Program and Course Structure

Department of Environmental Sciences

School of Basic Sciences and Research

M.Sc. (Environmental Science)

COURSE STRUCTURE AND SYLLABI
(As Per Guidelines of CBCS of UGC)

Programme code : SBR 0701

Batch : 2021-2023

1.1 Vision, Mission and Core Values of the University

Vision of the University

To serve the society by being a global University of higher learning in pursuit of academic excellence, innovation and nurturing entrepreneurship.

Mission of the University

1. Transformative educational experience
2. Enrichment by educational initiatives that encourage global outlook
3. Develop research, support disruptive innovations and accelerate entrepreneurship
4. Seeking beyond boundaries

Core Values

- Integrity
- Leadership
- Diversity
- Community

1.2 Vision and Mission of the School

Vision of the School Achieving excellence in the realm of science to address the challenges of evolving society

Mission of the School

- To equip the students with knowledge and skills in basic and applied sciences
- Capacity building through advanced training and academic flexibility.
- To establish centre of excellence for ecologically and socially innovative research.
- To strengthen inter-institutional and industrial collaboration for skill development and global employability.

Core Values

- Integrity
- Leadership
- Diversity
- Community

1.3 Vision and Mission of Environmental Science Department

Vision of Environmental Science Department

The vision of the Department of Environmental Science is to produce educated community who will ensure clean, safe, secured and sustainable environment for all.

Mission of Environmental Science Department

1. Equipping students with the knowledge to environmental problem and their conservation.
2. Conducting need-based research on contemporary environmental issues and producing scholarly works in the field of environmental science.
3. Organizing national and international events (e.g. conferences/workshops/seminars/symposiums/training programs).
4. Creating public awareness on natural resources; and past, present and future environmental constraints on Earth.

Core Values

- Integrity
- Leadership
- Diversity

1.4.1

PEO 1: To prepare students with strong foundation by imparting quality education in the field of Environmental Science and enable them to compete at national and international level.

PEO2: Use of various new and advance instrumentation techniques to address environmental problems.

PEO 3: To enhance communicative quantitative reasoning and interpretation skill for the analysis of field and laboratory data.

PEO 4: Inculcate students with high ethical & moral values, leadership qualities and having elevated efficiency to meet the growing demands of industries/ Higher Educational Institutes/ R &D, consulting firms etc.

1.4.2 Mapping PEOs with Mission Statements:

PEO Statements	School Mission 1	School Mission 2	School Mission 3	School Mission 4
PEO1:	2	3	3	2
PEO2:	3	2	2	2
PEO3:	3	2	3	3
PEO4:	3	2	3	2

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

1.4.3 Program Outcomes (PO's)

PO1: Enable students to understand and efficiently apply the basic concepts of physical, chemical, mathematical, and biological sciences appropriately to the discipline of environmental science.

PO2: Students become competent in carrying out various scientific studies including monitoring, modeling and analysis of major environmental components such as air, water, soil, and sediments. Additionally students were strategically trained to interpret and assess toxicological behavior of various contaminants and its effect on environment and human health.

PO3: Enable students to interpret and conduct risk assessment analysis of any environmental entities like river, lakes, agricultural lands, rural and urban atmosphere.

PO4: Acquired the skills of planning and framing useful strategies to deal with various types of environmental problems.

PSO1 : Students become proficient in identification, critically analyzing, and addressing various environmental issues and to explore and provide possible solutions.

PSO2 : Enable student to address the environmental and resource management issues through appropriate application of various software based techniques.

PSO3 : Qualitative and quantitative assessment of water, air and soil quality through various instrumentation based techniques.

PSO4 : Students become well trained to demonstrate knowledge and to apply basic environmental principles to his own work, as member or leader in a team and to execute multidisciplinary projects.

1.4.4 Mapping of Program Outcome Vs Program Educational Objectives

	PEO1	PEO2	PEO3	PEO4
PO1	3	3	3	2
PO2	2	3	3	2
PO3	2	3	2	3
PO4	3	3	2	2
PSO1	2	3	2	3
PSO2	3	3	3	2
PSO3	2	3	3	2
PSO4	3	2	2	3

1. Slight (Low)
2. Moderate (Medium)
3. Substantial (High)

1.4.5 Program Outcome Vs Courses Mapping Table:

1.4.5.1 COURSE ARTICULATION MATRIX

Course	PO1	PO2	PO3	PO4
MES101	3	2	2	2
MES102	2	2	2	3
MES103	2	3	3	2
MES104	2	2	2	3
MES105	2	2	2	2
MSG001	2	2	3	2
MES151	3	2	2	2
MES106	3	2	2	2
MES107	2	2	2	2
MES108	3	3	2	2
MES109	2	2	2	2
MES110	2	2	2	3
MWE203	3	2	2	3
MES152	3	3	2	2
CCU401	2	2	2	3
MES201	2	3	2	3
MES202	3	2	2	2
MES203	2	2	2	2
OPEXXX	2	2	2	2
MES204	3	3	2	2
MES 261	2	2	3	3
MES252	2	2	3	3
MES263	3	2	2	3
MES001	2	2	3	3

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

Program Structure
School of Basic Sciences & Research
M. Sc. ENVIRONMENTAL SCIENCE
Batch: 2021-2023
TERM: I

S. No.	Paper ID	Subject Code	Subjects	Teaching Load			Credits	Co/Elective Pre-Requisite /Co Requisite	Type of Course 1) CC 2) AECC 3) SEC 4) DSE
				L	T	P			
THEORY SUBJECTS									
1.		MES101	Climatology and Oceanography	4	-	-	4	Core	CC
2.		MES102	Applied Environmental Chemistry	4	-	-	4	Core	CC
3.		MES103	Natural Resource Management	4	-	-	4	Core	CC
4.		MES104	Fundamentals of Instrumentation Techniques	4	-	-	4	Core	CC
5.		MES105	Hydrology Basics and Water Management	4	-	-	4	Core	CC
6.		MSG001/ MWE108	Energy Economics and Policy/ Glaciology & Climate Change	4	-	-	4	Core	GE
Practical									
7.		MES151	Water Pollution & Monitoring Lab	-	-	4	2	Core	CC
TOTAL CREDITS							**26**		

Program Structure
School of Basic Sciences & Research
M. Sc. ENVIRONMENTAL SCIENCE
Batch: 2021-2023
TERM: II

S. No.	Paper ID	Subject Code	Subjects	Teaching Load			Credits	Core/Elective Pre-Requisite/Co Requisite	Type of Course 1) CC 2) AECC 3) SEC 4) DSE
				L	T	P			
THEORY SUBJECTS									
1.		MES106	Concepts of Environmental Toxicology	4	-	-	4	Core	CC
2.		MES107	Environmental Law and Audit	4	-	-	4	Core	CC
3.		MES108	Remote Sensing and GIS Application	4	-	-	4	Core	CC
4.		MES109	Global Climate System and Sustainable Development	4	-	-	4	Core	CC
5.		MES110	Disaster Management	4	-	-	4	Core	CC
6.		MWE203/ MEE112	Research Methodology/ Energy Sources and Global Scenario	4			4	Core	GE
Lab									
7.		MES152	Remote Sensing & GIS Lab	-	-	2	2	Core	CC
8.		CCU401	Community Connect Course	0	0	2	2	Core	SEC-1
TOTAL CREDITS							**28**		

Program Structure
School of Basic Sciences & Research
M. Sc. ENVIRONMENTAL SCIENCE
Batch: 2021-2023
TERM: III

S. No.	Paper ID	Subject Code	Subjects	Teaching Load			Credits	Pre-Requisite/ Co Requisite	Type of Course 1) CC 2) AECC 3) SEC 4) DSE
				L	T	P			
THEORY SUBJECTS									
1.		MES201	Water Treatment and Purification Techniques	4	-	-	4	Core	CC
2.		MES202	EIA and Risk Assessment Analysis	4	-	-	4	Core	CC
3.		MES203	Environmental Pollution and Control	4	-	-	4	Core	CC
4.		MES204	Health Safety and Environment	4	-	-	4	Core	CC
5.		OPEXXX	Open Elective	2	-	-	2	Core	SEC-1
Practical									
6.		MES261	Dissertation -1	-	-	4	4	Core	CC
7.		MES 252	Environmental Data Analysis	-	-	2	2	Core	CC
TOTAL CREDITS							**24**		

Program Structure
School of Basic Sciences & Research
M. Sc. ENVIRONMENTAL SCIENCE
Batch: 2021-2023
TERM: IV

S. No.	Paper ID	Course Code	Course	Teaching Load			Credits	Core/ Elective	Type of Course 1) CC 2) AECC 3) SEC 4) DSE
				L	T	P			
Practical									
1.		MES263	Dissertation-2	-	-	24	12	Core	Core
2.		MES001	Industrial Training Report	-	-	12	6	Core	Core
TOTAL CREDITS							**18**		

