Course Structure MSc Environmental Science

GOKUL GLOBAL UNIVERSITY SIDHPUR

FACULTY OF SCIENCE

M.SC SEM I (Environmental Science)

Sr.No	course type	course code	course name				Examination		
				Lecure (Hrs.)	Practical (Hrs.)	Credits	internal	External	Total Marks
1	DISCIPLINE SPECIFIC COURSE (DSC)	MES101DSC	Principles of Environmental Sciences	4	0	4	30	70	100
2	DISCIPLINE SPECIFIC COURSE (DSC)	MES102DSC	Current Environmental issues	4	0	4	30	70	100
3	DISCIPLINE SPECIFIC COURSE (DSC)	MES103DSC	Biochemistry and Analytical techniques	4	0	4	30	70	100
4	DISCIPLINE SPECIFIC COURSE (DSC)	MES104DSC	Ecology and Biodiversity	4	0	4	30	70	100
5	PRACTICAL COURSE (PRA)	MES101PRA	Biochemistry and Analytical techniques	0	6	3	0	75	75
6	PRACTICAL COURSE (PRA)	MES102PRA	Ecology and Biodiversity	0	6	3	0	75	75
7	Elective course	MES105SE	Conservation and Biology and Wildlife Management	2	0	2	15	35	50
		MES106SE	Environmentally Sustainable Technologies						
		Total		**18**	**12**	**24**	**135**	**465**	**600**

GOKUL GLOBAL UNIVERSITY SIDHPUR

FACULTY OF SCIENCE

M.SC SEM II (Environmental Science)

Sr.No	course type	course code	course name				Examination		
				Lecure (Hrs.)	Practical (Hrs.)	Credits	internal	External	Total Marks
1	DISCIPLINE SPECIFIC COURSE (DSC)	MES201DSC	Environmental Chemistry	4	0	4	30	70	100
2	DISCIPLINE SPECIFIC COURSE (DSC)	MES202DSC	Environmental Modeling , Remote sensing and GIS	4	0	4	30	70	100
3	DISCIPLINE SPECIFIC COURSE (DSC)	MES203DSC	Solid Waste Management	4	0	4	30	70	100
4	DISCIPLINE SPECIFIC COURSE (DSC)	MES204DSC	Disaster Management	4	0	4	30	70	100
5	PRACTICAL COURSE (PRA)	MES201PRA	Environmental Monitoring techniques	0	6	3	0	75	75
6	PRACTICAL COURSE (PRA)	MES202PRA	Solid Waste Management	0	6	3	0	75	75
7	Elective course	MES205SE	Water Resource Management	2	0	2	15	35	50
		MES206SE	Industrial Wastes and their management						
		Total		**18**	**12**	**24**	**135**	**465**	**600**

GOKUL GLOBAL UNIVERSITY SIDHPUR

FACULTY OF SCIENCE

M.SC SEM III (Environmental Science)

Sr.No	course type	course code	course name				Examination		
				Lecure (Hrs.)	Practical (Hrs.)	Credits	internal	External	Total Marks
1	DISCIPLINE SPECIFIC COURSE (DSC)	MES301DSC	Environmental Health and Disaster Management	4	0	4	30	70	100
2	DISCIPLINE SPECIFIC COURSE (DSC)	MES302DSC	Environmental Monitoring and Management System	4	0	4	30	70	100
3	DISCIPLINE SPECIFIC COURSE (DSC)	MES303DSC	Ecological Assessment Techniques RS, & GIS	4	0	4	30	70	100
4	DISCIPLINE SPECIFIC COURSE (DSC)	MES304DSC	Environmental LAW , Impact Assessment & Audit	4	0	4	30	70	100
5	PRACTICAL COURSE (PRA)	MES301PRA	Practical - 1 (Enviromental Monitoring & Management)	0	6	3	0	75	75
6	PRACTICAL COURSE (PRA)	MES302PRA	Practical-2 (RS,GIS &Ecological Assessment)	0	6	3	0	75	75
7	Elective course	MES305SE	Wlidelife and Conservation Biology - III	2	0	2	15	35	50
		MES306SE	Fisherise and Aquaculture -III						
		Total		**18**	**12**	**24**	**135**	**465**	**600**

GOKUL GLOBAL UNIVERSITY SIDHPUR

FACULTY OF SCIENCE

M.SC SEM IV (Environmental Science)

Sr.No	couse type	course code	course name				Examination		
				Lecure (Hrs.)	Practical (Hrs.)	Credits	internal	External	Total Marks
1	DISCIPLINE SPECIFIC COURSE (DSC)	MES401DSC	MAJOR DISSERTATION	60	60	22	0	550	550
2	Elective Course	MES401DSC	Eco-turism and Conservation (ETC)	2	0	2	15	35	50
3		MES402DSC	Environmental Communcation and Conflict Resolution (ECC)						
		TOTAL		62	60	24	15	585	600

GOKUL GLOBAL UNIVERSITY, SIDHPUR			
Programme Code	**MES**	**Programme Name**	**M.Sc. Environmental Science**
Course Code	**MES101DSC**	**Semester**	**I**
Principles of Environmental Sciences			
Course type :	Discipline Specific Course	**Total Credit :**	04
Teaching time (hours)		**Examination Marking scheme**	
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
60	-------	30	70 (Paper of 3 hrs)	100

Unit	Topic	Content	Hours	Weightage
1		**Multidisciplinary nature of environmental studies and Science**	15	25%
	1.1	Definition, scope and importance, Need for public awareness. Institutions in Environment, People in Environment		
2		**Introduction to Environment and its components Atmosphere**	15	25%
	2.1	Structure and composition of atmosphere, Earth's current atmosphere and challenges		
	2.2	Hydrosphere: Hydrosphere: Structure, types, importance and hydrological cycles; Current issues conservation and management of water resources		
	2.3	Lithosphere: Structure and Composition of Earth crust; Soil properties (Physical and chemicals), Soil components and their importance; Soil erosion, degradation and soil conservation		
3		**Ecosystems**	15	25%
	3.1	Concept of an ecosystem; Structure and function of an ecosystem;		
	3.2	Ecological succession; Introduction, types, characteristic features, structure and function of the following ecosystem:.		
	3.3	(a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)		
4		**Material Cycles in Ecosystems**	15	25%

	4.1	Water Cycle or Hydrological Cycle		
	4.2	Carbon Cycle, Nitrogen Cycle, Oxygen Cycle, Sulphur Cycle, Phosphorous Cycle		

Suggested Readings:

Reference Books:

- Kaushik, A and Kaushik, C. (2004). Perspectives in Environmental Studies. New Age International (P) Limited, Publishers
- Bharucha, E. (2004). Text Book for Environmental Studies. University Grant Commission.
- Saravanan, K. (2005). Principles of Environmental Science and Technology. New Age International (P) Limited, Publishers
- Singh, Y.K. (2006). Environmental Science. New Age International (P) Limited, Publishers

