

2021

SYLLABUS OF POSTGRADUATE PROGRAMMES



SCHOOL OF ENVIRONMENTAL SCIENCES
MAHATMA GANDHI UNIVERSITY



Mahatma Gandhi University

School of Environmental Sciences

Programmes:

- 1. MSc. Environment Science and Management**
- 2. MSc. Environment Science and Disaster Management**

PROGRAMME SPECIFIC OUTCOMES (PSO)

MSc. ENVIRONMENT SCIENCE & MANAGEMENT

1. To understand the basic concepts of environment and its interactions with the earth and environmental systems and various ecosystems associated with it.
2. Capability to analyse, evaluate and interpret the causes and effects of various environmental problems at local, regional and global scale and to develop management strategies.
3. Capacity to analyse and determine the magnitude of different kinds of environmental pollution, their sources using environmental analytical techniques, quantitative and computational techniques.
4. Acquire interdisciplinary knowledge on the global aspects of climate change, its effects on the environment and its governance
5. Capacity to use biotechnological methods in water and wastewater treatment technology. Ability to apply appropriate techniques for efficient solid waste management practices and to find the solutions to the air pollution problems.

6. Ability to use different tools for the management of energy resources, biodiversity conservation, natural disasters and technical knowhow of remote sensing & GIS applications in environment management.
7. Ability to analyse a given research problem, identify research gaps, developing suitable research methodology with suitable research design , data collection, data analysis with suitable statistical tool , interpretation of the findings leading to perfect solution to the problem given.
8. Demonstrate proficiency in quantitative methods, qualitative analysis, critical thinking, and written and oral communication needed to conduct high-level work as interdisciplinary scholars and/or practitioners.
9. Master the core concepts and methods from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.
10. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.

MSc. ENVIRONMENT SCIENCE & DISASTER MANAGEMENT

1. To understand the basic concepts of environment, its interaction with the earth systems, and various ecosystems associated with it in relation to the disasters.
2. Enhance the capability to analyse, evaluate and interpret the causes and effects of various environmental problems in relation to disasters at local, regional and global scale and to develop management strategies.
3. Acquire basic knowledge, understanding and implementation of the International strategy on Disaster Reduction (UN-ISDR); to increase the skills and abilities for disaster risk reduction (DRR).
4. Acquire practical and research knowledge to build capacities that will reduce disaster risks and contribute to better relief measures.
5. Attain capacity to describe, analyse and evaluate the environmental, social, cultural, economic, legal and organisational aspects influencing vulnerabilities and capacities to face disasters.
6. Develop ability to work with theoretical and practical processes of disaster management (disaster risk reduction, response, and recovery) and relate their interconnections.

7. Enhance capacity to analyse, and communicate information on risks, relief needs and the lessons learned from past disasters in order to formulate mitigation strategies for the future scenarios; also to build clarity in presentation, discussion and in delivering the conclusions based on the knowledge and arguments.
8. Create ability to design and perform research on different aspects of emergencies and disaster events while demonstrating insights into the potential and limitations of science, its role in society and people's responsibility
9. Ability to coordinate community based disaster management strategies, in local and regional levels.
10. Demonstrate proficiency in quantitative methods, qualitative analysis, critical thinking, with written and oral communication skills needed for conducting high quality work as interdisciplinary scholars and/or practitioners.



SCHEME OF THE SYLLABUS**MSc. Environment Science and
Disaster Management****Credit and Semester System****2021 admission onwards****Semester I**

Sl. No.	Course Code	Name of the Course	Credits	Credits Required	Total Credits
01	ES M 21 C 51	Introduction to Environment & Ecosystems	3	18	24
02	ES M 21 C 52	Earth's systems processes and landforms	3		
03	ES M 21 C 53	Natural and anthropogenic disasters	3		
04	ES M 21 C 54	Pollution hazards and its Management	3		
05	ES M 21 C 05	Research Methodology and Statistics	3		
06	ES M 21 C 06	Lab course-1 (Equipment used in Disaster Management, First aid, Geosciences)	3		
07	ES M 21 E 10	Introduction to Remote Sensing, GNSSs and GIS	2	6	
08	ES M 21 E 55	Chemical systems in Environment	2		
09	ES M 21 E 56	Basic Life Skills/First Aid for Disaster Management	2		
10	ES M 21 E 57	Field skills and techniques in Disaster Management	2		

Semester II

Sl. No.	Course Code	Name of the Course	Credits	Credits Required	Total Credits
11	ES M 21 C 11	Analytical Techniques and Instrumentation	3	18	24
12	ES M 21 C 12	Environmental Laws, Ethics, Education and Policy	3		
13	ES M 21 C 14	Environmental Biotechnology and Waste Management	3		
14	ES M 21 C 15	Biodiversity and Conservation Biology	3		

15	ES M 21 C 58	Public health aspects and emergency services in disaster management	3	6	
16	ES M 21 C 16	Lab course-II (Environmental Chemistry, Environmental Biotechnology, RS & GIS)	3		
17	ES M 21 E 17	Ecotoxicology	2		
18	ES M 21 E 59	Disaster Risk Reduction and Sustainable Development	2		
19	ES M 21 E 60	Applications of Science and Technology for Disaster Management	2		
20	ES M 21 E 61	Social Work Approaches and Practices	2		

Semester III

Sl.No.	Course Code	Name of the Course	Credits	Credits Required	Total Credits
21	ES M 21 C 62	Disaster Risk Assessment & Mitigation	3	18	24
22	ES M 21 C 63	Standards in Humanitarian Aid, Relief and Rehabilitation	3		
23	ES M 21 C 64	Community Based Disaster Management	3		
24	ES M 21 C 65	Governance, Law and Policies in Disaster Management	3		
25	ES M 21 C 25	Lab course III (RS & GIS and Instrumental analysis)	3		
26	ES M 21 C 26	Group Project/Field work	3		
27	ES M 21 E 27	Climate Change & Governance	2	2	
	Open Course			4	

Semester IV

Sl.No.	Course Code	Name of the Course	Credits	Credits Required	Total Credits
28	ES M 21 C 70	Internship (Community/Institution) – One month	4	4	16
	ES M 21 C 71	Project Work (Report/Thesis)	12	12	

SYLLABUS

M.Sc. Environment Science and Disaster Management

Credit and Semester System

2021 admission onwards

SEMESTER I



MAHATMA GANDHI UNIVERSITY

**Name of the Course: ES M21 C 51
Introduction to Environment & Ecosystems**

School Name	School of Environmental Sciences					
Programme	M.Sc. Environment Science and Disaster Management					
Course Name	Introduction to Environment & Ecosystems					
Type of Course	Core					
Course Code	ES M21 C 51					
Names of Academic Staff & Qualifications	Dr. Syllas V.P., MSc., PhD					
Course summary & Justification						
Semester		1	Credit			3
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs
		40	10		4	54
Pre-requisite	The students have basic understanding and readings on ecology and environmental science					

