course is to focus on understanding the role of pollutants, xenobiotics in the natural environment and to understand the basics of environmental toxicology and risk assessment.

UNIT I - Basics of Toxicology

Introduction to toxicology, scope and types - Classification of toxic agents. Routes of exposure, duration and frequency of exposure, Dose response relationship - LC₅₀ LD₅₀.

UNIT II - Toxicity Testing

Toxicity testing (i) laboratory animals, (ii) toxicity testing in animals, (iii) toxicological field studies, Concepts of Bioassay, Types and characteristics - Immunotoxicity, histotoxicity and cell toxicity.

Unit III - Environmental Risk Assessment

Environmental Risk - Definition, Risk Characterization - Hazard Identification, Exposure Assessment Methods, Risk Assessment - National and International guidelines. Environmental Risk – Mitigation measures.

UNIT IV - Xenobiotics

Xenobiotics - Bio accumulation and Bio magnifications - mechanisms of toxicity. - food toxicity, genotoxicity, Molecular neurotoxicity.

UNIT V - Pesticide toxicology

Bioaccumulation and Bio magnifications of toxic materials in food chain, Types, mechanism and Toxicology of major pesticides - Environmental impacts of pesticides, biotransformation, bio monitoring, concept of bio indicator groups and examples.

Reference Books

1. Alberts B, Bray D, Hopkin K et al. (2009) Essential Cell Biology, 3rd edition,

- 2. Alberts B, Johmson A, Lewis J, Raff M, Roberts K and Walter P (2002) Molecular Biology of the Cell, Garland Science, New York.
- 3. Buchanan BB, Gruissem W and Jones RL (2002) Biochemistry and Molecular Biology of Plants, ASPB, USA.
- 4. Cooper GM and Hausman RE (2013) The Cell: A Molecular Approach, 6th edition, Sinauer Associates, Sunderland, MA, USA.
- 5. David L. Nelson, Michael M. Cox (2004) Lehninger Principles of Biochemistry (1970) by Albert L. Lehninger Published April 23rd 2004 by W. H. Freeman (first published).
- 6.Gerald Karp (2002) Cell and Molecular Biology: Concepts and Experiments, 7th edition.

SKILL BASED SUBJECT PAPER – 4

Name of the course: B.Sc Environmental managementsemester : VIName of the paper: Environmental Biotechnology and Herbal scienceCredits: 2Paper type: skill basedHours of teaching : 3

ENVIRONMENTAL BIOTECHNOLOGY AND HERBAL SCIENCE

UNIT I

Environmental Biotechnology: Basic Concept, Aim and Scope – Pollution Monitoring – Biotechnological Methods – Biosensors – Biological Treatment of Waste Water.

UNIT II

Agricultural Biotechnology – Micro Propagation – Techniques – Application – Bio Fertilizers – Mass Cultivation Techniques of Rhizobium, Azolla and Phospho bacteria – Bio-Pesticides – Petroleum Plants.

UNIT III

Mushrooms Technology – Nutritive Value of Edible Mushrooms – Medicinal Value of Mushrooms – Advantages of Mushrooms Cultivation – Cultivation of Oyster Mushrooms.

UNIT IV

Herbal Science – Traditional System of Medicine – Siddha – Ayurveda – Homeopathy – Common Medicinal Plants – Zingiber officinale– Aloe vera – Ocimum sanctum – Asafoetida – Honey.

UNIT V

Conservation Methods for Herbal Plants – Insitu and Ex-situ Conservation – Herbal Farms – Biotechnology in Conservation of Medicinal Plants – Adulteration of Herbal Products – Reason – Types – Disadvantages.

REFERENCE

1. N. Arumugam, V. Kumaresan, Applied Plant Biotechnoloy. 2016, Saras Publication, Nagarcoil.

2. V.Kumaresan, Herbal Biotechnology & Pharmacography, 2015, Saras Publication, Nagarcoil.

3. Gupta B.K. Elements of Biotechnology, 1997, Tata McCraw Hill Pub. New Delhi.

4. Scagg, A.H. 2005. Environmental Biotechnology. Oxford University Press.

5. Wainwright, M. 1999. An Introduction to Environmental Biotechnology. Springer.