Subject Code: MES101DSC **Semester: I**

Subject Name: Principles of Environmental Science **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Identifies simple observable features (e.g., shape, color, texture, aroma) of leaves, trunk and bark of plants in immediate surroundings
CO2	To spread awareness of the reasons behind environmental degradation and suggest methods to reduce the activities that are harming the environment.
CO3	It is a human endeavor to understand the world by building - up conceptual models on the basis of observations and thus arriving at theories, laws and principles.
CO4	Understanding difficulties arising in using economic analysis in environmental policy design
CO5	

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO2	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO3	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**1**	**2**	**-**		
CO4	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**-**
CO2													**2**	**-**
CO3													**2**	**-**
CO4													**1**	**-**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR			
Programme Code	**MES**	**Programme Name**	**M.Sc. environmental Science**
Course Code	**MES102DSC**	**Semester**	**I**
Current Environmental Issues			
Course type :	Discipline Specific Course	**Total Credit :**	04
Teaching time (hours)		**Examination Marking scheme**	
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
60	-------	30	70 (Paper of 3 hrs)	100

Unit	Topic	Content	Hours	Weightage
1		**Air and Soil Issues**	15	25%
	1.1	Air Pollution, Green House Effect, Global Warming, Acid rain, Climate Change, Ozone Layer Depletion, Soil erosion, Degradation of land, desertification, Over use of Pesticides, Insecticides and Herbicides		
2		**Water Issues:**	15	25%
	2.1	Environmental issues related to water resource projects		
	2.2	Narmada dam, Tehri dam, Almatti dam, Cauvery and Mahanadi, Hydro-power projects in Jammu & Kashmir,		
	2.3	Himachal and North-Eastern States. Water conservation-development of watersheds, Rain water harvesting and		
	2.4	ground water recharge. National river conservation plan – Namami Gange and Yamuna Action Plan. Eutrophication and Biomagnifications. Conservation of wetlands, Ramsar sites in India		
3		**Forest and Wildlife Issues**	15	25%
	3.1	Deforestation, Biodiversity loss, Depletion of Natural Resources, Extinction of wildlife and loss of natural habitat, Poaching and hunting		
4		**Human and Waste Management**	15	25%

	4.1	Population, Ethics, Public awareness, Urbanization, Industrialization, Solid Waste Issues: Solid Waste Management Issues, Impact on Human Health and Environment		

Suggested Readings:

1. Kaushik, A and Kaushik, C. (2004). Perspectives in Environmental Studies. New Age International (P) Limited, Publishers
2. Bharucha, E. (2004). Text Book for Environmental Studies. University Grant Commission.
3. Saravanan, K. (2005). Principles of Environmental Science and Technology. New Age International (P) Limited, Publishers
4. Singh, Y.K. (2006). Environmental Science. New Age International (P) Limited, Publishers

Subject Code: MES102DSC **Semester: I**

Subject Name: Current Environmental Issues **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	An Environmental Studies major will be able to recognize the physical, chemical, and biological components of the earth's systems and show how they function.
CO2	Helps students understand how their decisions and actions change the environment, strengthens knowledge and skills needed to address complex environmental issues
CO3	EIA helps to identify potential environmental impacts of a project, such as air and water pollution, soil erosion, deforestation, and biodiversity loss.
CO4	To spread awareness of the reasons behind environmental degradation and suggest methods to reduce the activities that are harming the environment
CO5	

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO2	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO3	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO4	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**1**	**-**
CO2													**2**	**-**
CO3													**2**	**-**
CO4													**1**	**-**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR			
Programme Code	**MES**	**Programme Name**	**M. Sc. Environmental Science**
Course Code	**MES103DSC**	**Semester**	**I**
Biochemistry and Analytical techniques			
Course type :	Discipline Specific Course	**Total Credit :**	04
Teaching time (hours)		**Examination Marking scheme**	
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
60	-------	30	70 (Paper of 3 hrs)	100

Unit	Topic	Content	Hours	Weightage
1		**Biochemistry I**	15	25%
	1.1	Basic chemistry for biologist		
	1.2	Protein Structure and Function : Amino Acids, Structure of Proteins, Globular Proteins, Fibrous Proteins, Enzymes		
	1.3	Introduction to Carbohydrates, Glycolysis, Tricarboxylic Acid Cycle, Gluconeogenesis, Glycogen Metabolism, Metabolism of Monosaccharides and Disaccharides, Pentose Phosphate Pathway and NADPH, Glycosaminoglycans and Glycoproteins		
	1.4	Characteristics and types of lipid, Metabolism of Dietary Lipids, Fatty Acid and Triacylglycerol		
2		**Biochemistry II**	15	25%
	2.1	Amino Acids: Characteristics and types of Amino acids, Conversion of Amino Acids to Specialized Products, Nucleotide Metabolism		
	2.2	Integration of Metabolism: Metabolic Effects of Insulin and Glucagon, The Feed/Fast Cycle, Diabetes Mellitus, Obesity, Nutrition, Vitamins		
	2.3	Nucleotide metabolism: Characteristics and types of Nucleic acids, Biosynthesis and catabolism of purines and pyrimidines		
	2.4	Storage and Expression of Genetic Information: DNA Structure and Replication, RNA Structure and Synthesis, Protein Synthesis		

3		**Fundamental Instrumentation**	**15**	**25%**
	3.1	Electrochyemistry : pH and buffers, Potentiometric and Conductometric titration		
	3.2	Microscopy: Light, phase contrast, fluorescence, scanning and transmission electron microscopy and other advanced microscopy		
	3.3	Biophysical methods: Analysis of biomolecules using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy		
	3.4	Atomic Absorption Spectrophotometer and Flame photometry		
4		**Chromatography and Advanced Environmental Instrumentation**	**15**	**25%**
	4.1	Chromatographic methods: Paper chromatography, gel- filtration, ion-exchange and affinity chromatography; Thin layer		
	4.2	Gas chromatography and High pressure liquid (HPLC) chromatography		
	4.3	Biosensors: Principle and applications		
	4.4	Methods in field biology		

Suggested Readings:

1. Biochemistry 3rd edition (2005) by Reginald H. Garrett, Charles M. Grisham.
2. Lehninger's Principles of Biochemistry by David L. Nelson and Michael M. Cox, Macmillan Worth publisher, 2009.
3. Biochemistry 6th edition by Jeremy M Berg, Lubert Stryer, John L. Tymoczko, 2008.
4. Murray, R.K., Granner, B.K., Mayes, P.A., Rodwell, V.W., Harper's Biochemistry Prentice Hall International, 2008.
5. Voet and Voet's Biochemistry, D. Voet and J. Voet 3rd Edition, John Wiley and Sons Inc., 2005.
6. Biochemistry, 5th Ed by Eric E Conn, Paul K Stumpf, George Bruening and Roy H Doi, 2009.
7. Wilson, K. and Walker, J., (2010). Principles and Techniques of Biochemistry and Molecular Biology, 7th edition, Cambrige University Press (Low price edition), New York.
8. Webster J. G., (2009). Bioinstrumentation, Student edition, Wiley India (P) Ltd. New Delhi.
9. Sharma, B. K., (2005). Instrumental methods of chemical analysis, 24th edition, GOEL publishing house, Meerut.