MES101: **Climatology and Oceanography**

School: SBSR		**Batch : 2021-2023**	
Program: MSc		**Current Academic Year: 2021**	
Branch: Environmental Science		**Semester: I**	
1	Course Code	**MES101**	
2	Course Title	**Climatology and Oceanography**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	1. Provide basic knowledge and concept on meteorological components 2 . Enable understanding of various atmospheric elements and phenomenon 3: Provide a thorough concept on air circulation 4: Enable students to understand about oceanic components and its related phenomenon 5: To impart comprehensive knowledge related to climate change 6: Overall in-depth understanding of various atmospheric and oceanic components and their role in influencing climate	
6	Course Outcomes	CO1: Includes introduction to atmospheric structure and composition CO2: Knowledge on various cloud forming processes and precipitation CO3: The concepts on global air masses and air circulation CO4: Thorough understanding of oceanic components like ocean currents, circulation and their relation in modification of climate CO5: Detailed overview in interpreting climatic variability through interpreting meteorological and oceanological change. CO6: Thorough understanding of the elements of meteorology and oceanography and their role in weather formation and climate change.	
7	Course Description	To develop thorough understanding of various meteorological and oceanographical components and how these components interact with each other for the formation of weather. Further with the passage of time how these factors contributes to the formation of climate.	
8	Outline syllabus		CO Mapping
	Unit 1	**Meteorological aspect**	
	A	Composition and Structure of the Atmosphere	CO1/CO6
	B	Insolation and heat balance	CO1/CO6
	C	Distribution of solar radiation, Energy Balance and	CO1/CO6

		Temperature			
	Unit 2	**Water in the atmosphere**			
	A	Atmospheric moisture, Water vapor and Humidity			CO2/CO6
	B	Atmospheric stability, lapse rates			CO2/CO6
	C	Cloud Formation and Precipitation process			CO2/CO6
	Unit 3	**Global air masses and circulation**			
	A	Katabatic and anabatic winds, Cyclone and anticyclone, Tornadoes			CO3/CO6
	B	Hadley cell, Jet Stream, Trade winds, ITZC			CO3/CO6
	C	Origin and mechanism of south west monsoon			CO3/CO6
	Unit 4	**Elements of oceanography**			
	A	The origin of ocean, earth structure and plate tectonics			CO4/CO6
	B	Reliefs of ocean basins, Marine sediments, water and sea water, concept of CCD			CO4/CO6
	C	Ocean circulation, ocean currents, ENSO and PDA			CO4/CO6
	Unit 5	**Climate change and variability**			
	A	Climate record, natural causes of climate change, human influence on climate change			CO5/CO6
	B	Melting and Disintegration of Glaciers, Rising Sea Levels			CO5/CO6
	C	Ocean acidification, depletion of coral reefs			CO5/CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*				
	Other References	**Reference Books:** 1.Climatology and Oceanography by D.S. Lal, Rastogi Publication 2. Climate Change 1995: The Science of Climate Change, John Theodore Houghton, Intergovernmental Panel on Climate Change, Cambridge University Press, 06-Jun-1996 3. Climate Change Science & Policy, Stephen H. Schneider, Armin Rosencranz, Michael D. Mastrandrea, Island Press, 14-Dec-2009.			

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2	3	3	2	2	2
CO2	3	1	2	1	1	3	2	3
CO3	1	1	2	2	2	1	1	3
CO4	1	1	2	3	2	1	3	2
CO5	2	1	2	2	2	1	2	2
CO6	2	2	3	2	2	2	2	2

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

MES102 : Applied Environmental Chemistry

School: SBSR		**Batch : 2021-23**	
Program: MSc		**Current Academic Year: 2021**	
Branch: Environmental Science		**Semester:**	
1	Course Code	**MES102**	
2	Course Title	**Applied Environmental Chemistry**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	1. Provide an insight into basic concept of chemistry 2 Enable to determine and investigate various water quality parameters 3: Provide a thorough concept on various chemical reactions takes place in the atmosphere 4: Enable to gain thorough knowledge on water chemistry and various related chemical reactions. 5: Detail understanding of the soil structure and various physicochemical factors influences soil formation 6: Overall in-depth understanding of various chemical reactions occurs in different segments of environments and factors affecting these reactions.	
6	Course Outcomes	CO1: Basic concept of chemistry and principles governing environmental reactions CO2: Knowledge of chemical water quality parameters CO3: The concepts of various chemical reactions takes place in the atmosphere CO4: Basic water chemistry and reactions CO5: Basic chemical and biological reactions occur in soil and affecting soil formation process. CO6: Overall understanding and knowledge of basic principles of environmental chemistry	
7	Course Description	To develop an understanding of basic principles that regulate and influence water, atmosphere and soil chemistry.	
8	Outline syllabus		CO Mapping
	Unit 1	**Basic concept of Chemistry**	
	A	Stoichiometry, Gibb's energy	CO1/CO6
	B	Chemical potential, chemical equilibria, acid base reactions	CO1/CO6
	C	Solubility product, solubility of gases in water	CO1/CO6

	Unit 2	**Concept and Scope of Environmental Chemistry**			
	A	Definition, Scope & Importance of Environmental Chemistry			CO2/CO6
	B	Definition and explanation for various terms: Acid, Base, pH			CO2/CO6
	C	Dissolved Oxygen, Biochemical oxygen demand, Chemical Oxygen Demand			CO2/CO6
	Unit 3	**Atmospheric Chemistry**			
	A	Atmospheric structure, Atmospheric composition			CO3/CO6
	B	Air pollution, Chemistry of Greenhouse gases, Acid rain			CO3/CO6
	C	Reactions, Primary and Secondary Pollutants, Photochemical Smog			CO3/CO6
	Unit 4	**Hydrospheric**			
	A	Water chemistry basics, Water Structure and Anomalous Behaviour of Water			CO4/CO6
	B	Oxidation and reduction, Dispersions, Dissolution and precipitation			CO4/CO6
	C	Chemical characteristics of water, Self-cleaning capacity			CO4/CO6
	Unit 5	**Pedospheric Chemistry**			
	A	Introduction to Soil Chemistry, Composition, Soil Profile, Formation of Soil			CO5/CO6
	B	Physico-Chemical Properties of Soil, Soil Reactions (Cation & Anion Exchange Phenomenon)			CO5/CO6
	C	Major Nutrients of Soil, Biogeochemical pathways			CO5/CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Environmental Chemistry: A.K. Dey, (Wiley Eastern Ltd), 1987. 2. A Text book of Environmental Chemistry: O.D. Tyagi, M. Mehra (Anand Publications Pvt, Ltd) 1994.			
	Other References				

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	2	3	2	3	1
CO2	2	2	1	3	2	3	3	2
CO3	2	2	2	1	2	1	1	3
CO4	2	1	1	2	2	2	2	3
CO5	2	1	2	2	2	1	2	2
CO6	2	2	2	2	2	2	2	2

1-Slight (Low)

2-Moderate (Medium)

3-Substantial (High)

MES103 Natural Resource Management

School: SBSR		**Batch : 2021-23**	
Program: M.Sc.		**Current Academic Year: 2021**	
Branch: Environmental Science		**Semester:**	
1	Course Code	MES104	
2	Course Title	**Natural Resource Management**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	1. Provide an insight into various natural resources 2. Enable understanding of ecology, ecosystem and sustainability 3. Provide a thorough concept on earth and water resources 4. Enable students to develop and understanding about biodiversity and biosystematics 5. Enable understanding about natural resource management 6. Overall in-depth understanding of various available natural resources and management	
6	Course Outcomes	CO1. Includes introduction to various natural resources. CO2. Knowledge on ecology, ecosystem and sustainability CO3. The concepts on earth and water resources CO4. The concepts on biodiversity and biosystematics CO5. Detailed understanding about various natural resources management CO6. Thorough understanding of available natural resources and its management	
7	Course Description	To develop thorough understanding of various natural resources and its management	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	
	A	Introduction to Natural Resource Bases; Forest resources; Land resources;	CO1/CO6
	B	Water resources; Energy resources; Food resources;	CO1/CO6
	C	Mineral resources; Management of Common International Resource	CO1/CO6
	Unit 2	**Ecology, Ecosystems towards Sustainability**	
	A	Definitions, history and relevance, levels of ecology, types of ecosystem, abiotic and biotic environments,	CO2/CO6

		biotic – abiotic interactions; Population ecology; Community ecology; Ecosystems ecology; Ecosystem conservation;	
	B	Global ecology/ Threats to Ecosystems: Greenhouse effect and climate change, ozone depletion, ecosystems responses to long-term climate patterns;	CO2/CO6
	C	Sustainability: Sustainability theory, the underlying ecological imperative, carrying capacity, sustainability and society (social justice, development, economy), Sustainable Forest, Management, Agenda-21 and UNEP programmes towards sustainable development.	CO2/CO6
	Unit 3	**Earth and Water Resources**	
	A	Earth resources: Earth Resources: Atmosphere, lithosphere, hydrosphere Interior of Earth, geological work of wind and water, underground water, igneous, sedimentary and metamorphic rocks	CO3/CO6
	B	Mineral types, mineral resources of India, erosion and weathering, soil formation, soil profiles, types of erosion, estimation of soil loss; Water Resources: hydrology, the hydrological cycle and its components, drainage systems	CO3/CO6
	C	Classification of water resources, characteristics of water resources. Surface run-off, stream flow estimation, problems of water and ground water resource depletion, watershed types and Functions	CO3/CO6
	Unit 4	**Biodiversity and Biosystematics**	
	A	Introduction to biodiversity: Definition, components, scope, and constraints of biodiversity (genetic diversity, species diversity, ecosystem diversity – agro-biodiversity, urban – peri-urban biodiversity)	CO4/CO6
	B	Forest biodiversity; biodiversity indices, threats to biodiversity	CO4/CO6
	C	Plant and animal taxonomy and systematics: Brief history and definition, the importance of taxonomy in Natural Resource Management, national and international organizations associated with taxonomic studies.	CO4/CO6
	Unit 5	**Applications for management**	
	A	Soil and water conservation measures, erosion control, case studies in water resource conservation and management	CO5/CO6
	B	Flood management and control, landslide control and mitigation measures, coastal zone management	CO5/CO6
	C	Watershed management and case studies, earthquake mitigation for buildings and dams, forest fire mitigation and management	CO5/CO6