CO No.	<i>At the end of the course, the student will be able to:</i>	Taxonomic Level (TL)	PSO
1.	Explain the concept of ecology and relevance of environmental science	U	1
2	Able to distinguish the structure, organization and processes in various ecosystems	A	1, 10
3.	Develop a knowledge on the structural and functional aspects of a population as an ecological unit	Ap	1, 2
4	Understand and analyse the concept of biological community, changes and interactions within community	U, A	6,9
5	Develop skill on applied aspects of ecology including mathematical or conceptual model of population or community dynamics to analyse the various factors of population growth and regulation.	Cr	7, 8



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**Name of the Course: ES M21 C 51
Introduction to Environment & Ecosystems**

Unit	Course Description	Hours	CO No.
1.0	Introduction	11	1,2
1.1	Basic concepts of Environment –	2	1
1.2	Multidisciplinary approach	2	1,2
1.3	Basic concepts - Science, Matter and Energy	2	1,
1.4	Evolution of earth, origin of species, diversity and distribution of species	3	1
	Global environmental issues – an introduction	2	1, 2
2.0	Ecology	12	2, 3
2.1	Definition, History of ecology, Subdivisions, Ecology and other subjects.	2	2
	Fundamental ecological variables	2	2, 3
2.2	Ecosystems: Definition, Components, Structure and function, Size of Ecosystem,	3	2
2.3	Classification of ecosystems	3	2
2.4	Comparative Ecosystem Ecology	2	2,3
3.0	Population Ecology	10	3,5
3.1	Definition, Structure and Measures	2	3
3.2	Population growth,	2	3
3.3	Regulation strategies of species	2	3
3.4	Survivability Population genetics	2	3
3.5	Human population	2	3,5
4.0	Community Ecology	10	4, 5
4.1	Concepts, Community gradients, Characters of community	2	4
4.2	Ecological Succession and climax Community	3	4



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**Name of the Course: ES M21 C 51
Introduction to Environment & Ecosystems**

4.3	Organization -interactions between species	3	4
4.4	Stress ecology and adaptation	2	4,5
5.0	Applied Ecology	11	3,4, 5
5.1	Estimating abundance, species diversity measures	2	3
5.2	Diversity indices	2	5
5.3	Mathematical ecology : Eco-informatics	2	5
5.4	Museology	1	5
5.5	Taxonomy and Biosystematics	2	3, 4,
5.6	Biomass productivity and estimation techniques	2	3,4,

Teaching and Learning Approach	<ul style="list-style-type: none"> • Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning (Video), interactive Instruction:, Active co-operative learning, Seminars, Group Assignments Authentic learning, , Library work and Group discussion, Presentation by individual student/ Group representative; Field work and field visits
Assessment Types	<ol style="list-style-type: none"> 1. Continuous Internal Assessment (CIA) <ul style="list-style-type: none"> Internal test Assignments based on the theory Seminar Presentation Field visit report 2. Semester End examination

References

1. Brewer, R. (1994), the Science of Ecology, Saunders College Publishing, New York.
2. Chapman, J. L. And Reiss, M. J. (1992), Ecology: Principles and Application, Cambridge University Press, Cambridge.
3. Groombridge, B. (ed) 1992. Global Biodiversity: Status of the Earth's Living Resources, Chapman and Hall, London.
4. Hughes, J, D. 2001. An Environmental History of the World. Routledge, London.
5. Michael, P. 1990. Ecological methods for Laboratory and Field Investigations, Tata McGrew Hill Publishing Company Ltd, New Delhi.
6. Odum,E.P.1971.Fundamentals of ecology



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Name of the Course: ES M21 C 51
Introduction to Environment & Ecosystems

7. Sutherland, W. J. 2004. 1997. Ecological Census Techniques - A Handbook. Cambridge University Press. P336.



MAHATMA GANDHI UNIVERSITY

**Name of the course: ES M21 C 52
Earth System Processes and Landforms**

School Name	School of Environmental Sciences					
Programme	M.Sc. Environment Science and Disaster Management					
Course Name	Earth System Processes and Landforms					
Type of Course	Core					
Course Code	ES M21 C 52					
Names of Academic Staff & Qualifications	Dr. Baiju K.R. MSc., PhD					
Course summary & Justification	The course describes the relation between the earth systems and geological agents to the environment and its relation to natural disasters. It explains various geological processes involved in the formation of environment and the impacts due the exploration of geological resources.					
Semester		1	Semester			1
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs
		40	10		4	54
Pre-requisite	Basic knowledge about the Earth					

CO No.	<i>At the end of the course, the student will be able to:</i>	Taxonomic Level (TL)	PSO No.
1.	Explain the basics of Earth systems its processes and landforms	U	1
2	Distinguish various Plate tectonic processes and resultant features	A	1
3.	Identify major minerals, rocks and structures on the Earth	Ap	1
4	Distinguish the major land forms formed by the action of various geological agents	A	1, 4
5	Analyse the interrelationship between various spheres (Atmosphere, Lithosphere and Hydrosphere) of the Earth	E	1



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**Name of the course: ES M21 C 52
Earth System Processes and Landforms**

6	Describe the various resources of the earth and its environmental impacts due its exploration	U	2, 3
7	Appraise the different geo-scientific approaches for sustainable environment	E	2

Unit	Course Description	Hours	CO No.
1	The Earth as a System	9	
1.1	Earth in relation to Universe- Origin of the solar system- Geologic Times scale – The Geologic Record – Evolution of life	3	1
1.2	Earth as a System of Interacting Components –Lithosphere, atmosphere, Hydrosphere	2	1, 5
1.3	Plate Tectonics: Interior of the earth- – Types of Plate boundaries-Plate mosaic – Rates of plate motion – Plate reconstruction – Mantle convection. Geological processes related to Plate tectonics- Seafloor spreading, Mountain building, Earthquakes, Volcanism	4	1, 2
2	Materials of the earth	10	
2.1	Introduction to Rock-forming minerals and their Physical properties	2	3
2.2	Types of Rocks: igneous, metamorphic and sedimentary Major Rock types - Origin and composition– The rock cycle	3	3
2.3	Geological Structures: folds, faults and joints	3	3
2.4	Disintegration of rocks: Weathering: Types of weathering, Formation of Soil, Soil profile.	2	1, 3
3	Introduction to Physical Geology and Geomorphology	10	
3.1	Geological agents and Landforms: Streams- Geological work of streams and land forms; Glaciers- types and land forms, Wind: Geological work of wind and land forms; Oceans: Shoreline process – wave erosion, deposition or accretion; modification of shorelines	7	4
3.2	Geomorphology of India and Kerala: Brief description of different important units	3	4
4	The Hydrosphere	8	
4.1	Hydrological cycle-Aquifers – types and properties, water table and Ground water movement Ground water recharge-recharge areas-discharge areas	3	1, 5
4.2	Methods of ground water abstraction-undesirable side effects of over exploitation-threats to ground water system-physical	4	5, 6