Subject Code: MES103DSC **Semester: I**

Subject Name: Biochemistry & Analytical techniques **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Be able to undertake investigations and perform analyses that provide information about biochemical questions and help to solve biochemical problems.
CO2	To reinforce chemical principles central to analytical chemistry. To introduce instrumental techniques for chemical measurement. To develop critical thinking for interpreting analytical data.
CO3	Understand the catalytic role of enzymes, the importance of enzyme inhibitors in the design of new drugs, therapeutic and diagnostic applications of enzymes
CO4	The purpose of analytical techniques is to determine a parameter, usually by means of an instrument, and by taking advantage of the physical, chemical or biological properties of the material.
CO5	

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO2	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO3	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO4	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**-**
CO2													**2**	**-**
CO3													**2**	**-**
CO4													**1**	**-**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR			
Programme Code	**MES**	**Programme Name**	**M.Sc. Environmental Science**
Course Code	**MES103DSC**	**Semester**	**I**
Ecology and Biodiversity			
Course type :	Discipline Specific Course	**Total Credit :**	04
Teaching time (hours)		**Examination Marking scheme**	
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
60	-------	30	70 (Paper of 3 hrs)	100

Unit	Topic	Content	Hours	Weightage
1		**Principle and concept of Ecology**	15	25%
	1.1	Characteristics of a population; population growth curves and regulation;		
	1.2	Levels of Ecology; Population, Community, Ecosystem, Biome		
	1.3	Ecosystem – Food Chain & Food Web. Ecological Pyramid:		
	1.4	Pyramid of Numbers, Pyramid of Biomass, Pyramid of Energy		
2		**Natural history of Indian subcontinent**	15	25%
	2.1	Major habitat types of the subcontinent, geographic origins and migrations of species		
	2.2	Common Indian mammals, birds		
	2.3	Seasonality and phenology of the subcontinent		
	2.4	Hotspots of Indian Biological diversity		
3		**Introduction to Biodiversity**	15	25%
	3.1	Introduction, Types of Biodiversity; Species Diversity		
	3.2	Genetic Diversity, Ecosystem Diversity.		
	3.3	Values and benefits of Biodiversity		
	3.4	Uses and Importance of biodiversity. Factor Promoting High Diversity.		
4		**Losses and Conservation of Biodiversity**	15	25%

	4.1	Major Causes of loss of biodiversity.		
	4.2	Threatened biodiversity, IUCN red list categories.		
	4.3	Conservation and Management of Biodiversity		
	4.4	Issues in conservation of biodiversity. Protected areas of Biodiversity. Biodiversity in India.		

Suggested Readings:

- Ray, S and Ray, A.K. Biodiversity and Biotechnology. *New Central Book Agency (P)Ltd.*
- Sharma, P.D. (2018). Text Book of Ecology and Environment. *Rastogi Publications.*
- Sharma, J.P. (2017). Text Book of Environmental Studies. *University Science Press.*
- Kumar, S. (2018). Fundamental of Environmental Studies. *Sultan Chand Education Publisher.*

Subject Code: MES104DSC **Semester: I**

Subject Name: Ecology & Biodiversity **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Understand, explain and discuss species distribution patterns and their changes at both local and global scales.
CO2	Preserving species diversity, utilizing species, sustaining ecosystems, preserving life-supporting systems, and crucial ecological processes.
CO3	Helps us understand how organisms live with each other in unique physical environments.
CO4	To understand the distribution of biotic and abiotic factors of living things in the environment.
CO5	

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**2**	**-**		
CO2	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO3	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO4	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**-**
CO2													**2**	**-**
CO3													**1**	**-**
CO4													**2**	**-**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR			
Programme Code	**MES**	**Programme Name**	M.Sc.Environmental Science
Course Code	**MES106SE**	**Semester**	I
Environmentally Sustainable Technologies (EST)			
Course type :	Subject Elective	**Total Credit :**	02
Teaching time (hours)		**Examination Marking scheme**	

Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
30	-------	15	35	50

Unit	Topic	Content	Hours	Weightage
1		**Sustainable Development**		
	1.1	Overview Definition Need and Significance Barriers	**15**	**50%**
	1.2	Categories of Sustainable Development		
	1.3	Measurable Benefits.		
2		**Environmental Sustainable Technologies**		
	2.1	Scope, Need	**15**	**50%**
	2.2	Characteristics of EST • Reduction in pollution • Reduction in Wastes		
	2.3	Transferring Technologies. • Benefits • Barriers		
	2.4	Role of Government		

Suggested readings:

1. Sinclair A. R., Fryxell J M and Caughly G. (2006)

2. Wildlife Ecology, Conservation and Management. Blackwell Publishing, U.S.A.
3. Gopal R. (1992) Fundamentals of Wildlife Management. Justice Home, Allahabad, India.
4. Jairajpuri M. S. (1990) Collection and preservation of animals. Zoological Survey of India.
5. Magguran, A.E. (1996). Ecological diversity and its measurements. Princeton University.
6. Gadgil, M. (2002) A methodology mannual for scientific inventorying, monitoring and conservation of Biodiversity
7. Hickman C. P., et al. 2006 Integrated principals of Zoology, McGraw Hill Higher Education. 931pp. 14th edition.

Subject Code: MES104DSC **Semester: I**

Subject Name: Environmentally Sustainable Technologies **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Students will be able to define sustainability and identify major sustainability challenges.
CO2	Students will have an understanding of the carrying capacity of ecosystems as related to providing for human needs.
CO3	Educational goals that aim to support students' full development and well-being in an holistic and sustainable perspective.
CO4	Apply fundamental and disciplinary concepts and methods in ways appropriate to their principal areas of study.
CO5	

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**1**	**2**	**-**		
CO2	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO3	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO4	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**-**
CO2													**2**	**-**
CO3													**1**	**-**
CO4													**2**	**-**
CO5														

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Programme Code		MES	Programme Name	M.Sc .Environmental Science
Course Code		MES101PRA	Semester	I
Biochemistry and Analytical Techniques				
Course type :		Practical	Total Credit :	08
Teaching time (hours)		Examination Marking scheme		
Theory (hrs)	Practical (hrs)	Internal (Marks)	External (Marks)	Total (Marks)
-------		------	75	75

LIST OF EXPERIMENTS

1. To study climatic conditions and weather maps
2. Determination of Atmospheric humidity
3. To study the climatic conditions in open field, desert, wet land and under tree shed
4. Estimation of carbohydrates (Coles & DNS method)
5. Estimation of proteins (Folin, Bradford and Biurates)
6. Estimation of lipids