	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Coastal Ecology & Management, Mann, K.H. 2000. Ecology of Coastal Waters with Implications for Management (2nd Edition).Chap. 2-5, pp.18-78 & Chap. 16, pp.280-303. 2. Global Change and Natural Resource Management, Vitousek, P.M. 1994. Beyond global warming: Ecology and global change. Ecology 75, 1861-1876.			
	Other References				

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2	3	3	2	2	2
CO2	3	1	2	2	2	3	2	3
CO3	2	2	2	2	2	1	1	3
CO4	2	2	2	3	2	1	3	2
CO5	2	1	2	2	2	1	2	2
CO6	2	2	3	2	2	2	2	2

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

MES 104: Fundamentals of Instrumentation techniques

School: SBSR		**Batch : 2021-23**	
Program: MSc		**Current Academic Year: 2021**	
Branch: Environmental Science		**Semester: I**	
1	**Course Code**	**MWE204**	
2	**Course Title**	**Fundamentals of Instrumentation techniques**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	1. To impart knowledge on soil analysis techniques 2. To impart knowledge on analytical principle related with water quality control. 3. Understanding of various gravimetric based principles and technique. 4. Understanding of spectrometric principles and techniques 5. Understanding of chromatographic and microscopic principles and techniques 6. Over understanding of basic instrumentation techniques for environmental analysis.	
6	Course Outcomes	CO1: Collection and preservation of soil samples CO2: Different physical and chemical analysis used for soil samples CO3: Different analysis used for water samples CO4: Heavy metal analysis in water CO5: Various principles and technique used in environmental analysis CO6: Overall understanding of basic instrumentation techniques	
7	Course Description	To develop an understanding regarding basic concepts involved in various instruments used for the analysis.	
8	Outline syllabus		CO Mapping
	Unit 1	**Soil analysis**	
	A	Collection and preservation of soil samples	CO1/CO6
	B	Physical analysis	CO1/CO6
	C	Chemical analysis	CO1/CO6
	Unit 2	**Water analysis**	
	A	Physical analysis	CO2/CO6
	B	Chemical analysis	CO2/CO6
	C	Heavy metal quantification	CO2/CO6
	Unit 3	**Principle and techniques of instrumentation used in environmental analysis**	
	A	Gravimetric, and volumetric analysis	CO3/CO6

	B	Colorimetric and Potentiometric analysis			CO3/CO6
	C	X-ray diffractometry			CO3/CO6
	Unit 4	**Principle and techniques of spectrometry**			
	A	Flame photometry, Atomic absorption spectroscopy			CO4/CO6
	B	Differential spectrophotometry, NMR spectroscopy			CO4/CO6
	C	Mass spectroscopy, Fourier Transform Infra Red Spectroscopy			CO4/CO6
	Unit 5	**Principle and techniques of chromatography and microscopy**			
	A	Gas chromatography, Ion chromatography			CO5/CO6
	B	Thin layer chromatography, High Performance Liquid Chromatography			CO5/CO6
	C	Scanning Electron Microscopy and Transmission Electron Microscopy .			CO5/CO6
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	APHA- Standard methods for the examination of water and wastewater. 17th edn. American Public Health Association, American water works Association and Water pollution control Federation, Washington, USA.			
	Other References	Practical methods in ecology and Environmental science- Trivedy R.K, Goel P.K, Trisal C			

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2	3	2	2	1
CO2	2	2	2	2	3	2	2	1
CO3	2	2	2	2	3	2	2	1
CO4	2	2	2	2	3	2	2	1
CO5	2	2	2	2	3	2	2	1
CO6	2	2	2	2	3	2	2	1

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

MES105: Hydrology Basics and Water Management

School: SBSR		**Batch : 2021-23**	
Program: MSc		**Current Academic Year: 2021**	
Branch: Environmental Science		**Semester: I**	
1	Course Code	**MES105**	
2	Course Title	**Hydrology Basics and Water Management**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	1. Understanding of basics of concept of hydrological cycle, monsoon system 2. Enable understanding of various physical factors influencing precipitation, types of precipitation, technical analysis of precipitation data 3: Provide a thorough concept on discharge and runoff 4: Enable students to understand about flood, its frequency and techniques of estimation. 5: To impart knowledge on ground water hydrology including concept of aquifer, groundwater flow and related phenomena 6: Overall this course helps in-depth understanding of various process and phenomenon related with hydrology.	
6	Course Outcomes	CO1: Understanding of role of hydrological cycle, knowledge of hydrologic budget. CO2: Knowledge on types on precipitation, its process, various technical aspects related with precipitation CO3: It deals with the discharge process runoff, and its quantitative estimation CO4: It gives understanding of flood, various technical aspects related with flood including flood frequency studies, flood routing concept etc. CO5: To understand the concept of aquifers, its types and various hydraulic phenomenon associated with aquifers CO6: Thorough understanding of various hydrological process and related hydrological events and related technical aspects.	
7	Course Description	To develop in-depth understanding on monsoon system, factors regulating hydrological cycle and water budget. Also provide focus on precipitation process and ways of analysis of precipitation data. Further this course also throw light on various analytical and technical component related with flood, indepth overview on ground water hydrology that includes concept of aquifers, Darcy's law and hydraulic potential .	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	

	A	Definition, need, history of hydrology			CO1/CO6
	B	world water inventory, the Indian scenario			CO1/CO6
	C	the hydrologic cycle, hydrologic budget, the monsoon system.			CO1/CO6
	Unit 2	**Precipitation**			
	A	Precipitation: process, forms, assessment of precipitation in ungauged basins, Analysis of Precipitation data: required number of rain gauges, data consistency check and data gap fill up			CO2/CO6
	B	Presentation of rainfall data–mass curve and hyetograph, precipitation variability, , estimation of mean precipitation over an area, depth area relationship			CO2/CO6
	C	Intensity duration-frequency relationship, probable maximum precipitation, Horton's equation and phi index method			CO2/CO6
	Unit 3	**Discharge and Runoff**			
	A	Measurement of Discharge, direct and indirect estimation methods, measurement of stage Runoff: components, water yield, flow duration curve, flow mass curve			CO3/CO6
	B	Hydrograph, factors affecting flood hydrograph, Unit Hydrograph-definition, assumptions, limitation, derivation of UH from storm hydrograph, derivation of UH of longer duration from UH of shorter duration			CO3/CO6
	C	Derivation of UH of shorter duration from UH of longer duration, derivation of storm hydrograph from UH			CO3/CO6
	Unit 4	**Flood**			
	A	Estimation of flood peak-Rational method, empirical formulae, Unit Hydrograph techniques			CO4/CO6
	B	Flood frequency studies; Flood Routing concept and techniques; hydrologic reservoir routing using Modified Pulse method			CO4/CO6
	C	Hydrologic channel routing using Muskingum method			CO4/CO6
	Unit 5	**Ground water hydrology**			
	A	Concept of aquifers, flow of water to a well in confined and unconfined aquifers, infiltration			CO5/CO6
	B	Soil properties, Darcy's Law and Hydraulic Potential, The Steady-state			CO5/CO6
	C	Groundwater Flow Equation Streamlines and Flow Nets, Regional Flow and Geologic Controls on Flow			CO5/CO6
	Mode of examination	Theory			
	Weightage	CA	MTE	ETE	

	Distribution	30%	20%	50%	
	Text book/s*	1. Subramanya K. (2004) Engineering Hydrology, Tata McGraw-Hill, New Delhi. 2. Chow V.T. (1988) Applied Hydrology, Tata McGraw Hill Publishing Co. 3. Patra K.C. (2011) Hydrology and Water Resources Engineering, Narosa Publishing House			
	Other References				

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3	1	3	1	1	1	1	1
CO2	2	2	2	2	1	1	1	1
CO3	2	2	2	2	1	1	2	1
CO4	2	1	3	2	2	2	2	1
CO5	3	1	3	2	2	1	1	2
CO6	3	1	2	2	2	2	1	2

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

MES151: Water Pollution and Monitoring Lab

School: SBSR		**Batch 2021-2023**
Program: M.Sc		**Current Academic Year : 2021**
Branch: Environmental Science		**Semester I**
1	**Course Code**	**MES151**
2	**Course Title**	**Water Pollution and Monitoring Lab**
3	Credits	2
4	Contact hours	0-2-0
	Course Status	Compulsory
5	Course Objectives	1. Provide an insight into various water quality parameters 2. . Enable student about water sampling techniques 3. Enable student to carry out experiments and data interpretation 4. Students gets expose to certain water quality analysis based instruments 5. Helps in analysis and comparison of results 6. Overall students will develop skill in water sampling techniques and water quality analysis.
6	Course Outcome	CO1 : pH and total dissolve solid determination in water samples CO2 : Analysis of CO_2 and alkalinity of the water samples CO3 : Estimation of Hardness and chloride content in water samples CO4 : Determination of dissolved oxygen in the water sample CO5 : Biological oxygen demand analysis of water sample CO6 : Overall understanding of various physical and chemical water quality parameters.
7	Course Description	This course gives exposure to students in terms of various qualitative and quantitative analytical techniques that helps in assessing water quality.

Scheme			**Scheme of Examination**		
L	P	T	Internal Assessment	Mid Term Examination	End Term Examination
0	2	0	60%	0%	40%

Course outline

This course gives exposure to students in terms of various qualitative and quantitative analytical techniques that helps in assessing water quality.