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Earth System Processes and Landforms**

	destruction of aquifers-ground water depletion-degradation of ground water quality-point source of contamination-diffuse source of contamination- aquifer vulnerability-aquifer over exploitation-		
4.3	Sustainable ground water development and management	1	5, 6, 7
5	The Atmosphere	7	
5.1	Structure and composition of the atmosphere	1	5
5.2	Interaction between lithosphere and atmosphere: Winds, Precipitation etc. Wind – types and formation, Precipitation – rainfall, snow fall.	3	5
5.3	Humidity and radiation Monsoon, El Nino, Droughts, Tropical Cyclones	3	5
6	Geological Resources and the Environment	10	
6.1	Major geological resources- minerals, rocks, coal, oil and natural gas	2	6
6.2	Environmental impacts of rocks/mineral mining and processing, River sand mining and its environmental concern Rock Quarrying, Clay mining and its impacts	3	6, 7
6.3	Shoreline activities and its environmental impacts	2	1,6,7
6.4	Geological issues in the disposal of domestic waste and industrial waste	3	7

Teaching and Learning Approach	Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning (Video), interactive Instruction:, Active co-operative learning, Seminars, Group Assignments Authentic learning, , Library work and Group discussion, Presentation by individual student/ Group representative; Field work and field visits
Assessment Types	<ol style="list-style-type: none"> Continuous Internal Assessment (CIA) <ul style="list-style-type: none"> Internal test Review of Book /Article Seminar Presentation Field visit report Semester End examination



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**Name of the course: ES M21 C 52
Earth System Processes and Landforms**

References

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2. Earle, S. (2015). Physical Geology. Victoria, B.C.: BCcampus. Retrieved from <https://opentextbc.ca/geology/> 719 p
3. Fetter CW 1990 Applied Hydrogeology CBS New Delhi 592 p
4. Grotzinger et al 2007 Understanding Earth, WH Freeman New York , 579 p
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6. Soman K 2001 Geology of Kerala Geological Society of India Bangalore 430 p.
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<https://doi.org/10.1007/978-94-011-6026-1>



MAHATMA GANDHI UNIVERSITY

**Name of the course: ES M21 C 53
Basic Concepts of Disaster Management**

School Name	School of Environmental Sciences					
Programme	M.Sc. Environment Science and Disaster Management					
Course Name	Basic Concepts of Disaster Management					
Type of Course	Elective					
Course Code	ES M21 C 53					
Names of Academic Staff & Qualifications	Dr. Baiju K.R. MSc., PhD					
Course summary & Justification	The course deals with the major natural and anthropogenic disasters its environmental constraints. The course also elaborates on the basic disaster management strategies employed worldwide.					
Semester		1	Credit			2
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs
		40	7		7	54
Pre-requisite						

CO No.	<i>At the end of the course, the student will be able to:</i>	Taxonomic Level (TL)	PSO No.
1.	Explain the relation between Earth's processes and disasters	U	1, 2
2	Distinguish various types and causative factors of disasters	An	2, 3
3.	Illustrate the key concepts of disaster management	U	3
4	Analyse the International disaster management system	An	3, 5, 6
5	Assess the disaster management strategies in India	E	3, 5, 6



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**Name of the course: ES M21 C 53
Basic Concepts of Disaster Management**

6	Analyse the relation between disasters and development	An	8, 10
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Unit	Course Description	Hours	CO No.
1.	Environment and Disasters	10	1, 2
1.1	Science and Facts of Natural Hazards. Earth's processes as disasters: Internal and external	4	1
1.2	Characteristics. Causal factors and characteristics of disasters.	3	2
1.3	Climate change and Disasters	3	2
2	Types and Classification of Disasters	10	1,2
2.1	Natural Disasters: Meteorological disasters, Geological disasters, Biological disasters	5	1,2
2.2	Anthropogenic Disasters: Chemical, Industrial and Nuclear related Disasters, Accident related Disasters	5	1,2
3.	Disaster Management Concepts	8	3
3.1	Introduction to key concepts, terminologies and their complexities (Hazard, vulnerability, Exposure, Risk, Crisis, emergencies, Vulnerability, Disasters, Resilience)	4	3
3.2	Disaster management Spectrum and its components Scope of DM and Disaster Management Cycle	4	3
4	International Disaster management System	10	3,4
4.1	Organizations, bodies and Finance. International Strategies and functions. Role of United Nations in Disaster management.	4	4
4.2	International Disaster management support system. Unified response strategy.	3	3,4
4.3	Mapping Disasters using global datasets. National and international information networks and inventories	3	3,4
5	Disaster Management in Indian Context	10	3, 5
5.1	Major Disasters in India. National Vulnerability profile	3	3
5.2	National Disaster management Hierarchy and Institutionalisation	3	5
5.3	National Disaster Decision support system. Technological applications. Role of research organisations.	2	3, 5
5.4	Challenges of disasters in India	2	5
6	Disasters and Development	6	4, 6
6.1	Relationship between disasters and development, implications. History of disaster response strategies	2	4, 6
6.2	Disasters, Poverty and Development. Global challenges and trends of Disasters	2	6



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**Name of the course: ES M21 C 53
Basic Concepts of Disaster Management**

6.3	Disaster Risk Management - key concerns. Mainstreaming Disaster Risk Reduction to developmental efforts.	1	6
6.4	Geography and dimensions of Disasters- global outlook.	1	4, 6

Teaching and Learning Approach	Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning (Video), interactive Instruction:, Active co-operative learning, Seminars, Group Assignments Authentic learning, , Library work and Group discussion, Presentation by individual student/ Group representative; Field work and field visits
Assessment Types	<ol style="list-style-type: none"> 3. Continuous Internal Assessment (CIA) 4. Internal test 5. Review of Book /Article 6. Seminar Presentation 7. Field visit report 8. Semester End examination

References

1. Coppola D. P., 2007. Introduction to International Disaster management. Elsevier. Butterworth-Heinemann.
2. Peduzzi P., Dao H., and Herold C., 2005. Mapping Disastrous Natural Hazards Using Global Datasets Natural Hazards Volume 35, Number 2, 265-289,
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5. Kapur A., Neeti, Meena, Deepthima, Roshani and Debanjali, Disasters in India Studies of grim Reality. Rawat Publications, New Delhi



MAHATMA GANDHI UNIVERSITY

**Name of the course: ES M21 C 54
Pollution Hazards and its Management**

School Name	School of Environmental Sciences						
Programme	M.Sc. Environment Science and Management						
Course Name	Pollution hazards and its Management						
Type of Course	Core						
Course Code	ES M21 C 54						
Names of Academic Staff & Qualifications	Dr. Mahesh Mohan , MSc., PhD						
Course summary & Justification	The course describes different types of environmental pollution like air, water, soil etc. and types and sources of pollutants including emerging contaminants. The course explains the interaction and movement of pollutants through the environment. It will also describe the control measures of various pollution.						
Semester		1		Semester		1	
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs	
		40	10		10	60	
Pre-requisite							