GOKUL GLOBAL UNIVERSITY, SIDHPUR				
Programme Code	**MES**		**Programme Name**	**M. Sc. Environmental Science**
Course Code	**MES102PRA**		**Semester**	**I**
Ecology and Biodiversity				
Course type:	Practical		**Total Credit :**	08
Teaching time (hours)		**Examination Marking scheme**		
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
-------		------	75	75

LIST OF EXPERIMENTS

Study of Habitat and vegetation

1. Different habitat types in the ecosystem
2. Quantification of vegetation (Species area curve method, Quadrate method, Transect method, Ten tree method)
3. Modified Whittaker Plot method
4. Quantitative analysis of vegetation by IVI, Density, Frequency, Abundance, Richness

GOKUL GLOBAL UNIVERSITY, SIDHPUR

Programme Code	**MES**	**Programme Name**	**M.Sc. Environmental Science**
Course Code	**MES201DSC**	**Semester**	**II**

Environmental Chemistry

Course type :	Discipline Specific Course	**Total Credit :**	04

Teaching time (hours)		**Examination Marking scheme**		
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
60	-------	30	70 (Paper of 3 hrs)	100

Unit	Topic	Content	Hours	Weightage
1		**Chemistry and Control of Air Pollution**	15	25%
	1.1	Definition, types of pollution and pollutants, significance of pollution control		
	1.2	Chemistry and control of air pollution: Measurement of air pollution, sampling techniques and testing of air qualities		
	1.3	Control measures of air pollution: Particulate control technology		
	1.4	Control of gaseous pollutants, SOx, NOx control technology.		
2		**Chemistry and control of water pollution**	15	25%
	2.1	Fresh water and marine pollutants, sources of water pollutants		
	2.2	Domestic wastes and their impacts on water quality		
	2.3	Treatment of polluted water, water purification, domestic and industrial waste water treatment		
	2.4	Desalination of water		
3		**Chemistry and control of land pollution**	15	25%
	3.1	Sources and types of soil pollutants		
	3.2	Interaction of pollutants with soil components and organisms		
	3.3	Control measures of soil pollution		
	3.4	Solid and hazardous waste disposal methods		
4		**Industrial Pollution & Control**	15	25%
	4.1	Managing industrial wastes and environmental degradation		
	4.2	Cleaner bioprocesses for pollution control		
	4.3	CDM Technologies		

	4.4	Concept of green industries		

Suggested Readings:

Reference Books:

1. Environmental Engineering – Devis Cornwell 3rd edition (1998). Mc Graw Hill.
2. Environmental Engineering – Gerald Kiely (1998) Mc graw Hill
3. Environmental Engineering – A global Prospective (2000) edt by Gary Vanloon& Duffy. Oxford Pub.
4. Encyclopedia of Environmental pollution and Control – R.K.Trivedi
5. An Introduction to air Pollution – R.K.Trivedi and P.K.God (1998) Technology Pub.
6. Environmental Pollution control Engineering – C.S.Rao (1995) – Wiley Eastern ltd.
7. Nature and properties of Soil- N.C.Brady (1997) Mc. Millan pub.
8. Environmental Chemistry – A.K.De(1995), Widy Eastern.
9. Chemistry for Environmental Engineering- Sawyer, Mac Carty, Partein (1994) Mc. Graw Hill
10. Introduction to Environmental engineering and Sciences – Gilbert N. Masters (1998) Printice hall of India Pvt. Ltd New Delhi
11. Air pollution (7 volume) A.C.Stern
12. Air pollution Control Engineering – Noel De nevers – Second edition – Mc.Graw Hill international edition.
13. Environmental Pollution - Management and Control for sustainable Development – R.K.Khitoliya, S.Chand and company, New Delhi

Subject Code: MES201DSC **Semester: II**

Subject Name: Environmental Chemistry **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	It is important to study environmental chemistry as it helps in understanding and solving various environmental issues.
CO2	Environmental Chemistry works together to give information for threat assessment, repair research, and establishing the level of environmental management needed for the entire system
CO3	Students will gain an understanding of: chemical reactions and strategies to balance them. the relative quantities of reactants and products. the fundamental properties of atoms, molecules, and the various states of matter
CO4	Environmental Chemists are therefore often the more public-facing chemists, as the research they conduct helps inform decisions that affect all of us.
CO5	

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO2	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO3	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO4	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**-**
CO2													**2**	**-**
CO3													**3**	**-**
CO4													**1**	**-**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR			
Programme Code	**MES**	**Programme Name**	**M.Sc. environmental Science**
Course Code	**MES202DSC**	**Semester**	**II**
Environmental Modeling, Remote sensing and GIS			
Course type :	Discipline Specific Course	**Total Credit :**	04
Teaching time (hours)		**Examination Marking scheme**	
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
60	-------	30	70 (Paper of 3 hrs)	100

Unit	Topic	Content	Hours	Weightage
1		**Mathematical modeling**	15	25%
	1.1	Basics of mathematical modeling, its applications and limitations in environmental science		
2	1.2	Environmental Planning through mathematical modeling		
	1.3	Possible steps in modeling approaches		
	1.4	Application of Modeling in Industries and pollution control		
		Remote Sensing	15	25%
	2.1	Introduction to remote sensing, physical basis for remote sensing		
	2.2	Types of satellite information		
	2.3	Process of information extraction through RS		
	2.4	Remote sensing as a tool for study and management of ecosystems		
3		**GIS: I**	15	25%
	3.1	GPS: Introduction, Principle, working and application		
	3.2	Toposheet : Reading, Identification, Scanning		
	3.3	Geographical Information System (GIS) Introduction and Principle		
	3.4	Creation of GIS Database (Data Conversion from GPS and Toposheets)		
	3.5	Setting up a GIS Laboratory		
4		**GIS: II**	15	25%
	4.1	Georeferensing and Digitization of Data		

	4.2	GIS Data structure : Raster and Vector		
	4.3	GIS analysis Capabilities		
	4.4	Introduction to Eco-informatics in research		

Suggested Readings:

1. Environmental Engineering – Devis Cornwell 3rd edition (1998). Mc Graw Hill.
2. Environmental Engineering – Gerald Kiely (1998) Mc graw Hill
3. Environmental Engineering – A global Prospective (2000) edt by Gary Vanloon& Duffy. Oxford Pub.
4. Encyclopedia of Environmental pollution and Control – R.K.Trivedi
5. An Introduction to air Pollution – R.K.Trivedi and P.K.God (1998) Technology Pub.
6. Environmental Pollution control Engineering – C.S.Rao (1995) – Wiley Eastern ltd.
7. Nature and properties of Soil- N.C.Brady (1997) Mc. Millan pub.
8. Environmental Chemistry – A.K.De(1995), Widy Eastern.
9. Chemistry for Environmental Engineering- Sawyer, Mac Carty, Partein (1994) Mc. Graw Hill
10. Introduction to Environmental engineering and Sciences – Gilbert N. Masters (1998) Printice hall of India Pvt. Ltd New Delhi
11. Air pollution (7 volume) A.C.Stern
12. Air pollution Control Engineering – Noel De nevers – Second edition – Mc.Graw Hill international edition.
13. Environmental Pollution - Management and Control for sustainable Development – R.K.Khitoliya, S.Chand and company, New Delhi