Course Evaluation

Attendance	None
Any other	--
References	
Text book	Vogel's "Textbook of quantitative Analysis", Pearson

Other References		
Softwares		
Week 1-3	**Unit 1**	**Practical related to –** pH and dissolve solids determination
	a)	Determination of pH of the various industrial, tap and ground water samples
	b)	Determination of total solids, dissolved solids and suspended solids in various industrial, tap and ground water samples
Week 4-7	**Unit 2**	**Practical related to –** CO_2 and alkalinity determination
	a)	Determination of CO_2 in pond water and ground water samples
	b)	Determination of alkalinity in water samples collected from local industries, tap and ground water.
Week 8-10	**Unit 3**	**Practical related to –** hardness and chloride determination
	a)	Determination of hardness in water samples collected from local industries, tap and ground water.
	b)	Determination of chloride in water samples collected from local industries, tap and ground water.
Week 11-12	**Unit 4**	**Practical related to** – dissolve oxygen determination by Winkler's method
		Determination of dissolve oxygen content of water samples collected from local industries, tap and ground water.
Week 13-14	**Unit 5**	**Practical related to** – biological oxygen demand determination
		Determination of biochemical oxygen demand of the water samples collected from local industries, tap and ground water.

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2	3	2	2	2
CO2	2	2	2	2	2	2	2	2
CO3	2	2	2	2	3	2	2	2
CO4	3	2	2	2	2	2	2	2
CO5	3	2	3	3	3	2	2	2
CO6	3	2	3	3	3	2	2	2

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

MES 106: Concepts of Environmental Toxicology

School: SBSR		**Batch : 2021-2023**	
Program: MSc		**Current Academic Year: 22**	
Branch: Environmental Science		**Semester: II**	
1	Course Code	MES106	
2	Course Title	Concepts of Environmental Toxicology	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	1. Understanding of various concepts related with toxicology, types of toxicants and toxicity as a function of dose response relationship. 2. Understanding of various mechanisms related with toxicity and detoxification process. 3: Provide a thorough concept on hepato, renal and immuno toxicology. 4: Impact of nanoparticles related toxicity in environment and human 5: Enable to comprehend the concept of environmental health 6: Overall this course helps in-depth understanding of various sources, effects and mechanism of toxicity.	
6	Course Outcomes	CO1:Concept of toxicology and its sources CO2:Dose response relationship CO3: Mechanism of toxicity CO4:Problems caused due to toxic chemicals CO5: Nanoparticles and its toxicity and human exposure and diseases CO6: Overall understanding of various sources, effects and mechanisms of toxicity.	
7	Course Description	To develop basic understanding of sources and mechanism of toxicity	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Toxicology**	
	A	General concept of toxicology and toxic chemical in environment	CO1/CO6
	B	Sources and mechanism of toxicity	CO1/CO6
	C	Dose-response relationship	CO1/CO6
	Unit 2	**Toxicity Mechanisms**	
	A	Bioaccumulation	CO2/CO6
	B	Bio-magnification	CO2/CO6
	C	Bio-transformation	CO2/CO6

	Unit 3	**Chemical Toxicology**			
	A	Hepato and Renal Toxicology			CO3/CO6
	B	Developmental Toxicology and Immunotoxicology			CO3/CO6
	C	Organic Pollutants and Inorganic Pollutants			CO3/CO6
	Unit 4	**Environmental Nanotoxicology**			
	A	Nanoparticles in environment and its fate			CO4/CO6
	B	Toxicological and eco-toxicology			CO4/CO6
	C	Exposure and threat of nanoparticles			CO4/CO6
	Unit 5	**Environmental Health**			
	A	Global and regional perspectives of environmental health			CO5/CO6
	B	Human exposure and health impact			CO5/CO6
	C	Environmental diseases			CO5/CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	Ware, George M.(Ed) (2007) Reviews of environmental contamination and toxicology. Vol. 190: Continuation of residue reviews, Springer Publishers			
	Other References	Tatiya, Ratan raj (2013) Elements of industrial hazards: Health, safety, environment and loss prevention Taylor and Francis. Theodore, Louis (2012) Environmental health and hazard risk assessment: Principles and calculations, CRC Press Wong, Ming H. (Ed.) (2013) Environmental contamination: Health risks and ecological restoration, CRC press Manahan, Stanley E. (2013) Fundamentals of environmental and toxicological chemistry: Sustainable sciences, CRC press			

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2	2	2	2	2
CO2	2	2	2	2	2	2	3	2
CO3	3	2	2	3	3	2	2	2
CO4	2	2	2	2	2	2	2	3
CO5	2	2	3	2	2	2	3	2
CO6	2	2	2	2	2	2	3	2

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

MES107 : Environmental Law and Audit

School: SBSR		**Batch : 2021-23**
Program: MSc		**Current Academic Year: 2022**
Branch: Environmental Science		**Semester: II**
1	Course Code	MES107
2	Course Title	**Environmental Law and Audit**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Compulsory
5	Course Objective	1. Understanding of various laws enacted at global level for the protection and conservation of environment. 2. Understanding of various law implemented at national level for the abatement of pollution and conservation of environment. 3: Provide a thorough concept on various environmental policies 4: Understanding of various provisions related to environment protection 5: Enable to comprehend the concept of environmental auditing 6: Overall this course helps in-depth understanding of various rules, regulation and policies related to the protection of environment
6	Course Outcomes	CO1: Understanding of role of Stockholm conference, Rio declaration and role of United Nation in protection of global environment. CO2: Knowledge various types of laws enacted for the prevention and protection of environment and abatement of pollution. CO3: It deals with various policies, rules and regulations in safeguarding our environment. CO4: It gives understanding of the duties and responsibilities towards environmental protection. CO5: To understand the concept of environmental auditing and techniques of auditing CO6: Thorough and indepth understanding of various environmental related laws, regulations and policies that helps keeps our environment preserved and protected.
7	Course Description	To develop in-depth understanding on various laws enacted to make use of the natural resources like air, water, and forest in a sustainable manner. The course also covers various duties and responsibilities towards environment as a citizen of India. It also introduce a concept of environmental auditing, its types and the techniques to carried out

		auditing.	
8	Outline syllabus		CO Mapping
	Unit 1	**International Environmental Law**	
	A	Evolution and development of International Environmental laws with reference to Stockholm Conference, Nairobi Declaration	CO1/CO6
	B	Rio+5, Rio+10 (Johannesburg Summit), Rio+20 etc. Agenda-21, etc.	CO1/CO6
	C	Global environmental issues and laws: to control Global warming, Ozone depletion, CITES. Role of UN in protection of Global Environment	CO1/CO6
	Unit 2	**Environmental law**	
	A	The Water (Prevention and Control of Pollution) Act 1974, Water cess act-1977,Prevention and Control of Air Pollution Act 1981, Forest Conservation Act 1981	CO2/CO6
	B	Environment (protection) Act 1986, Factories Act, Motor Vehicle Act , Solid waste management and hazardous rules	CO2/CO6
	C	Coastal Regulation Zones (CRZ) Rules 1991. Bio-Medical Waste (Management and Handling) Rules, 1998	CO2/CO6
	Unit 3	**Pollution abatement policies, rules and regulations**	
	A	Environmental Policy and laws. The role of courts	CO3/CO6
	B	Role of central & state Government	CO3/CO6
	C	Central & State pollution control boards for Safeguard for Environmental Protection	CO3/CO6
	Unit 4	**Environmental protection Mechanism**	
	A	Duties and responsibilities of citizens in environmental protection	CO4/CO6
	B	Important legislations related to environment: Provision of constitution of India regarding environment (article 48 A & 58A)	CO4/CO6
	C	Public liability Insurance Act. 1991	CO4/CO6
	Unit 5	**Environmental Audit**	
	A	Concept of environmental audit, objectives of audit, types of audit, Matrix Method and Baetelle Method of Auditing	CO5/CO6
	B	Organisation of Auditing Programme-pre visit and collection. Audit protocol, onsite audit, data sampling-Inspections-Evaluation and presentation	CO5/CO6
	C	Exit interview, Audit report-Action plan-Management of audits.	CO5/CO6
	Mode of examination	Theory	

	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Divan S. and Rosencranz A. (2005) Environmental Law and Policy in India, 2nd ed., Oxford, New Delhi. 2. Leelakrishnan P. (2008) Environmental Law in India, 3rd ed., Lexis Nexis, India			
	Other References				

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	2	2	2	2
CO2	2	3	2	2	2	2	2	2
CO3	3	2	2	3	2	3	2	3
CO4	2	2	2	2	2	3	2	2
CO5	3	2	3	2	2	3	2	2
CO6	3	2	2	2	2	2	2	2

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

MES108 : Remote Sensing and GIS Application

School: SBSR		**Batch : 2021-2023**	
Program: MSc		**Current Academic Year: 2022**	
Branch: Environmental Science		**Semester: II**	
1	**Course Code**	**MES108**	
2	**Course Title**	**Remote Sensing and GIS Application**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	1.Detailed understanding of various elements of remote sensing 2. Understanding of concepts and various components of GIS along with its advantages and disadvantages 3: Provide a thorough concept on interpretation GIS database 4: Enable to validate the data using remote sensing tool 5: Application of remote sensing in environmental management 6: Overall this course helps in-depth understanding of various components of remote sensing and application in the management of environment.	
6	Course Outcomes	CO1: Describe the concept of remote sensing and principle behind the same. CO2: Principles of GIS CO3: Use GIS and its different components for application in case studies CO4: Validate the remote sensing data by field measurements CO5: Remote Sensing Application in Land Use, Human Settlement and environmental analysis CO6: Overall understanding of various components of remote sensing and application environmental management.	
7	Course Description	To develop an understanding of geoinformatics, its principle, tools and techniques and application different fields of environmental science	
8	Outline syllabus		CO Mapping
	Unit 1	**Definition, types and concept of remote sensing**	
	A	Electromagnetic Radiation and Electromagnetic Spectrum, Interaction with the Atmosphere and radiation target	CO1/CO6
	B	Passive & Active Remote Sensing, Aerial Photographs and Satellite based Remote Sensing, Digital Image Processing and Interpretation	CO1/CO6
	C	Platforms and RS Data Acquisition Systems, Microwave Thermal Remote Sensing	CO1/CO6
	Unit 2	**Principles of GIS**	
	A	Basic Concepts: definition and component of GIS,	CO2/CO6
	B	Areas of GIS application, GIS Data and Data Structures.	CO2/CO6