CO No.	At the end of the course, the student will be able to:	Taxonomic Level (TL)	PSO No.
1.	Identify and distinguish the sources and types of water, air, and soil pollution.	R	2, 3
2	Articulate knowledge about impact and control measures of water, air, and soil pollution.	U	3
3.	Describe environmental analysis for various water, air and soil quality parameters	E	3, 8
7	Expound the water and waste water treatment	U	5



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**Name of the course: ES M21 C 54
Pollution Hazards and its Management**

5	Explain Fate and transport of pollutants and distinguish the regional and global impact of pollution	A	2, 3
6	Describe Radioactive pollution and radioactive waste management methods	U	5
7	Conduct environmental sampling and analysis	Ap	7, 8

Unit	Course Description	Hours	CO No.
1	Air Pollution		
1.1	Air Pollution – Definition and Sources - Natural and anthropogenic; Types of Pollutants- Primary and Secondary. Acid rain, Smog-Photochemical and Classical; Ozone depletion	2	1
1.2	Factors affecting air pollution, Transport and diffusion of pollutants. Gas laws governing the behaviour of pollutants in the atmosphere.	3	5
1.3	Indoor air pollution – Types and sources of pollutants	2	1
1.4	Effects of pollutants on human beings, plants, animals, materials and on climate. Identification of aeroallergens. Air-borne diseases and allergies.	3	2
1.5	Air pollution control	2	2
1.6	Noise Pollution and control : Characteristics of noise, sources, Effects of noise, Standards, Measurement and control	2	1,2
2	Water Pollution		
2.1	Water Pollution - Types -surface and ground water, Surface water pollution-Sources – point and nonpoint, Types of pollutants – chemical, physical and biological	3	1
2.2	Chemical pollutants – inorganic (metals and other elements) and organic (POPs); Nutrients and Eutrophication, Organic matter - sources and degradation Biological pollutants Microbial pollution	3	1
2.3	Ground water pollution – sources and types of pollutants, Geological and anthropogenic pollutants in ground water – Arsenic, Fluoride, Saline water intrusion etc. Movements of contaminants in ground water,	3	1



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Pollution Hazards and its Management**

2.4	Coastal and Marine pollution-Oil spills, Thermal pollution, Impacts of water pollution	2	1
2.5	Heavy metals and other POPs in aquatic systems - cycling and interactions, Fate and transport of pollutants- factors affecting, Global oceanic transport of pollutants	2	1,5
2.6	Management of point and non-point sources of water pollution, water pollution control, Role of State and Central Pollution Control Boards	2	2, 7
3	Soil Pollution		
3.1	Soil/sediment Pollution – sources and types, soil as a pollutant, Soil quality parameters-Physico-chemical parameters of soil quality, factors affecting pollutants in the sediments – texture, pH, redox potential, organic carbon etc.	3	1
3.2	Sedimentation rate and contamination profile, sediment pollution indices	2	1,5
3.3	Soil Pollution Control. Industrial waste effluents and heavy metals, their interactions with soil components. Soil micro-organisms and their functions, Degradation of different insecticides, fungicides and weedicides in soil. Different kinds of, synthetic fertilizers (NP & K) and their interactions with different components of soil.	3	2
4	Environmental Pollution monitoring		
4.1	Monitoring-online and offline, Environmental sampling and analysis – stages (sampling, treatment, detection and interpretation), scope and criteria, Sampling – water, air and soil, equipment for air, water and soil sampling. Analysis – types and methods, Speciation, Certified reference materials,	4	3,7
4.2	Water quality parameters-physical, chemical and biological, analysis, Water quality standards, Tracers – dyes and isotopes in pollution monitoring	4	3,7
4.3	Ambient Air quality Monitoring, Air quality Standards-ambient and emission, Air Sampling equipment. Methods of monitoring and control of air pollution SO ₂ , NO, CO, CO ₂ , Ozone, SPM-PM _{2.5} & PM 10. Air quality index. Noise measurement	3	3,7
4.4	Soil/sediment sampling and monitoring. soil quality standards. Methods for assessing pollutant contamination profile in the sediments – chronology and pollutant detection	2	3,7



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**Name of the course: ES M21 C 54
Pollution Hazards and its Management**

5	Radioactive Pollution		
5.1	Radioactivity in the environment, Radioactive Pollution: Radionuclides- sources, types of radiation, Radioactive fallout,	2	1, 6
5.2	Ecological risks from radiation, effects on humans, exposure standards.	2	1,6
5.3	Control measures: radioactive waste treatment.	2	2,6
6	Emerging contaminants		
6.1	Emerging contaminants – definition, types and sources Sources and health impacts of PPCPs, POPs, PCCDS, PFAs, Dioxins, PCBs etc.	2	1,2
6.2	Plastics pollution in the freshwater and marine ecosystems Natural disasters and Pollution –	2	1,2

Teaching and Learning Approach	Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning (Video), interactive Instruction:, Active co-operative learning, Seminars, Group Assignments Authentic learning, , Library work and Group discussion, Presentation by individual student/ Group representative; Field work and field visits
Assessment Types	<ol style="list-style-type: none"> Continuous Internal Assessment (CIA) Internal test Review of Book /Article Seminar Presentation Field visit report Semester End examination

References

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**Name of the course: ES M21 C 54
Pollution Hazards and its Management**

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Suggested readings

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MAHATMA GANDHI UNIVERSITY

**Name of the course : ES M21 C 05
Research Methodology and Statistics**

School Name	School of Environmental Sciences					
Programme	M.Sc. Environment Science and Management M.Sc. Environment Science and Disaster Management					
Course Name	Research Methodology and Statistics					
Type of Course	Elective					
Course Code	ES M21 C 05					
Names of Academic Staff & Qualifications	P. Padma, M.A., M.Phil., M.Ed.,					
Course summary & Justification	The course deals with the general research methodology and statistical practices for environmental sciences and disaster management.					
Semester		1	Credit			3
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs
		40	7		7	54
Pre-requisite	Basic research aptitude and knowledge in statistics					

CO No.	At the end of the course, the student will be able to:	Taxonomic Level (TL)	PSO
1.	Describe the various research methods and statistical technique for doing research	U	7,8
2	Infer the literature; data analysis and result presentation procedures.	U	7
3.	Develop testing hypothesis for research	A	7
4	Appraise various statistical technique for doing research	E	8
5	Interpret and explain research articles in their academic discipline.	U	7,8
6	Apply statistical soft wares for data analysis	A	8