Subject Code: MES202DSC **Semester: II**

Subject Name: Environmental modeling remote sensing & GIS **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Explain and communicate quantitative remote-sensing principles and integrate different tools for remote sensing data analysis.
CO2	Perform image corrections and enhancements and generate high-level remote sensing products
CO3	Remote Sensing data & GIS along with some models can be used to monitor and mapping of natural resources and environmental pollution in addition to natural disasters like cyclone, tsunami, avalanche, floods, drought, hailstorm, wildfire etc.
CO4	Environmental modelling may be used purely for research purposes, and improved understanding of environmental systems, or for providing an interdisciplinary analysis that can inform decision making and policy.
CO5	

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**	-	-	-	-	**2**	**2**	-		
CO2	**2**	**1**	**2**	-	-	-	-	**2**	**1**	-		
CO3	**3**	**2**	**2**	-	-	-	-	**2**	**2**	-		
CO4	**3**	**1**	**1**	-	-	-	-	**1**	**1**	-		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	-
CO2													**2**	-
CO3													**3**	-
CO4													**1**	-
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR			
Programme Code	**MES**	**Programme Name**	**M.Sc. Environmental Science**
Course Code	**MES203DSC**	**Semester**	**II**
Solid Waste Management			
Course type :	Discipline Specific Course	**Total Credit :**	04
Teaching time (hours)		**Examination Marking scheme**	
Theory (hrs) / **Practical** (hrs)		**Internal** (Marks)	**External** (Marks) / **Total** (Marks)
60	-------	30	70 (Paper of 3 hrs) / 100

Unit	Topic	Content	Hours	Weightage
1		**Introduction to Solid Waste Handling and Management**	15	25%
	1.1	Classification of solid waste- source based and their types		
	1.2	Waste characteristics and quantitative estimation of municipal solid waste		
	1.3	Waste generation and composition, Factors affecting solid waste management		
	1.4	Material flow Methodology.		
2		**Processing of Urban waste**	15	25%
	2.1	Methods of collection		
	2.2	storage, transportation, Material separation, Processing on site and off site for source reduction		
	2.3	Methods of disposal- Dumping, Sanitary Landfill, Incineration, Pyrolysis, Composting		
	2.4	Ocean Dumping, Leachate Management for MSW landfills.		
3		**Applied Uses of Solid Waste**	15	25%
	3.1	Biogas production, Composting and Vermicomposting, International cooperation in municipal solid waste management,		
	3.2	Integrated Waste management		
	3.3	Municipal Solid waste Management & Handling Rules,2000.		

	4.1	Solid Waste Management Rules		
	4.2	Plastic Waste Management Rules		
	4.3	Bio-Medical Waste Management Rules		
	4.4	Hazardous and Other Waste (Management and Trans boundary Movement) Rules		

Suggested Readings:

1. George Tchobanaglous, Hilary Theissen and Samuel A. Vigil, (1993), Integrated Solid Waste Management: Engineering Principles and Management Issues –, McGraw-Hill ScienceEngineering.

2. Bhide and Sundaresan (1983), Solid Waste Management in Developing Countries,Indian National Scientific Documentation Centre. NewDelhi.

3. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., (1986), EnvironmentalEngineering, McGraw Hill Publishing company, NewYork.

4. Sincero, A.P., and Sincero, G.A., (1999), Environmental Engineering – A Design Approach, Prentice- Hall of India Pvt. Ltd., NewDelhi.

5. Sasikumar K and Krishna S. G., (2009), Solid Waste Management, PHI Learning Pvt.Ltd., NewDelhi.

Subject Code: MES203DSC **Semester: II**
Subject Name: Solid waste management **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Minimize the Production of Waste. Proper management practices help minimize the garbage and scraps that need handling
CO2	Reduce Pollution Effects. Secondly, it's vital to lower the impact garbage has on pollution.
CO3	Waste management is aimed to reduce the adverse effects of waste on environment, health and the beauty of nature.
CO4	Make physical and chemical analysis of municipal solid wastes and apply them for a management system that will be set up. make route optimization for a solid waste collection and transport system.
CO5	

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO2	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO3	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO4	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**-**
CO2													**2**	**-**
CO3													**3**	**-**
CO4													**1**	**-**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR			
Programme Code	**MES**	**Programme Name**	**M.Sc. Environmental Science**
Course Code	**MES204DSC**	**Semester**	**II**
Disaster Management			
Course type :	Discipline Specific Course	**Total Credit :**	04
Teaching time (hours)		**Examination Marking scheme**	
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
60	-------	30	70 (Paper of 3 hrs)	100

Unit	Topic	Content	Hours	Weightage
1		**Unit 1:Understanding Disaster**	15	25%
	1.1	Concept and definitions of disaster;		
	1.2	Hazard, vulnerability, risk, capacity		
	1.3	Types, trends, causes and consequences		
	1.4	Control of various disasters, viz., Geological, Hydro meteorological, Biological and Technological disasters.		
2		**Disaster Management**	15	25%
	2.1	Vulnerability of natural hazards in India;		
	2.2	Disaster management cycle		
	2.3	Activities associated with various stages of cycles		
	2.4			
3		**Institutional Framework**	15	25%
	3.1	Constitutional frameworks in India		
	3.2	Role of Governments		
	3.3	Non Governments and State Government agencies		

	3.4			
4		**IV Risk Assessment**	**15**	**25%**
	4.1	. Concept and evaluation of risk		
	4.2	Hazard identification; Exposure assessment; Hazard assessment; Risk characterization		
	4.3	Man-made Environmental degradation		
	4.4	Problems related to toxic wastes and chemicals and radioactive substance disposal		

Suggested Readings:

1. Disaster Management by Savindra Singh, JeetendraSingh

2. Disaster Management and Preparedness by Nidhi Gupta, Dhawan and AmbrinaSardar Khan

3.Safety and Disaster Management by Dr S Arulsay and J Jeyadevi

4. Disaster Mitigation: Experiences & mitigations by Pradeep Sahni, AlkaDhameja, Uma Medury

5. Disaster Management at Health care settings by Shreen Gaber

Subject Code: MES204DSC **Semester: II**
Subject Name: Disaster management **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Develop a deep understanding of disaster resilience, risk mitigation, and recovery policies as they arise from natural hazards around the globe
CO2	If the students are properly trained, they can rush to the disaster spot and can help the disaster management team for quick rehabilitation and resettlement of victims at times of floods, earthquakes and drought etc.
CO3	Disaster education aims to provide knowledge among individuals and groups to take actions to reduce their vulnerability to disasters.
CO4	After studying this course, you should be able to: understand what is meant by management and managerial effectiveness. identify the roles which are fulfilled while working as a manager. identify managerial activities that contribute to managerial effectiveness.
CO5	