	C	Advantage and Limitation of GIS			CO2/CO6
	Unit 3	**GIS Database**			
	A	Creating GIS Database-GIS Software, file organization and formats			CO3/CO6
	B	Method of spatial data capture			CO3/CO6
	C	Editing of data			CO3/CO6
	Unit 4	**Validation of Data**			
	A	Introduction to conventional field survey techniques			CO4/CO6
	B	Surveying Instruments			CO4/CO6
	C	Geopositioning-Basic Concepts,Positioning Types.			CO4/CO6
	Unit 5	**Remote Sensing Application in Environmental Science**			
	A	Agriculture, Soil, Forestry, Geosciences, Geology and Water Resources			CO5/CO6
	B	Environmental Analysis and Managements, Marine Science			CO5/CO6
	C	Land Use Application and Human Settlement Analysis			CO5/CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	Asrar Ghassem Theory and applications of optical remote sensing New York: John Wiley and Sons. Campbell J.B. (2002) Introduction to Remote Sensing, 3rd ed., The Guilford Press. Curran P.J., Principles of Remote Sensing, UK, ELBS.			
	Other References				

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	2	2	2	2
CO2	3	2	3	2	2	2	3	2
CO3	2	2	2	2	2	2	2	2
CO4	2	2	2	2	3	2	2	2
CO5	2	2	2	2	3	2	3	2
CO6	3	2	2	2	3	2	2	2

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

MES109: Global Climate System and Sustainable Development

School: SBSR		**Batch : 2021-23**
Program: M.Sc.		**Current Academic Year: 2022**
Branch: Environmental Science		**Semester: II**
1	Course Code	**MES109**
2	Course Title	**Global Climate System and Sustainable Development**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Compulsory
5	Course Objective	1. Understanding of various components of climate and related events 2. Understanding of green house effect concept and factors responsible for and role of IPCC towards climate change 3. Provide a thorough concept on sustainable development and various elements of sustainable development 4. Understanding of sustainable development in terms of business perspective 5. Enable to comprehend the concept of climate change and various policies initiated by government for mitigation. 6. Overall this course helps in-depth understanding of climate change, elements that responsible for climate change and various governmental approach for its mitigation.
6	Course Outcomes	CO1. Understanding of climate and its components, concept of global circulation CO2. Understanding of factors responsible for green house effect and global warming and role of IPCC CO3. It deals with the concept and understanding of sustainable development CO4. To understand the concept of sustainable development and its role in various businesses related activities. CO5. It gives clear understanding of the relation between climate change mitigation and sustainable development. CO6. Thorough and in-depth understanding of the causes responsible for climate change and ways of mitigating climate change by adopting governmental policies and promoting sustainable development.

7	Course Description	To develop in-depth understanding of climate and its related components. Factors that affecting the climate and leads to climate change. Various policies, regulations and efforts taken at global level in tackling the problem of climate change. Further the course also throws light on the interrelationship between sustainable development and climate change mitigation.			
8	Outline syllabus				CO Mapping
	Unit 1	**Climate and weather**			
	A	Origin of the earth, Constitution of the earth's interior system			CO1/CO6
	B	Weather and climate, Difference between Weather & Climate, Components of Earth's climate system			CO1/CO6
	C	Pressure, temperature, humidity, clouds, precipitation			CO1/CO6
	Unit 2	**Climate System**			
	A	Factors driving Natural and Anthropogenic sources of GHG emissions to the atmosphere			CO2/CO6
	B	Global warming potential, impact of climate change on ecosystem			CO2/CO6
	C	Kyoto Protocol, Role of IPCC in climate change impact			CO2/CO6
	Unit 3	**Sustainable Development**			
	A	Definition of Sustainable Development, Need of Sustainable Development,			CO3/CO6
	B	Environmental Sustainability, Economic Sustainability, Social Sustainability			CO3/CO6
	C	Sustainable Agriculture. Human Development and Sustainability			CO3/CO6
	Unit 4	**Sustainable Development and Business Perspective**			
	A	Sustainable Development and Business Strategy Prospective			CO4/CO6
	B	Corporate Social Responsibility, Industrial Ecology			CO4/CO6
	C	Enhancing Environment Management Systems			CO4/CO6
	Unit 5	**Environmental Audit**			
	A	Use of alternate energy resources for sustainability			CO5/CO6
	B	Govt. Policies for Mitigation - Current Status & Future Planning			CO5/CO6
	C	National & International Initiative			CO5/CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Sustainable Development: Economics & Environment in the Third World, David William			

		Pearce, Edward Barbier, Anil Markandya, Earthscan, 1990. 2. Sustainable Development: Critical Issues, Organisation for Economic Co-Operation and Development, OECD Publishing, 28-Jun-2001Environmental Impact Assessment, L. W. Canter, Mc Graw Hill, New York, 2010. 3. Climate Change: Physical Science Basis. IPCC, 2013.	
	Other References		

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2	3	2	2	2
CO2	2	2	2	2	2	2	3	2
CO3	2	2	2	2	2	2	2	2
CO4	2	2	2	2	2	3	2	2
CO5	3	2	3	3	2	3	2	1
CO6	3	3	3	3	2	2	2	2

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

MES 110: Disaster Management

School: SBSR		**Batch : 2021-20223**	
Program: M.Sc.		**Current Academic Year: 2022**	
Branch: Environmental Science		**Semester: II**	
1	Course Code	**MES110**	
2	Course Title	**Disaster Management**	
3	Credits	04	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	1. Concept of need of disaster management 2. Detail understanding of various types of disasters 3. Understanding and prediction of various risks associated with the disasters. 4. To understand the role and response of various national and international agencies during disaster 5. To analyze the various importance of rehabilitation and reconstruction process that facilitates effective coordination between relief and development.	
6	Course Outcomes	CO1. Knowledge about the various kinds of natural disasters. CO2. Impart conceptual understanding of various man made disasters CO3. Understanding of vulnerability and risk assessment concept. CO4. Understanding of the role of preparedness in disaster management program. CO5. Enlighten the relationship between disaster and development. CO6. Overall it commune a comprehensive view of the concept of disaster management	
7	Course Description	1. Various forms of natural and man made disasters 2. Conceptual understanding of various relevant disaster terminology. 3. Highlight the concept of disaster prevention and mitigation 4. The need of response plan and role of various agencies 5. Health management of disasters in pre, during and post disaster scenario.	
8	Outline syllabus		CO Mapping
	Unit 1	**Natural disasters and Management**	
	A	Introduction to natural disasters, Disaster management in India at District, State, and Central level, Flood, Drought	CO1/CO6
	B	Cyclones, Earthquakes, Tsunami and Landslides	CO1/CO6

	C	Avalanches, Volcanoes, Climate change: Global Warming and Ozone layer Depletion			CO1/CO6
	Unit 2	**Man made disasters and Management**			
	A	Introduction to man-made disasters, Nuclear Disasters, Chemical Disasters, Biological Disasters			CO2/CO6
	B	Building fire, Forest fire, Oil fire, Mine fire			CO2/CO6
	C	Air pollution, Water pollution, Deforestation, Road accidents, Air accidents, Sea accident			CO2/CO6
	Unit 3	**Hazard, risk and vulnerability management**			
	A	Concepts and elements of risks, risk reduction, risk analysis techniques.			CO3/CO6
	B	Participatory risk assessment, vulnerability assessment, vulnerability identification.			CO3/CO6
	C	Vulnerability factors and reduction strategies			CO3/CO6
	Unit 4	**Disaster preparedness and response**			
	A	Concepts and Significance, Disaster preparedness measures and plan			CO4/CO6
	B	Disaster and vulnerable groups, application of emerging technologies in disaster management			CO4/CO6
	C	Emergency plans, logistics management, damage assessment, rumour and panic management			CO4/CO6
	Unit 5	**Rehabilitation and health management during disaster**			
	A	Components of disaster medicine, medical preparedness plan, community health management			CO5/CO6
	B	Psychological rehabilitation, role of information and technology in health response, damage assessment			CO5/CO6
	C	Environmental Infrastructure development, Infrastructural planning in response to disaster, monitoring, evaluation and constraints of rehabilitation work			CO5/CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	**Reference Books:** 1. World Disasters Report, 2004, *Building Community Resilience,* International Red Cross and .~ Red Crescent Societies. 2. Oliver, John E. (Ed.), 2005, Encyclopedia of World Climatology, Springer, Netherland.			