MAHATMA GANDHI UNIVERSITY

**Name of the course : ES M21 C 05
Research Methodology and Statistics**

Unit	Course Description	Hours	CO No.
1	I. RESEARCH METHODOLOGY	26	
1.1	Meaning- Objectives- motivation- Significances of research, Types of research, Research methods and methodology, Research and Scientific Method, Criteria of Good research, Problems of researcher	4	1,2
1.2	Selection of the problem: Criteria for selection of problem and evaluating problems, Statement of problem formulation and definition.	2	4,5
1.3	Research design: Meaning, need for research design, Features and important concepts relating to research design, Different research design, Basic principles of experimental design.	3	1,2
1.4	Survey of literature: Different methods of surveying literature, different sources of information, internet, search engines, web sites, recording surveying information.	2	2
1.5	Hypothesis: Nature, types and sources of hypothesis, characteristics of a good hypothesis.	2	3
1.6	Sampling: Unit of sampling, population: techniques, characteristics of good samples, different types of sample, sampling errors and ways to reduce them.	3	1,2,5
1.7	Collection and analysis and interpretation of data: Procedure of data collection, scoring of data, tabulation, editing and analysis and interpretation of data.	3	4,6
1.8	Research Report: Composition, pagination, Title pages, Systems of indicating references, Bibliography, Appendices.	3	4,5,6
1.9	Mini project for data analysis	4	5,6
	II. Statistics	20	
2	Fundamental Statistics		
2.1	Introduction – Importance and limitation.	1	1
2.2	Classification and Tabulation of data	1	1,2
2.3	Graphical Representation	2	1,2



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**Name of the course : ES M21 C 05
Research Methodology and Statistics**

2.4	Measures of Central Tendencies – Mean, Median and Mode	2	3,4
2.5	Measures of Dispersion - Range, Standard Deviation and Co-efficient of Variation	2	3,4
2.6	Moments, Skewness and Kurtosis	2	3,4
2.7	Correlation and Regression – Scatter diagrams – Karl Pearson’s Coefficient of correlation – Rank correlation – Linear and Curvilinear regressions.	3	4,5
2.8	Probability – Frequency approach- Addition and multiplication theorems- Binomial, Poisson and Normal Distribution- Probit analysis (Graphic Method only)	3	4
2.9	Testing of Hypothesis: Null and Alternative Hypothesis – Two types of error – Level of significance Test based on t, Z, F, Chi –square and Analysis of Variance – one-way, two-way, three-way analysis.	4	4,5,6
3	Application of Computer in Statistics	8	5,6
3.1	Data analysis using packages - MS excel	8	

Teaching and Learning Approach	Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning (Video), interactive Instruction:, Active co-operative learning, Seminars, Group Assignments Authentic learning, , Library work and Group discussion, Presentation by individual student/ Group representative
Assessment Types	<ol style="list-style-type: none"> Continuous Internal Assessment (CIA) <ul style="list-style-type: none"> Internal test Assignment Seminar Presentation Mini project for data analysis Semester End examination




MAHATMA GANDHI UNIVERSITY

**Name of the course : ES M21 C 05
Research Methodology and Statistics**


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	MAHATMA GANDHI UNIVERSITY
	Name of the course: ES M21 C 06 Lab course-I

School Name	School of Environmental Sciences						
Programme	M.Sc. Environment Science and Management M.Sc. Environment Science and Disaster Management						
Course Name	Lab course-I (Environmental Chemistry, Géosciences and Ecology)						
Type of Course	Core						
Course Code	ES M21 C 06						
Names of Academic Staff & Qualifications	Dr. Mahesh Mohan, Dr. Sylas VP., Dr. Baiju KR						
Course summary & Justification	The course will enable students to understand various physico-chemical parameters determining water, air and soil quality and to carry out environmental sampling and analysis. It will also enable students to identify rock and minerals and carry out geological field work. The students will understand biodiversity and can carry out biodiversity assessment.						
Semester		1	Semester			1	
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs	
			20	40		60	
Pre-requisite	Theoretical knowledge in basics of environmental sciences						


CO No.	<i>At the end of the course, the student will be able to:</i>	Taxonomic Level (TL)	PSO No.
1.	Understand the basic principles of the analysis of water, air, soil quality parameters	U	1, 2, 3, 4, 6
2	Carry out analysis of physico-chemical parameters of air, water and soil	U	1, 2, 6
3.	Conduct noise pollution measurement	Ap	1, 3
4	Carry out ecological assessment	Ap	1, 3, 5
5	Identify various rocks and minerals	Ap	1, 3

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	Name of the course: ES M21 C 06 Lab course-I

6	Draw rose diagrams for various geological analysis	A	6, 8
7	Conduct geological field survey	Ap	6, 8

Unit	Course Description	Hours	CO No.
1	Environmental Chemistry	13	1, 2, 3
1.1	Volumetric Analysis: Basic Principles	4	1, 2, 3
1.2	Acidimetry and Alkalimetry—Estimation of hydrochloric acid, sodium carbonate, oxalic acid	3	1, 2, 3
1.3	Permanganometry- Mohrs salt, potassium permanganate	4	1, 2, 3
1.4	Gravimetric analysis	2	1, 2, 3
2	Water and Noise quality	12	1, 2, 3
2.1	Colour, turbidity, conductivity, TDS, TSS, TS, pH, acidity, alkalinity, chloride, salinity, hardness, DO, BOD	10	1, 2, 3
2.2	Noise analysis	2	3
3	Ecology	14	4
3.1	Biodiversity assessment : Quadrature method	6	4
3.2	Plankton analysis	4	4
3.3	Zooplankton analysis	4	4
4	Environmental Geosciences	21	5, 6, 7
4.1	Identification of rocks and minerals	6	5
	Soil analysis- Physical (Texture, Bulk density, moisture content) and chemical parameters (pH, OC/OM, EC)	8	5, 6
4.2	Rose diagrams- Wind rose	4	6
4.3	Measuring strike and dip of rock formations. Basic map reading.	3	6, 7


Teaching and Learning Approach	Practical lab sessions
Assessment Types	1. Continuous Internal Assessment (CIA) Practical tests

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	Name of the course: ES M21 C 06 Lab course-I

	2. Semester End examination
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9. Miroslav Radojevic and Vladimir N Bashkin, Practical Environmental Analysis, RSC Publishing.
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	MAHATMA GANDHI UNIVERSITY
	Name of the course: ES M21 E 10 Introduction to Remote Sensing, GNSSs and GIS

School Name	School of Environmental Sciences					
Programme	M.Sc. Environment Science and Management					
Course Name	Introduction to Remote Sensing, GNSSs and GIS					
Type of Course	Core					
Course Code	ES M21 E 10					
Names of Academic Staff & Qualifications	Dr. Abin Varghese. MSc., M. Phil., Ph. D					
Course summary & Justification	Teaching of critical spatial thinking in higher education empowers graduates to effectively engage with spatial data. Geoinformatics teach to understand its wide application across many science disciplines; we evaluate how this contributes to critical spatial thinking. The discipline of GIS covers the whole process of spatial decision-making in environment as well as disaster management. We outline how some existing GIS principles could be improved to focus on the development of critical spatial thinking skills, competences and abilities that are valuable to graduates.					
Semester	1	Credit			3	
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs
		40	14	0	0	54
Pre-requisite						



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**Name of the course: ES M21 E 10
Introduction to Remote Sensing, GNSSs and GIS**