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO2	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO3	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**2**	**-**		
CO4	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**-**
CO2													**2**	**-**
CO3													**3**	**-**
CO4													**2**	**-**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR			
Programme Code	**MES**	**Programme Name**	M.Sc. Environmental Science
Course Code	**MES206SE**	**Semester**	**II**
Industrial Wastes and their management (IWM)			
Course type :	Subject Elective	**Total Credit :**	02
Teaching time (hours)		**Examination Marking scheme**	

Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
30	-------	15	35	50

Unit	Topic	Content	Hours	Weightage
1		**Unit-1**		
	1.1	Introduction to industrial Wastes	**15**	**50%**
	1.2	Sources and classification of Industrial Wastes		
	1.3	Characterization, Sampling and Analysis Techniques		
	1.4	Industrial Waste Water & Their treatment		
2		**Unit -2**		
	2.1	Disposal of Wastes	**15**	**50%**
	2.2	Reduction of Waste Volume and Strength		
	2.3	Chemical, Biological and Physical treatment of Industrial Wastes		
	2.4	Important regulation for Industrial Wastes in India: Recycle Plastic Act-1999, Batties Act2001, Ozone Depleting Substance Rule-2000		

Suggested readings:

1. Bharucha, E. (2004). Text Book for Environmental Studies. University Grant Commission.
2. Saravanan, K. (2005). Principles of Environmental Science and Technology. New AgeInternational (P) Limited, Publishers
3. Ray, S and Ray, A.K. Biodiversity and Biotechnology. *New Central Book Agency (P)Ltd.*
4. Sharma, P.D. (2018). Text Book of Ecology and Environment. *Rastogi Publications.*
5. Sharma, J.P. (2017). Text Book of Environmental Studies. *University Science Press.*

Subject Code: MES206SE **Semester: II**

Subject Name: Industrial wastes their management **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Minimize the Production of Waste. Proper management practices help minimize the garbage and scraps that need handling
CO2	Reduce Pollution Effects. Secondly, it's vital to lower the impact garbage has on pollution.
CO3	Students can utilize their belongings like paper, pencils and pens to the maximum and produce less amounts of wastes
CO4	Uncontrolled disposal of industrial waste leads to environmental pollution and irreparable damage
CO5	

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO2	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO3	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**2**	**-**		
CO4	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**1**	**-**
CO2													**2**	**-**
CO3													**1**	**-**
CO4													**2**	**-**
CO5														

GOKUL GLOBAL UNIVERSITY, SIDHPUR				
Programme Code	**MES**	**Programme Name**	**M.Sc.EnvironmentalScience**	
Course Code	**MES201PRA**	**Semester**	**II**	
Environmental monitoring techniques				
Course type :	Practical	**Total Credit :**	03	
Teaching time (hours)		**Examination Marking scheme**		
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
-------		------	75	75

LIST OF EXPERIMENTS

1. **Methods for air sampling**
   1.1To study the devices and methods for air samples
   ii. Determination of SO2 from air samples
   iii. Determination of NO2 from air samples
2. Environmental Sample analysis: Soil
   2.1 i. Physical properties of soil:
   (A) Colour, (B) Texture, (C) Water holding capacity (D) Porosity and bulk density, (E) Moisture, (F) pH and Temperature ii. Chemical properties of soil: (A) Chloride, (B) Soil minerals, (C) Chemical oxygen demand (E) Inorganic phosphorus, (F) Sulphate, (G) Nitrogen iii.Biological
   2.2 properties of soil:
   (A) Soil microorganism analysis, (B) Soil Macrofauna

3. GIS: i. Introduction to Software Arc- view GIS 3.2

(A) Scanning of map (B) To view the scanned Map in Arc-view GIS 3.2 (C) Digitization of polygone layer (D) Digitization of line layer (E) Digitization of point layer (F) Map reading: Land use, Urban areas, Water resources, Forest & Ocean

References:

- **Stem A.C.,(1977), Air pollution, Academic Press, New York**
- **S.K. Maiti.(2001). Handbook of methods in Environmental Studies vol 1. Water & waste Analysis, ABD Pub.**

- **Guidelines from GPCB-CPCB**
- **Paliwal U.L (2002) Environment Audit, Indus Valley Publication, Jaipur**

GOKUL GLOBAL UNIVERSITY, SIDHPUR				
Programme Code	**MES**		**Programme Name**	**M.Sc. Environmental Science**
Course Code	**MES202PRA**		**Semester**	**II**
Solid waste management				
Course type :	Practical		**Total Credit :**	03
Teaching time (hours)		**Examination Marking scheme**		
Theory (hrs)	**Practical** (hrs)	**Internal** (Marks)	**External** (Marks)	**Total** (Marks)
-------		------	75	75

LIST OF EXPERIMENTS

- Sampling methods of soil and solid waste
- Solid waste characteristics
- Analysis of moisture content
- Analysis of organic content
- Analysis of organic matter
- Analysis of Sodium and Potassium
- Analysis of Nitrogen content
- Analysis of Phosphorus
- Preparation of compost
- Biological analysis of municipal solid waste

Reference books:

- **Guidelines from GPCB-CPCB**

Paliwal U.L (2002) Environment Audit, Indus Valley Publication, Jaipur

Program: Master of Science **Subject / Branch:** Environmental Science

Year : 2022/23 **Semester:** 3

Course title :	Environmental Health and Disaster Management	**Course code :**	MES301DSC
Course type :	Discipline Specific Course	**Course credit :**	04

Teaching (Hours/week)			Examination Scheme			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
4	0	0	20	10	70	100

Content

Unit	Description in detail	Credit	Weightage
I	**Environmental Health** Basic principles of environmental health Physiological responses of man to relevant stresses in environment Epidemic and Pandemic disease in environment Global and national agencies working for environmental health	1	25 %
II	**Occupational health and hazards** Types of occupational hazards and their health effects. Classification of occupational diseases based on agents and origins Industrial accidents-causal factors and prevention measures, (OSHAS) Measures for protection of health of workers; prevention of occupational diseases	1	25 %
III	**Disaster management –I** Disaster: Definition and classification Risk assessment and vulnerability analysis Disaster preparedness Disaster response at national, state and local level	1	25 %
IV	**Disaster management –II** Disaster medicines Rehabilitation, reconstruction and recovery Participatory management Disaster management act (2005)	1	25 %

Reference Books:

Environmental Engineering - Devis Cornwell 3rd edition (1998). Mc Graw Hill.

Environmental Engineering - Gerald Kiely (1998) Mc graw Hill

Environmental Engineering - A global Prospective (2000) edt by Gary Vanloon& Duffy. Oxford Pub.