		3. Introduction to disaster management, 2010, Damon Coppola, Elsevier (BH), USA	
	Other References		

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	3	2	2	2
CO2	2	2	3	2	2	2	2	2
CO3	2	2	2	2	2	2	2	3
CO4	2	2	2	2	3	2	3	2
CO5	2	2	2	2	3	2	3	2
CO6	2	2	2	2	2	2	3	2

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

3.3 Template: Syllabus for Theory Subjects

School: SBSR		**Batch : 2021-23**	
Program: MSc		**Current Academic Year: 2022**	
Branch: Water Resources and Environmental Management		**Semester: III**	
1	**Course Code**	MWE203	
2	**Course Title**	**Research Biostatistics and Computer Application**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	1. Understanding of various elements of research. 2. Enable to understand the concept of qualitative and quantitative research. 3. Thorough understanding of statistical approach in research 4. Understanding of computer application in research 5. Impart knowledge on thesis writing and various ethical issues related to publishing.	
6	Course Outcomes	CO1: Research and hypothesis CO2: Qualitative and Quantitative research CO3: Concept and levels of measurements CO4: Computer application based softwares CO5: CO6: Overall understanding on various aspects of research and related areas.	
7	Course Description	To develop an understanding of methods and various tools applied in research	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to research**	
	A	Foundations of Research, Concept of theory Concept of theory.	CO1/CO6
	B	Characteristics of scientific method – Understanding the language of research.	CO1/CO6
	C	Hypothesis Testing – Logic & Importance, Concept and Importance in Research, Exploratory Research Design, Experimental Design.	CO1/CO6
	Unit 2	**Qualitative and Quantitative Research**	

	A	Qualitative and Quantitative Research,			CO2/CO6
	B	Concept of measurement			CO2/CO6
	C	Levels of measurement			CO2/CO6
	Unit 3	**Statistical Research**			
	A	Sampling, Characteristics of a good sample,			CO3/CO6
	B	Probability Sample, Determining size of the sample,			CO3/CO6
	C	Data Analysis, Bivariate analysis.			CO3/CO6
	Unit 4	**Computer Applications**			
	A	Basic concepts of MATLAB			CO4/CO6
	B	Basic concepts of SPSS			CO4/CO6
	C	Application of softwares			CO4/CO6
	Unit 5	**Writing thesis and ethics**			
	A	Interpretation of Data and Paper Writing, Layout of a Research Paper.			CO5/CO6
	B	Journals in Environmental Sciences, Impact factor of Journals, When and where to publish?			CO5/CO6
	C	Ethical issues related to publishing, Plagiarism and Self-Plagiarism.			CO5/CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	C. R. Kothari, Research Methodology: Methods and Techniques, New Age Publication.			
	Other References				

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	2	3	3	2	3
CO2	3	3	3	2	3	2	2	3
CO3	3	3	2	2	3	2	2	2
CO4	3	2	2	2	3	2	3	3
CO5	2	3	2	2	3	2	3	2
CO6	3	2	3	2	3	2	2	3

MES152 : Remote Sensing and GIS Lab

School: SBSR		**Batch : 2021-2023**
Program: M. Sc		**Current Academic Year: 2022**
Branch: Environmental Science		**Semester: II**
1	Course Code	**MES152**
2	Course Title	**Remote Sensing & GIS Lab**
3	Credits	02
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	1. Provide an insight into various aspect of remote sensing 2. Enable students to do geo-referencing 3. Enable student to do layer staking 4. Students will get to know that how make maps of various locations 5. Enable student to do digitization 6. Overall students will develop skill in remote sensing.
6	Course Outcomes	CO1. Knowledge about earth explorer CO2. How to do geo-referencing CO3. How to do layer staking CO4. How to make map CO5. How to digitize CO6. Overall understanding of various components of remote sensing.
7	Course Description	This course gives remote sensing exposure to the students.
Week 1-3	**Unit 1**	Data downloading from earth explorer
Week 4-7	**Unit 2**	How to Geo-reference the image
Week 8-10	**Unit 3**	How to stake the layer
Week 11-12	**Unit 4**	How to make the map
Week 13-14	**Unit 5**	Image processing: Digitization
	Text book/s*	1. Asrar Ghassem Theory and applications of optical remote sensing New York: John Wiley and Sons. 2. Campbell J.B. (2002) Introduction to Remote Sensing, 3rd ed., The Guilford Press.

		3. Curran P.J., Principles of Remote Sensing, UK, ELBS.

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2	2	2	2	2
CO2	2	2	2	2	2	2	2	2
CO3	2	3	2	2	2	2	2	2
CO4	2	2	2	2	3	2	2	2
CO5	2	2	2	2	3	2	2	2
CO6	2	2	2	2	3	2	2	2

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

CCU401: Community Connect

School: SBSR		**Batch : 2021-2023**	
Program: M.Sc.		**Current Academic Year: 2022**	
Branch: Environmental Science		**Semester: II**	
1	Course Code	CCU401	
2	Course Title	Community Connect	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Compulsory	
5	Course Objective	1. To expose our students to different social issues faced by the people in different sections of society. 2. To connect their class-room learning with problem solving skills in real life scenario.	
6	Course Outcomes	1. Recognise social problems prevailing in different sections of society and finding the solution in sustainable manner. 2. Get practical exposure of all round development which complements their class room learning. 3. These activities will add value to students, faculty members, school and university. 4. Students develop skill in terms of interaction, data interpretation and its analysis. 5. In addition to Indian students international students also gets an opportunity to have an exposure with the local peoples and culture and enable them to connect with them by discussing various social, environmental and related issues. 6. Overall this course helps student to gain insight into the socio-economic structure of rural India and to understand various problems that obstruct the growth and development of rural India	
7	Course Description	In this mode, students will make survey, analyze data and will extract results out of it to correlate with their theoretical knowledge. E.g. Soil problem, water pollution problem, sanitation issues, waste management and various related problems.	
8	Outline syllabus		CO Achievement
	Unit 1	**Introduction to the Topic**	CO1,CO6
	Unit 2	**Drafting the questionnaire**	CO2,CO6

	Unit 3	**Survey**			CO3,CO6
	Unit 4	**Data collection, Discussions and result interpretation**			CO4, CO6
	Unit 5	**Report writing and Presentation**			CO5,CO6
	Mode of examination	Presentation and Viva			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	-			
	Other References	Research Methodology: Methods and Techniques, Kothari and Garg, New Age International Pvt. Ltd Publishers			

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1	2	3	1	2	2
CO2	2	2	1	2	2	2	2	2
CO3	2	2	2	1	2	1	1	1
CO4	2	1	2	2	3	2	2	2
CO5	2	2	2	2	3	2	2	1
CO6	2	1	2	2	3	1	2	2

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

MES201: Water Purification and Treatment Processes

School: SBSR		**Batch : 2021-2023**	
Program: MSc		**Current Academic Year: 2022**	
Branch: Environmental Science		**Semester: III**	
1	**Course Code**	**MES201**	
2	**Course Title**	**Water Purification and Treatment Processes**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	1. The concepts, and importance of wastewater treatment 2. Various techniques involved in wastewater treatment 3. Basics of designing of treatment plant 4. Various strategies for wastewater reuse and recovery 5. Suitable treatment plant for specific industries 6. Overall understanding of the basic concept and principles of water and wastewater treatment	
6	Course Outcomes	CO1.Objective, design and treatment of water and wastewater CO2.Types of wastewater treatment methods CO3. Biological treatment methods CO4. Advanced wastewater treatment methods CO5. Energy recovery and wastewater reuse and recovery CO6. Overall understanding of the basic concept of wastewater treatment and various techniques employed for its reclamation	
7	Course Description	To develop an understanding of the various methods of water and wastewater treatment and basics of designing a treatment plant.	
8	Outline syllabus		CO Mapping
	Unit 1	**Water treatment and Characterization of Wastewaters**	
	A	Objectives of wastewater treatment	CO1/CO6
	B	Design of waste water treatment	CO1/CO6
	C	Types of wastewater treatment plants	CO1/CO6
	Unit 2	**Waste Water Treatment**	
	A	Physical Treatment	CO2/CO6
	B	Chemical Treatment	CO2/CO6
	C	Membrane Filtration	CO2/CO6
	Unit 3	**Biological Wastewater Treatment, Recycling and Reusing**	

	A	Types of biological treatment			CO3/CO6
	B	Aerobic treatment			CO3/CO6
	C	Anaerobic treatment			CO3/CO6
	Unit 4	**Advanced Wastewater Treatment**			
	A	Nutrient removal			CO4/CO6
	B	Photocatalysis, ozonation and bioreactors			CO4/CO6
	C	Energy recovery			CO4/CO6
	Unit 5	**Wastewater Reuse and Recovery**			
	A	Treatment reuse and recovery			CO5/CO6
	B	Case studies of various industry types			CO5/CO6
	C	Zero liquid discharge			CO5/CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	Jain S.K. and Singh V.P. (2006). Water Resources Systems Planning and Management, Reed Elsevier India Pvt. Ltd., New Delhi.			
	Other References	Larry M. (2003). Urban Storm Water Management Tools, McGraw Hill Publication.			