CO No.	<i>At the end of the course, the student will be able to:</i>	Taxonomic Level (TL)	PSO
1.	Demonstrate the basics of mapping concepts and Geodesy	U	1
2	Understand the various data formats and data types in GIS	U	1, 2
3.	Understand the significance of various satellite based remote sensing products	U	2, 8
4	Apply the spatial and non- spatial data using various methods	Ap	2
5	Appraise the importance of spatial planning in environment management	E	6, 7. 8
6	Design methods to solve the environmental issues based on various spatial data products	C	8
7	Outline and Evaluate the role of navigational satellite systems in geoinformatics	U, E	6, 7

Unit	Course Description	Hours	CO No.
1	Geodetical aspects, mapping concepts and surveying	10	1
1.1	Earth System – Geodesy: Datum/Spheroids and coordinate systems, map projection - different projections and their characteristics	4	1
1.2	Features on the earth’s surface: their basic properties – discrete vs continuous and geometries of representation	2	1
1.3	Cartography: Maps – their characteristics and elements, types - Basic surveying principles and techniques: EDMs and GNSSs; GNSSs – segments, various constellations, errors, differential correction and precise positioning	4	1



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**Name of the course: ES M21 E 10
Introduction to Remote Sensing, GNSSs and GIS**


	Map reading and interpretation Global, national and state mapping agencies and their authorized reference maps – general & thematic		
2	Remote sensing: Introduction	10	3
2.1	Remote sensing system – components and principles – platforms, sensors, medium, target, interactions and their characteristics including various resolutions, concept of DN value, radiance, reflectance, emission	3	3
2.2	Electromagnetic spectrum - energy interaction with atmosphere and earth surface, atmospheric windows, spectral properties of various objects on the earth's surface and the concept of spectral signature, active and passive remote sensing	4	3
2.3	Space borne earth observation: various orbits and their characteristics, operations, image acquisition and various data products Indian remote sensing programme & Other satellites and sensors like Landsat, SPOT, etc.	3	3
3	Digital Image Processing	10	3, 5, 6
3.1	Various image formats, loading and visualization – panchromatic and multispectral colour visualization – TCC and FCCs	3	3,5
3.2	Image restoration – geometric, radiometric – atmospheric errors and their correction Image enhancements – single band, multiband operations – layer stacking, ratioing and various indices, PCT, TCT, resolution merging/image fusion	4	3,6
3.3	Image interpretation – visual and digital; visual interpretation elements and key	3	3,6



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**Name of the course: ES M21 E 10
Introduction to Remote Sensing, GNSSs and GIS**

	Digital image classification – unsupervised and supervised; accuracy assessment		
4	Geographical Information System (GIS): Basics	10	2, 4
4.1	Concepts, components and organisation of GIS Representing & modelling spatial features and processes - vector and raster structures, relationship between features – topology; raster data compressions and storage formats	4	2
4.2	Non-spatial/attribute Database Management Systems (DBMS), significance of DBMS, principles, data types, models – RDBMS, data storage, query and retrieval	3	2
4.3	Basic GIS functions: data inputting methods & various data sources, data management, data manipulation and geographic analysis and output presentation	3	2,4
5	Global Navigational Satellite Systems: Basics	6	4, 5, 7
5.1	Basic concepts of Global Navigational Satellite Systems (GNSSs): History and timeline, overview. Components of GNSSs (Space Segment, Control Segment, User Segment), GPS working principle, -	3	5, 7
5.2	GPS (Global positioning System), - GLONASS, Galileo ,BeiDou, NavIC, GPS signals (L1 and L2 Frequencies)/ Course-Acquisition (C/A) code Precision (P) code,	3	4, 7
6	Geographic analysis and modelling	8	2, 3, 5, 6
6.1	Exploration, query, vector spatial analysis & geoprocessing – extraction, proximity, overlay Network analysis – route, trace, closest facility, allocation	3	2,5,6
6.2	Raster based spatial modeling and analysis – density, distance, map algebra – arithmetic & weighted overlay: multi-criteria	3	3,5,6

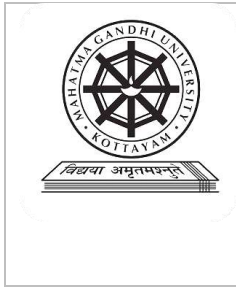
	MAHATMA GANDHI UNIVERSITY
	Name of the course: ES M21 E 10 Introduction to Remote Sensing, GNSSs and GIS

	decision making		
6.3	Surface modeling and analysis: DEM creation – input sources, interpolation; slope, aspect, volume, profile, hill shade, view shed, visibility, contouring	2	3,5,6

Teaching and Learning Approach	Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning (Video), interactive Instruction:, Active co-operative learning, Seminars, Group Assignments Authentic learning, , Library work and Group discussion, Presentation by individual student/ Group representative; Field work and field visits
Assessment Types	1. Continuous Internal Assessment (CIA) Internal test Review of Book /Article Seminar Presentation Field visit report 2. Semester End examination

References


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**Name of the course: ES M21 E 10
Introduction to Remote Sensing, GNSSs and GIS**

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 <p>The logo of Mahatma Gandhi University is circular, featuring a central geometric design with a compass rose and a book. The text 'MAHATMA GANDHI UNIVERSITY' is written around the top inner edge, and 'KOTTAYAM' is at the bottom. Below the circle is a banner with the Sanskrit motto 'विद्यया अमृतमपश्यत्'.</p>	<p style="text-align: center;">MAHATMA GANDHI UNIVERSITY</p> <hr/> <p style="text-align: center;">Name of the course: ES M21 E 10 Introduction to Remote Sensing, GNSSs and GIS</p>
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MAHATMA GANDHI UNIVERSITY

Name of the course ES M21 E 55
Chemical systems in Environment

School Name	School of Environmental Sciences						
Programme	M.Sc. Environment Science and Disaster Management						
Course Name	Chemical systems in Environment						
Type of Course	Core						
Course Code	ES M21 E 55						
Names of Academic Staff & Qualifications	Dr. C.T. Aravindakumar , MSc., PhD						
Course summary & Justification	The course describes the basics of chemistry involved in various environmental processes. It explains the chemical characteristics of environmental matrices such as atmosphere, water and soil. It explains various chemical processes involved in the formation of pollutants in the environment.						
Semester		1	Semester			1	
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs	
		30	10			40	
Pre-requisite							

CO No.	At the end of the course, the student will be able to:	Taxonomic Level (TL)	PSO No.
1.	Describe the basics of environmental chemistry	R	1
2	Demonstrate knowledge of chemical and biochemical principles of fundamental environmental processes in air, water, and soil.	U	1, 3
3.	Describe the chemistry of air, water and soil pollutants	E	3
4.	Apply basic chemical concepts to analyse chemical processes involved in different environmental problems (air, water & soil)	Ap	2
5.	Describe Chemical and physical factors involved in Fate and transport of pollutants	Ap	1, 3