Encyclopedia of Environmental pollution and Control - R.K.Trivedi

An Introduction to air Pollution - R.K.Trivedi and P.K.God (1998) Technology Pub.

Environmental Pollution control Engineering - C.S.Rao (1995)- Wiley Eastern ltd.

Nature and properties of Soil- N.C.Brady (1997) Mc. Millan pub.

Subject Code: MES301DSC **Semester: III**

Subject Name: Environmental health &Disaster management **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Develop a deep understanding of disaster resilience, risk mitigation, and recovery policies as they arise from natural hazards around the globe
CO2	If the students are properly trained, they can rush to the disaster spot and can help the disaster management team for quick rehabilitation and resettlement of victims at times of floods, earthquakes and drought etc.
CO3	Disaster education aims to provide knowledge among individuals and groups to take actions to reduce their vulnerability to disasters.
CO4	After studying this course, you should be able to: understand what is meant by management and managerial effectiveness. identify the roles which are fulfilled while working as a manager. identify managerial activities that contribute to managerial effectiveness.
CO5	

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO2	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO3	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**2**	**-**		
CO4	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**-**
CO2													**2**	**-**
CO3													**3**	**-**
CO4													**2**	**-**
CO5														

Program: Master of Science **Subject / Branch:** Environmental Science

Year : 2022/23 **Semester:** 3

Course title :	Environmental Monitoring and Management System	**Course code :**	MES302DSC
Course type :	Discipline Specific Course	**Course credit :**	04

Teaching (Hours/week)			Examination Scheme			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
4	0	0	20	10	70	100

Content

Unit	Description in detail	Credit	Weightage
I	**Sampling and Environmental Models** Sampling methodologies for environmental matrices, Sampling protocols- selection of sites, time and frequency for sampling, preservation, storage and handling of samples; Setting up an environment monitoring lab and Good Laboratory Practices Study of different environment quality models	1	25 %
II	**Air Pollution and Control** Measurement of air pollutants, Air quality standards, Air quality monitoring studies: wind roses, air sampling, analysis NOX, SOX, CO, O3 and particulate matter, Stack monitoring NAAQS, Air quality surveillance network, control approaches (stationary and mobile) Indoor air quality management and Air quality indices	1	25 %
III	**Water Pollution and Control** Measuring water pollutants and its monitoring methods Industrial and domestic water quality assessment Water quality standards, CPCB, BIS, ISO, USEPA, WHO, Water quality assurance, Water Quality Modeling	1	25 %
IV	**Monitoring and Green Building** Measuring and monitoring soil quality	1	25 %

	Physico-chemical and micro and macro-fauna sampling Impact assessment of industry, pesticide, fertilizer on soil quality Concept of bio-pesticide, bio-fertilizer and organic farming Concept of Green infrastructure, Green buildings, green industries, green belt etc		

Reference Books:

Environmental Engineering - Devis Cornwell 3rd edition (1998). Mc Graw Hill.

Environmental Engineering - Gerald Kiely (1998) Mc graw Hill

Environmental Engineering - A global Prospective (2000) edt by Gary Vanloon& Duffy. Oxford Pub.

Encyclopedia of Environmental pollution and Control - R.K.Trivedi

An Introduction to air Pollution - R.K.Trivedi and P.K.God (1998) Technology Pub.

Subject Code: MES302DSC **Semester: III**

Subject Name: Environmental monitoring & management **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Environmental monitoring is a tool to assess environmental conditions and trends, support policy development and its implementation, and develop information for reporting to national policymakers, international forums and the public.
CO2	The main objective of environmental monitoring is to manage and minimize the impact an organization's activities have on an environment
CO3	Ither to ensure compliance with laws and regulations or to mitigate risks of harmful effects on the natural environment and protect the health of human beings.
CO4	The Environment Management Plan (EMP) identifies feasible and cost-effective measures that have the potential to reduce potentially significant negative environmental impacts to acceptable levels.
CO5	

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO2	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO3	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO4	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**3**	**-**
CO2													**2**	**-**
CO3													**3**	**-**
CO4													**1**	**-**
CO5														

Program: Master of Science **Subject / Branch:** Environmental Science

Year : 2022/23 **Semester:** 3

Course title :	Ecological Assessment Techniques , Remote Sensing and GIS	**Course code :**	MES303DSC
Course type :	Discipline Specific Course	**Course credit :**	04

Teaching (Hours/week)			Examination Scheme			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
4	0	0	20	10	70	100

Content

Unit	Description in detail	Credit	Weightage
I	**Techniques for biodiversity assessment** Quantitative assessment of biodiversity: different types of transects, quadrates and data analysis. Population census techniques for vertebrates. Invertebrate sampling techniques Phylogenetic analysis of DNA sequences.	1	25 %
II	**Remote Sensing and Applications** Introduction to remote sensing, History and scope Energy sources and EMR, RS sensors and platforms Image processing and classification Land cover and Land use analysis, Analysis of spatial data. RS applications in different fields	1	25 %
III	**GIS Basics** Fundamentals of GIS and functions of GIS Software for GIS (GIS lab) Spatial data models Presentation of GIS data	1	25 %
IV	**GIS Application** Ecological modeling through GIS Species distribution models Fragmentation analysis Applications of GIS	1	25 %

Reference Books:

Environmental Engineering - Devis Cornwell 3rd edition (1998). Mc Graw Hill.

Environmental Engineering - Gerald Kiely (1998) Mc graw Hill

Environmental Engineering - A global Prospective (2000) edt by Gary Vanloon& Duffy. Oxford Pub.

Encyclopedia of Environmental pollution and Control - R.K.Trivedi

An Introduction to air Pollution - R.K.Trivedi and P.K.God (1998) Technology Pub.

Environmental Pollution control Engineering - C.S.Rao (1995)- Wiley Eastern ltd.

Nature and properties of Soil- N.C.Brady (1997) Mc. Millan pub.

Environmental Chemistry - A.K.De(1995), Widy Eastern.