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	3	2	2	2	2
CO2	2	2	3	2	2	3	2	2
CO3	2	2	2	3	2	3	1	2
CO4	2	2	2	3	3	2	1	2
CO5	2	2	2	3	3	2	1	2
CO6	2	2	3	3	3	3	2	2

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

MES 202: EIA and Risk Assessment Analysis

School: SBSR		**Batch : 2021-2023**	
Program: MSc		**Current Academic Year: 2022**	
Branch: Environmental Science		**Semester: III**	
1	**Course Code**	**MES201**	
2	**Course Title**	**Environmental Impact Assessment**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	1. Understanding of basic concepts, scope and purpose of EIA. 2. To provide knowledge on various methodologies employed for conducting EIA. 3. Provide a thorough concept on auditing and mitigation methods 4. Understanding of various elements of environmental risk assessment 5. Knowledge on emergency preparedness plan 6. Overall in-depth understanding of various components of EIA and risk assessment.	
6	Course Outcomes	CO1: EIA origin, concept, plans and case studies CO2: Steps and methods of EIA CO3: Monitoring, Mitigation and audit CO4: Methods for risk assessment, management plans and case studies CO5: Occupational health hazards and policies and emergency preparedness CO6: Overall understanding of various components of EIA and risk assessment.	
7	Course Description	To develop an understanding about EIA concepts and Methodologies, risk assessment, emergency preparedness and management plan	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to EIA**	
	A	Definition , scope and development of EIA, purpose, objectives and basic principles of EIA,	CO1/CO6
	B	Types of EIA, Strategic environmental assessment(SEA); History of EIA in India - EIA Gazette	CO1/CO6

		Notification, 1994 & 2006			
	C	Category A & Category B Projects, Prior Environment clearance(EC) requirements and stages, General EIA methodology			CO1/CO6
	Unit 2	**EIA methodology**			
	A	Screening- criteria, siting guidelines, prohibited zones; Scoping,			CO2/CO6
	B	Impact Identification -Checklists, matrices, qualitative methods, networks and overlay maps;			CO2/CO6
	C	Impact prediction- prediction models for impacts on air, water, soil and biological environment , Cost benefit analysis, Social impact assessment			CO2/CO6
	Unit 3	**Impact mitigation, monitoring & audit**			
	A	Mitigation methods and approaches, Appraisal, review, Decision making,			CO3/CO6
	B	Public consultation and participation, monitoring and auditing in EIA process, various forms of audit,			CO3/CO6
	C	Environment management plan (EMP), Environmental Impact Statement (EIS), Post-clearance Monitoring Protocol. Case studies: EIA of thermal power plant, mining.			CO3/CO6
	Unit 4	**Environmental Risk assessment**			
	A	Sources of Environmental hazards, Environmental risk assessment framework			CO4/CO6
	B	Path to risk analysis; Perception of risk, risk assessment in different disciplines.			CO4/CO6
	C	Elements of Environmental Risk Assessment, Methods for Risk Assessment: HAZOP and FEMA methods,			CO4/CO6
	Unit 5	**Risk management**			
	A	Risk communication and Risk Perception, comparative risks,			CO5/CO6
	B	Risk based decision making, Risk based environmental standard setting, , Emergency Preparedness Plans,			CO5/CO6
	C	Design of risk management programs, risk based remediation.			CO5/CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	Environmental Management: Principles & Practices, Christopher J. Barrow, Routledge, 1999 - Business &			

		Economics Handbook of Environmental Impact Assessment Vol. I and II, J. Petts, Blackwell Science, London, 2010.	
	Other References	Canter R.L., Environmental Impact Assessment, Mc Graw Hill International Edition, 1997 John G. Rau and David C. Wooten (Ed), Environmental Impact Analysis Handbook, McGraw Hill Book Company.	

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	2	2	2	2	2
CO2	2	2	1	2	2	3	2	2
CO3	2	2	2	1	2	3	2	2
CO4	2	2	2	2	3	2	2	2
CO5	2	2	2	2	3	2	2	2
CO6	2	2	2	2	3	3	2	2

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

MES203: Environmental Pollution and Control

School: SBSR		**Batch : 2021-23**	
Program: MSc		**Current Academic Year: 2022**	
Branch: Environmental Science		**Semester: III**	
1	Course Code	**MES203**	
2	Course Title	**Environmental Pollution and Control**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	1. Understanding of basics of pollution, types of air pollutants its sources and various impacts on human health and environment 2 . Enable understanding of various physical factors influencing dispersion of air pollutants 3: Provide a thorough concept on factors affecting water quality, major water pollutants, global water crisis, and treatment of wastewater 4: Enable students to understand types of soil, impact of industrialization and urbanization on soil quality and control measures 5: To impart knowledge on solid wastes, its types, and various disposal strategies 6: Overall this course helps in-depth understanding of basics of air, water and soil pollution, and various control measures adopted for the abatement of pollution	
6	Course Outcomes	CO1: Includes introduction and classification of air pollutants, its sources and its effects on local, regional and global scale. CO2: Knowledge on types on air pollutants, and analysis of various meteorological parameters responsible for dispersion of air pollutants in the atmosphere CO3: The concept of water quality and standards, various water pollution sources, effects and techniques employed for wastewater treatment CO4: Identification of soil types, and factors deteriorating the soil quality and various control measures to protect the critically degraded soil CO5: An overview on solid wastes its types, sources and various disposal strategies CO6: Thorough understanding of sources and factors responsible for air, water and soil pollution and various remedial measures employed in order to reduce the effect of pollution and abatement of pollutants.	
7	Course Description	To develop in-depth understanding of various aspects of air, water, and soil pollution. The course extensively covers various strategies that are being used for the control and abatement of the pollution.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	

	A	Definition, Classification of Pollution and Pollutants, Causes, Effects and Sources of Pollution			CO1/CO6
	B	Impacts of pollution on human health and biodiversity			CO1/CO6
	C	Effect of pollution in global, regional and local scale			CO1/CO6
	Unit 2	**Air Pollution**			
	A	Primary and Secondary Pollutants, Automobile Pollution, Industrial Pollution, Ambient Air Quality Standards and indices			CO2/CO6
	B	Meteorological aspects of air pollution- Wind profiles, Turbulent diffusion, Topographic effects, Temperature profiles in atmosphere, lapse Rates and Stability, Inversion, Plume behaviour			CO2/CO6
	C	Dispersion of air pollutants- solutions to the atmospheric dispersion equation - the Gaussian Dispersion Model, Instrumentation technique to control air pollution.			CO2/CO6
	Unit 3	**Water Pollution**			
	A	Point and Non-point Source of Pollution, major Pollutants of Water, Water Quality Requirement for different Uses			CO3/CO6
	B	Global water crisis Issues, Water quality standards, Coastal Pollution Due to Industrial Effluents, Effects of water pollution and its control			CO3/CO6
	C	Water and waste water treatment- primary and secondary treatment methods			CO3/CO6
	Unit 4	**Soil Pollution**			
	A	Classification of soil types, Effects of urbanization on land degradation			CO4/CO6
	B	Impact of Modern Agriculture on Soil, Effect on Environment and Life sustenance			CO4/CO6
	C	Abatement measures, Effects and Control measures.			CO4/CO6
	Unit 5	**Solid Waste Pollution**			
	A	Solid waste Classification, Different sources of Solid waste			CO5/CO6
	B	Different methods of Disposal, Effect of urban and industrial solid waste on environment			CO5/CO6
	C	Control methods, incineration, landfill			CO5/CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Text book of Environmental Science and Technology by Dr. M. Anji Reddy, BS Publications, 2010. 2. Environmental Science- Towards a sustainable future by Richard T. Wright, PHI Learning, New Delhi 2008.			
	Other References				

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2	1	2	1	1	1
CO2	2	2	1	2	2	2	3	2
CO3	3	2	2	3	3	2	2	2
CO4	2	1	1	2	2	2	2	3
CO5	2	1	3	2	2	1	1	2
CO6	2	1	2	2	2	2	1	2

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

MES204: Health Safety and Environment

School: SBSR		**Batch : 2021-23**	
Program: M.Sc.		**Current Academic Year: 2022**	
Branch: Environmental Science		**Semester: III**	
1	Course Code	**MES204**	
2	Course Title	**Health Safety and Environment**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	1. Understanding of relation among health safety and environment 2. Understanding about safety measures at various work places 3. Understanding about various components of health safety and environment 4. Understanding of health safety and environment related responsibilities and accountabilities in industries 5. Enable to understand health and safety management system 6. Overall this course helps in-depth understanding of health safety and management	
6	Course Outcomes	CO1. Understanding of relation among health safety and environment CO2. Understanding about safety measures at various work places CO3. It deals with the concept and understanding of health safety and environment CO4. To understand the concept of health safety and environment related responsibilities and accountabilities in industries. CO5. It gives clear understanding of health and safety management system. CO6. Thorough and in-depth understanding of health safety and management	
7	Course Description	To develop in-depth understanding of health safety and management. This course will also be beneficial to build an understanding about health and safety management systems and its implementation and accreditations	
8	Outline syllabus		CO Mapping
	Unit 1	**Health, Safety and Human Relation**	
	A	Definitions, Safety as a practice in life, Risk Perception, Health care	CO1/CO6
	B	Environmental Health, Public health etc.	CO1/CO6
	C	Safety at home, safety at rural areas, child labour,	CO1/CO6

		welfare. National initiatives to eradicate child labour and awareness			
	Unit 2	**Safety at work**			
	A	Socio - Economic reasons. Introduction to health and safety at various industries. Arrangements by organizations to protect the workers			CO2/CO6
	B	Interest of stake holders and neighbours, Training and awareness programmes on safety at work			CO2/CO6
	C	Health monitoring in India. Health monitoring in USA, UK and Middle east countries			CO2/CO6
	Unit 3	**Definitions**			
	A	Hazard, Hazardous event, Risk, Health, Safety, Environment etc			CO3/CO6
	B	Acceptable definitions and meaning			CO3/CO6
	C	Number of terms used in Health and safety originated by national and international organizations			CO3/CO6
	Unit 4	**Responsibilities and accountabilities in Industries**			
	A	National level: Responsibilities and accountabilities of owners, employers			CO4/CO6
	B	Workers, stake holders, suppliers, manufacturers, government entities etc			CO4/CO6
	C	International: Responsibilities and accountabilities entrusted on Government organizations in UK, USA and Middle East Countries			CO4/CO6
	Unit 5	**Introduction to health and safety management systems and its implementation and accreditations**			
	A	OHSAS 18001, ILO-OSH 2001, ISO 45000, HSG 65 Examples of management systems form other areas: ISO 9001, EMS 14001, ISO 22000 etc			CO5/CO6
	B	Organizations involved in developing occupational health and safety management systems: International organsiation for Standardization, British Standards Institution, Health and safety executive, International labour organisation			CO5/CO6
	C	Accreditations and monitoring of management systems			CO5/CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		30%	20%	50%	
	Text book/s*	1. Occupational health and safety management systems – requirements (OHSAS 18000 series)1 2. ISO 14001 (Environmental Management Systems)			