MAHATMA GANDHI UNIVERSITY

**Name of the course ES M21 E 55
Chemical systems in Environment**

6.	Explain energy crisis and different aspects of sustainability	E	2, 6
7.	Discuss local and global environmental issues	A	2, 4
Unit	Course Description	Hours	CO No.
1	Man and environment	6	
1.1	Definition. principles and scope of Environmental Science. Chemistry and the Environment. Man and Environment.	2	1,7
1.2	Water and the hydrosphere, Air and the atmosphere	2	1,2
1.3	Energy and cycles of energy, Chemical fate and transport.	2	1,6
2	Chemistry of the environment - basics	9	
2.1	Mass and Energy transfer across the various interfaces, material balance.	2	1,2
2.2	First and Second law of thermodynamics. Heat transfer' processes, Chemical potential; chemical equilibria, acid-base reaction.	3	1,2
2.3	Solubility product, solubility of gases in water, the carbonate system.	2	1,2
2.4	Unsaturated and saturated hydrocarbons, radionuclide's	2	1,2
3	Atmospheric chemistry	11	
3.1	The atmosphere Composition of Air: Classification of elements, chemical speciation. Particles, ions and radicals in the atmosphere.	3	3
3.2	Chemical and photochemical reactions in the atmosphere, reactions of atmospheric oxygen,	3	3,5
3.3	Chemical processes for formation of inorganic and organic particulate matter. Chemistry of air pollutants, Photochemical smog.	3	3,4,7
3.4	Energy transfer in atmosphere, Global climate and microclimate	2	5,7



MAHATMA GANDHI UNIVERSITY

**Name of the course ES M21 E 55
Chemical systems in Environment**

4	Aquatic chemistry	14	
4.1	Fundamentals of aquatic chemistry, The importance of water, The properties of water, gases in water	3	3,5
4.2	Calcium and other metals in water, Polyphosphates and phosphonates in water	2	3
4.3	Concept of DO, BOD, COD, sedimentation, coagulation, filtration, Redox potential.	3	4
5	Soil Chemistry	2	3
5.1	Nature and decomposition of soil, Inorganic and organic components of soil,	2	3,5
5.2	Acid base and ion exchange reactions in soils, macro and micronutrients in soil, Nitrogen pathways, NPK in soils.	2	3,7

Teaching and Learning Approach	Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning (Video), interactive Instruction: Active co-operative learning, Seminars, Group Assignments Authentic learning, Library work and Group discussion, Presentation by individual student/ Group representative.
Assessment Types	<ol style="list-style-type: none"> Continuous Internal Assessment (CIA) <ul style="list-style-type: none"> Internal test Review of Book /Article Seminar Presentation Field visit report Semester End examination

References

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4. James Girard, Principles of Environmental Chemistry
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MAHATMA GANDHI UNIVERSITY

**Name of the course ES M21 E 56
Basic Life Skills/First Aid for Disaster Management**

School Name	School of Environmental Sciences					
Programme	M.Sc. Environment Science and Disaster Management					
Course Name	Basic Life Skills/First Aid for Disaster Management					
Type of Course	Elective					
Course Code	ES M21 E 56					
Names of Academic Staff & Qualifications	Dr. Baiju K.R. MSc., PhD					
Course summary & Justification	The course deals with the basic life skills essential for disaster management and the First aid protocols to be followed for various disaster events					
Semester		1	Credit			2
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs
		30			6	36
Pre-requisite						

CO No.	<i>At the end of the course, the student will be able to:</i>	Taxonomic Level (TL)	PSO
1.	Explain the links between life skills and disaster management	U	6
2	Articulate knowledge about first aid in various emergencies	A	6, 7
3.	Inculcate basic methods in first aid and life support	A	6, 7
4	Demonstrate the working principle of first aid and disaster response equipment	U	6, 7
5	Critically evaluate the coping information, and linkage with services during disaster situations	E	6, 7, 8
6	Adapt first aid skills in disaster response	C	6, 7



MAHATMA GANDHI UNIVERSITY

**Name of the course ES M21 E 56
Basic Life Skills/First Aid for Disaster Management**

Unit	Course Description	Hours	CO No.
1.	Life skills and emergency management	6	
1.1	Life skills – definition and typology, Skills for effective disaster preparedness -assertiveness, decisiveness and political sensitivity, decision-making skills, concentration and time management, relationships, empathy, effective communication, critical thinking, assertiveness and equanimity.	6	1
2	First aid in various Emergencies	10	
2.1	The ABC Bites and Stings. Breathing. Bleeding. Fractures. Burns. Choking	2	2
2.2	Cold and Heat related illnesses. Convulsions and Seizures, Dizziness and Fainting.	2	2, 3
2.3	Eye and Ear injuries. Head, neck and spine injuries	2	2
2.4	Poison. Shock. Stroke and Tooth injuries	2	2
2.5	Drowning, Dizziness and Fainting	2	2
3	Basic Methods in First Aid	10	
3.1	Concept of Basic Life Support. Bandaging, Slings and Binders.	3	2
3.2	Checking Pulse. Cardiopulmonary resuscitation (CPR).	3	4
3.3	Automated External Defibrillator (AED). Ventilation.	2	4
3.4	Clearing Air-way obstruction. Using the Fire-extinguisher.	2	4
4	Psychological First Aid (PFA)	10	1, 5, 6
4.1	Definition of PFA, objectives, PFA identification, history of PFA, post-traumatic stress disorder (PTSD) types of PFA.	4	1
4.2	PFA steps- Contact and engagement, Safety and comfort, Stabilization, Information gathering, Practical assistance, Connection with social supports, Coping information, Linkage with services	6	5, 6

Teaching and Learning Approach	Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning (Video), interactive Instruction: Active co-operative learning, Seminars, Group Assignments Authentic learning, Library work and Group discussion, Presentation by individual student/ Group representative.
Assessment Types	1. Continuous Internal Assessment (CIA) Internal test Review of Book /Article Seminar Presentation Field visit report



MAHATMA GANDHI UNIVERSITY

**Name of the course ES M21 E 56
Basic Life Skills/First Aid for Disaster Management**

2. Semester End examination

Reference

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2. Bowman, W. D., Backer, H. D., Paton, B. C. (2005). *Wilderness First Aid: Emergency Care for Remote Locations*. United States: Jones and Bartlett Publishers.
3. Everly, G. S.; Lating, J. M. (2017). *The Johns Hopkins guide to psychological first aid*. Johns Hopkins University Press. OCLC 957724673.
4. Gray, Matt J.; Maguen, Shira; Litz, Brett T. (2004). "Acute Psychological Impact of Disaster and Large-Scale Trauma: Limitations of Traditional Interventions and Future Practice Recommendations". *Prehospital and Disaster Medicine*. 19 (1): 64–72. doi:10.1017/s1049023x00001497. ISSN 1049-023X. PMID 15453161.
5. Indian first aid manual, 2016 (7th edition), authorized manual – English version, St. John ambulance and Indian red cross society.
6. Jack Pinkowski. 2008. *Disaster Management Handbook*. CRC Publication
7. Jefferson's County Sheriff's Office. (2018). *Jefferson County Family emergency Preparedness Handbook*. Oregon: Jefferson's County Sheriff's Office. Retrieved from: https://www.jeffco.net/sites/default/files/fileattachments/public_safety/page/5629/preparedness_handbook.pdf.
8. Liebsch, J., Liebsch, B. (2006). *It's a Disaster! ... and what are You Gonna Do about It? A Disaster Preparedness, Prevention & Basic First Aid Manual*. United States: Fedhealth.
9. *Life Skills Education for Children and Adolescents in Schools (Report)*. World Health Organization. Retrieved January 23, 2021.
10. Staywell. (2012). *Responding to Emergencies: Comprehensive First Aid/ CPR/ AED*. United States: American National Red Cross.