Subject Code: MES303DSC **Semester: III**

Subject Name: Ecological assessment techniques RS & GIS **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	GIS makes it easy to monitor the environment using satellite images. Satellite images help monitor the natural resources, soil, and habitat of different species.
CO2	With the help of GIS, an organization can observe the distribution of different species and use this information to allocate funds for the species.
CO3	Explain and communicate quantitative remote-sensing principles and integrate different tools for remote sensing data analysis.
CO4	Recent advances in remote sensing technology have enabled researchers to gain a more comprehensive understanding of the environment. Through satellite imagery, researchers can observe changes in land cover, vegetation and water levels, track the spread and intensity of wildfires, and assess the movement of species.
CO5	

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO2	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO3	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO4	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**-**
CO2													**2**	**-**
CO3													**3**	**-**
CO4													**1**	**-**
CO5														

Program: Master of Science **Subject / Branch:** Environmental Science

Year : 2022/23 **Semester:** 3

Course title :	Environmental Law, Impact assessment and Audit	**Course code :**	MES304DSC
Course type :	Discipline Specific Course	**Course credit :**	04

Teaching (Hours/week)			Examination Scheme			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
4	0	0	20	10	70	100

Content

Unit	Description in detail	Credit	Weightage
I	**Environmental Laws and Policies** Introduction to Indian constitution and environment protection, National Environmental Policy, constitutional provisions (Article 48A, 51A). Acts, rules regulations and amendments thereof -Air (Prevention and Control of Pollution) Amendment Act, 1987, Water (Prevention and Control of Pollution) Amendment Act, 2012, Wildlife (Protection) Amendment Act (1972), Forest (Conservation) Second Amendment Rules, 2014,	1	25 %
II	**Environmental Laws and Case studies** Environment Laws (Amendment) Act, 2015, Factories Act (1948) and Rules Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2015, Bio-Medical Waste Management Rules, 2016, National Green Tribunal Act 2010 MSIHC Rules, Noise Pollution Act, 1998 Important Case studies of Environmental Law	1	25 %
III	**Environmental impact assessment** Objectives and development of EIA. EIA notifications, benefits of EIA, Prior Environmental Clearance, application for EC. EIA methodology, advance tools and GIS in EIA process	1	25 %

	Environmental Impact Statement (EIS), project types, important considerations in EIA		
IV	**Environmental auditing** Introduction and significance of environmental audit, Audit regulations, standards and protocols Green Balance Sheet (GBS), Social impact assessment (SIA), Strategic Environmental Assessment (SEA), post project analysis. Environmental appraisal.	1	25 %

Reference Books:

Environmental Engineering - Devis Cornwell 3rd edition (1998). Mc Graw Hill.

Environmental Engineering - Gerald Kiely (1998) Mc graw Hill

Environmental Engineering - A global Prospective (2000) edt by Gary Vanloon& Duffy. Oxford Pub.

Encyclopedia of Environmental pollution and Control - R.K.Trivedi

An Introduction to air Pollution - R.K.Trivedi and P.K.God (1998) Technology Pub.

Environmental Pollution control Engineering - C.S.Rao (1995)- Wiley Eastern ltd.

Nature and properties of Soil- N.C.Brady (1997) Mc. Millan pub.

Environmental Chemistry - A.K.De(1995), Widy Eastern.

Subject Code: MES304DSC **Semester: III**

Subject Name: Environmental Law impact assessment & audit **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	The Outcomes of environmental impact assessment help to identify potential environmental impacts of the proposed project or development.
CO2	EIAs make sure that project decision makers think about the likely effects on the environment at the earliest possible time and aim to avoid, reduce or offset those effects
CO3	Impact assessments help us understand the possible impacts of these types of projects before they start.
CO4	Assessments identify the best ways to avoid or reduce a project's negative impacts. They may also find ways to enhance the positive aspects of a project.
CO5	

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO2	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO3	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**2**	**-**		
CO4	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**2**	**-**
CO2													**2**	**-**
CO3													**3**	**-**
CO4													**1**	**-**
CO5														

Program: Master of Science **Subject / Branch:** Environmental Science

Year : 2022/23 **Semester:** 3

Course title :	Wildlife and Conservation Biology - 3	**Course code :**	MES301SE
Course type :	Elective	**Course credit :**	02

Teaching (Hours/week)			Examination Scheme			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
2	0	0	15	00	35	50

Content

Unit	Description in detail	Credit	Weightage
I	**Wildlife Research and Monitoring** Conventional Research & Monitoring techniques Advanced research & Monitoring techniques Camera trapping Radio telemetry	1	50 %
II	**Advances in wildlife Research** Noninvasive conservation genetics Wildlife research case studies Use of information technology in wildlife research (in silico wildlife research) Citizen science approach	1	50 %

Reference Books:

Nelson N. (2009): Liquids waste of industries theories, practicals and treatment butter worth-Heinemann.

Industrial waste water treatment- Graman. F

Metcalf and Eddy, revised by Tchobanoglous G. and Burtonfl (2003), Waste Water Engineering, Treatment. Disposal and reuse. McGraw-Hill, inc. Newyork city.

Subject Code: MES301SE **Semester: III**

Subject Name: Wildlife and Conservation Biology **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Students will realize that people are dependent on intact habitats that sustain the various organisms we need to produce food, medicines, clothing, and other materials.
CO2	Students will learn about certain species' roles in an ecosystem.
CO3	Students will discover that life can be found almost everywhere on earth.
CO4	Students will be able to identify species, characteristics, habitat requirements and life cycles of birds, fish and/or mammalian wildlife species.
CO5	

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO2	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**2**	**-**		
CO3	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**2**	**-**		
CO4	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**-**	**2**
CO2													**-**	**2**
CO3													**-**	**1**
CO4													**-**	**2**
CO5														

Program: Master of Science **Subject / Branch:** Environmental Science

Year : 2022/23 **Semester:** 4

Course title :	Eco- tourism and Conservation (ETC)	**Course code :**	MES401SC
Course type :	Elective	**Course credit :**	02

Teaching (Hours/week)			Examination Scheme			
Lecture	Tutorial	Practical	Internal		External	Total
			Mid	CE		
2	0	0	15	00	35	50

Content

Unit	Description in detail	Credit	Weightage
I	**Eco – Tourism** Introduction of tourism as an industry Concept of Eco Tourism Regulation of Eco tourism Impact of Ecotourism on the ecosystem	1	50 %
II	Role of ecotourism in conservation Ecotourism and local community Impact of ecotourism spots in india Tourism vs eco-tourism	1	50 %

Reference Books:

Bharucha, E. (2004). Text Book for Environmental Studies. University Grant Commission

Saravanan, K. (2005). Principles of Environmental Science and Technology. New AgeInternational (P) Limited, Publishers

Subject Code: MES401SE **Semester: IV**

Subject Name: Eco-tourism and conservation **Faculty Name/s: Pranav Patel**

Course Outcomes: At the end of the course, students shall be able to

CO1	Ecotourism is to minimize the impact brought about by tourism on the environment
CO2	The idea is to focus on uniting conservation, communities and sustainable development through the means of trave
CO3	To make the tourist industry more competitive and draw in private sector investment. To preserve and enhance the nation's natural and cultural resources. To ensure the nation's tourist industry develops in a sustainable, ethical, and inclusive manner.
CO4	Through ecotourism, people can learn about the importance of conservation and find ways to help protect the environment. It builds relationships between people and nature.
CO5	

CO - PO Competency and Program Indicators (PI)

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**-**		
CO2	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**2**	**-**		
CO3	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**2**	**-**		
CO4	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**-**		
CO5												

CO-PO & CO-PSO Mapping

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1													**-**	**2**
CO2													**-**	**2**
CO3													**-**	**1**
CO4													**-**	**2**
CO5														