		3. OSHA, Code of Federal Regulations – USA 4. Managing for health and safety (HSG 65 – UK) 5. Encyclopaedia of Occupational Health and Safety, ILO 6. HSE Guide Volume I, II and III, NSC – India 7. Safety, Health & Working Conditions – Training Manual - Publication of Joint Industrial Safety Council, Sweden and ILO, Geneva	
	Other References		

POs COs	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	2	3	2	1	2
CO2	2	3	2	1	3	2	2	2
CO3	2	3	2	2	3	2	2	1
CO4	2	1	3	3	2	2	2	2
CO5	3	2	3	3	2	2	2	1
CO6	3	2	3	3	2	2	2	2

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

MES 261: Dissertation I

School: SBSR		**Batch :2021- 2023**	
Program: M.Sc.		**Current Academic Year: 2022**	
Branch: Water Resource and Environmental Management		**Semester: III**	
1	Course Code	**MES-261**	
2	Course Title	**Dissertation I**	
3	Credits	4	
4	Contact Hours (L-T-P)	0-0-4	
	Course Status	Compulsory/Elective	
5	Course Objective	1. To enhance the practical knowledge and result analysis skills. 2. To enable the students experience a real-life problem solving under the supervision of faculty members. 3. To prepare the students perform functions that demand higher competence in national/international organizations. 4. To train the students in scientific research. 5. To help the students find meaning in life by broadening their field of vision. 6. Develop deep knowledge of a specific area of specialization by literature search.	
6	Course Outcomes	CO1. Able to do logical and systematic search for new and useful information on water resource. CO2. Able to do literature search, develop deeper interest/inquisitiveness in environmental science and interdisciplinary subjects. CO3. Able to understand the research areas related to the subject. CO4. Understand the basics of water and become familiar with qualitative and qualitative estimations. CO5. Able to analyse the results CO6. Enhance the analytical skills.	
7	Course Description	This course provides the knowledge of water and its various resources and gives confidence and a solid foundation for future learning.	
8	Outline syllabus		CO Achievement
	Unit 1	Introduction of subject / Literature search	CO1,CO6
	Unit 2	Concept building and Study designing	CO2,CO6

	Unit 3	Selection of the objectives			CO3,CO6
	Unit 4	Data collection, Discussions and result interpretation			CO4, CO6
	Unit 5	Report writing			CO5,CO6
	Mode of examination	Presentation and Viva			
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	-			
	Other References	Pubmed Search (NCBI) Review and research articles of Indexed Journals			

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
C204.1	2	2	2	2	3	2	2	3
C204.2	3	2	2	3	2	3	2	3
C204.3	3	2	2	2	3	2	2	3
C204.4	2	2	3	2	2	3	2	3
C204.5	3	3	2	2	3	2	2	3
C204.6	3	1	1	2	3	2	2	3

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

MES 252: Environmental Data Analysis Lab

School: SBSR		**Batch : 2020-2022**
Program: M. Sc		**Current Academic Year: 2022**
Branch: Water Resource and Environmental Management		**Semester: III**
1	Course Code	**MES -252**
2	Course Title	**Environmental Data Analysis Lab**
3	Credits	02
4	Contact Hours (L-T-P)	0-0-4
	Course Status	Compulsory
5	Course Objective	1. Provide an insight into various climatic parameters 2. Provide an insight to analyse the changing point of the data 3. Enable student to carry out data interpretation 4. Enable student to apply statistical tools to analyse the data 5. Helps in analysis and comparison of results 6. Overall students will develop skill in climatic data analysis.
6	Course Outcomes	CO1. Plotting the data CO2. Biasness correction of the data CO3. Analyse the outlier in the data CO4. Analyse the trend of the data CO5. Significance analysis through Mann-Kendall and Sen's slope test CO6. Overall understanding of various statistical tool to analyse the data
7	Course Description	This course gives exposure to students in terms of various qualitative analytical techniques that help in assessing climatic data

Week 1-3	**Unit 1**	**Practical related to –** Plotting the data
	a)	How to work in excel
	b)	Data arrangement and Plotting the graph
Week 4-7	**Unit 2**	**Practical related to –** Biasness correction of the data
	a)	Knowledge about the method which can used for biasness correction
	b)	Techniques used to remove the biasness of the data
Week 8-10	**Unit 3**	**Practical related to –** Analyse the outlier in the data

	a)	Knowledge about the method which can used to point-out the outlier of the data
	b)	Techniques used to remove the outliers
Week 11-12	**Unit 4**	**Practical related to –** Analyse the trend of the data
		Determination of the positive/negative trend of the data
Week 13-14	**Unit 5**	**Practical related to –** Significance analysis through Mann-Kendall and Sen's slope test
		How to perform Mann-Kendall and Sen's slope test
	Text book/s*	Research Methodology: Methods and Techniques

POs COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1	2	2	2	3	1	3
CO2	2	1	1	1	3	2	2	1	2
CO3	3	3	2	1	2	2	2	1	2
CO4	2	3	2	2	3	3	3	1	2
CO5	2	2	2	2	3	3	3	1	1
CO6	2	2	2	2	3	3	2	1	2

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

MES 263 : Dissertation 2

School: SBSR		**Batch :2021-2023**	
Program: M.Sc.		**Current Academic Year: 2023**	
Branch: Environmental Science		**Semester: IV**	
1	Course Code	**MES263**	
2	Course Title	**Dissertation B**	
3	Credits	12	
4	Contact Hours (L-T-P)	0-0-24	
	Course Status	Compulsory	
5	Course Objective	1. To enhance the practical knowledge and result analysis skills. 2. To enable the students experience a real-life problem solving under the supervision of faculty members. 3. To prepare the students perform functions that demand higher competence in national/international organizations. 4. To train the students in scientific research. 5.Develop research/ experimentation skills as well as enhancing project writing and oral presentation skills 6. Inculcate team spirit and time management.	
6	Course Outcomes	CO1. Able to develop analytical skill. CO2. Cultivate the understanding of problem, study design, methodology/ experimentation, significance of reproducibility of results. CO3. Understanding of ethics of science and research for supporting higher studies. CO4. Learn effective project organizational skills along with discussions, result interpretation and paper writing. CO5. Able to analyse the results. CO6. Enhance the research skills.	
7	Course Description	This course will help to develop knowledge and research skills applicable to a career in environmental science.	
8	Outline syllabus		CO Achievement
	Unit 1	Introduction of subject/ literature search	CO1,CO6
	Unit 2	Concept building and study design	CO2,CO6
	Unit 3	Deep understanding about the research topic	CO3,CO6

	Unit 4	Data collection, Discussions and result interpretation			CO4, CO6
	Unit 5	Report writing			CO5, CO6
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	-			
	Other References	Pubmed Search (NCBI) Review and research articles of Indexed Journals			

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	3	2	2	3
CO2	2	2	2	2	2	2	2	3
CO3	3	2	2	2	3	2	2	2
CO4	2	2	2	2	3	2	2	3
CO5	3	3	2	2	2	2	2	2
CO6	3	1	1	2	3	2	2	3

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)

MES001 : Industrial Training Report

School: SBSR		**Batch :2021-2023**	
Program: M.Sc.		**Current Academic Year: 2023**	
Branch: Environmental Science		**Semester: IV**	
1	Course Code	**MES001**	
2	Course Title	**Dissertation B**	
3	Credits	06	
4	Contact Hours (L-T-P)	0-0-12	
	Course Status	Compulsory/Elective	
5	Course Objective	1. To enhance the practical knowledge and result analysis skills. 2. Enhance problem solving capability of the students 3. To prepare the students perform functions that demand higher competence in national/international organizations. 4. Helps students to get trained in scientific research. 5.Develop research/ experimentation skills as well as enhancing project writing and oral presentation skills 6. Inculcate team spirit and time management.	
6	Course Outcomes	CO1. Able to develop analytical skill. CO2. Cultivate the understanding of problem, study design, methodology/ experimentation, significance of reproducibility of results. CO3. Understanding of ethics of science and research for supporting higher studies. CO4. Learn effective project organizational skills along with discussions, result interpretation and paper writing. CO5. Able to analyse the results. CO6. Enhance the research skills.	
7	Course Description	This course will help to develop knowledge and research skills applicable to a career in environmental science.	
8	Outline syllabus		CO Achievement
	Unit 1	Introduction of subject/ literature search	CO1,CO6
	Unit 2	Concept building and study design	CO2,CO6
	Unit 3	Deep understanding about the industrial process	CO3,CO6
	Unit 4	Data collection, Discussions and result interpretation	CO4, CO6

	Unit 5	Report writing			CO5, CO6
	Weightage Distribution	CA	MTE	ETE	
		60%	0%	40%	
	Text book/s*	-			
	Other References	Pubmed Search (NCBI) Review and research articles of Indexed Journals			

CO/PO	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	3	2	2	3
CO2	2	2	2	2	2	2	2	3
CO3	3	2	2	2	3	2	2	2
CO4	2	2	2	2	3	2	2	3
CO5	3	3	2	2	2	2	2	2
CO6	3	2	2	2	3	2	2	3

1-Slight (Low)
2-Moderate (Medium)
3-Substantial (High)