MAHATMA GANDHI UNIVERSITY

Name of the course **ES M21 E 57**
Field skills and techniques in Disaster Management

School Name	School of Environmental Sciences						
Programme	M.Sc. Environment Science and Disaster Management						
Course Name	Field skills and techniques in Disaster Management						
Type of Course	Elective						
Course Code	ES M21 E 57						
Names of Academic Staff & Qualifications	Dr. Baiju K.R. MSc., PhD						
Course summary & Justification	The course gives theoretical training about the filed skills to be acquired in disaster management.						
Semester		1	Credit			2	
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs	
		25	5		6	36	
Pre-requisite							

CO No.	At the end of the course, the student will be able to:	Taxonomic Level (TL)	PSO
1.	Identify the methodologies of field works in different disaster management spectrum and real time field actions	A	4
2	Explain the international code of conduct in disaster response	U	6
3.	Develop skills for working with vulnerable communities	A	5
4	Demonstrate the qualitative and quantitative methods in field work	U	8
5	Build a perspective on local disaster management committees and task forces	C	6, 7
6	Analyse the links between techniques, ethics and skills of field practice and disaster management	An	8



MAHATMA GANDHI UNIVERSITY

**Name of the course ES M21 E 57
Field skills and techniques in Disaster Management**

Unit	Course Description	Hours	CO No.
1.	Importance of field works in disaster management	8	1, 4, 5
1.1	Field oriented subjects, real-time disaster fieldwork,	3	1
1.2	Challenge of disaster fieldwork, Data collection in disaster setting	2	1, 4
1.3	Field works in different disaster management spectrum and advantages of field work in disaster management education.	3	1, 5
2	Field skills	8	
2.1	Skills in observation, understanding, data collection and gathering background information,	3	1
2.2	Skills in public relations and crisis communication, Planning and coordination	3	1, 5
2.3	Logistics management, time and other resource management, appropriate generalization.	2	1, 5,
3	Qualitative and quantitative methods in field work	8	1, 4
3.1	Qualitative and quantitative data, issues with biased data, primary and secondary data collection,	2	4
3.2	Sampling techniques- Simple random sampling, systematic sampling, clustered sampling, Convenience sampling, judgment (or Purposive) sampling, quota sampling, Questionnaire survey, questionnaire design	4	1, 4
3.3	Basic data analysis techniques for disaster management.	2	4
4	Working with vulnerable communities	6	3, 5
4.1	Ethnographic field work, focused group discussions with vulnerable communities	3	3
4.2	Local disaster Management Committees- membership and roles, knowledge, skills and resources required for task forces,	3	5
5	Ethics in field work	6	2, 6
5.1	Human rights and disasters, emphatical approach, anonymity and confidentiality, client relationships, Impartiality, use of information sheets for transparency of field work,	3	2,6
5.2	Non-discrimination, Respect of dignity, respect of person, neutrality, territorial sovereignty, professional behaviour, safety in field works, fair representation of samples,	2	2, 6
5.3	Cultural and cognitive biases, code of conduct in disaster response.	1	2



MAHATMA GANDHI UNIVERSITY

**Name of the course ES M21 E 57
Field skills and techniques in Disaster Management**

Teaching and Learning Approach	Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning (Video), interactive Instruction:, Active co-operative learning, Seminars, Group Assignments Authentic learning, , Library work and Group discussion, Presentation by individual student/ Group representative; Field work and field visits
Assessment Types	<ol style="list-style-type: none"> 1. Continuous Internal Assessment (CIA) <ul style="list-style-type: none"> Internal test Review of Book /Article Seminar Presentation Field visit report 2. Semester End examination

Reference

1. Allen; et al. (2010). "Perceptions of PFA Among Providers". Journal of Traumatic Stress. 23 (4): 509–513. doi:10.1002/jts.20539. PMID 20623598.
2. Bowman, W. D., Backer, H. D., Paton, B. C. (2005). Wilderness First Aid: Emergency Care for Remote Locations. United States: Jones and Bartlett Publishers.
3. Everly, G. S.; Lating, J. M. (2017).The Johns Hopkins guide to psychological first aid. Johns Hopkins University Press. OCLC 957724673.
4. Gray, Matt J.; Maguen, Shira; Litz, Brett T. (2004). "Acute Psychological Impact of Disaster and Large-Scale Trauma: Limitations of Traditional Interventions and Future Practice Recommendations". Prehospital and Disaster Medicine. 19 (1): 64–72. doi:10.1017/s1049023x00001497. ISSN 1049-023X. PMID 15453161.
5. Indian first aid manual, 2016 (7th edition), authorized manual – English version, St. John ambulance and Indian red cross society.
6. Jack Pinkowski. 2008. Disaster Management Handbook. CRC Publication
7. Jefferson’s County Sheriff’s Office. (2018). Jefferson County Family emergency Preparedness Handbook. Oregon: Jefferson’s County Sheriff’s Office. Retrieved from: https://www.jeffco.net/sites/default/files/fileattachments/public_safety/page/5629/preparedness_handbook.pdf



विद्याया अमृतमयम्

MAHATMA GANDHI UNIVERSITY

Name of the course ES M21 E 57
Field skills and techniques in Disaster Management

8. Liebsch, J., Liebsch, B. (2006). It's a Disaster! ... and what are You Gonna Do about It? A Disaster Preparedness, Prevention & Basic First Aid Manual. United States: Fedhealth.
9. Life Skills Education for Children and Adolescents in Schools (Report).World Health Organization. Retrieved January 23, 2021.
10. Staywell. (2012). Responding to Emergencies: Comprehensive First Aid/ CPR/ AED. United States: American National Red Cross.

SEMESTER II



MAHATMA GANDHI UNIVERSITY

**Name of the Course: ES M21 C 11
Analytical Techniques and Instrumentation**

School Name	School of Environmental Sciences						
Programme	M.Sc. Environment Science and Management						
Course Name	Analytical Techniques and Instrumentation						
Type of Course	Core						
Course Code	ES M21 C11						
Names of Academic Staff & Qualifications	Dr. C.T. Aravindakumar						
Course summary & Justification	The course will discuss on various classical and modern analytical techniques. After the program, the students will able to do the gravimetric, volumetric, and instrumental method of analysis.						
Semester		2	Semester			2	
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs	
						60	
Pre-requisite							

CO No.	At the end of the course, the student will be able to:	Taxonomic Level (TL)	PSO
1.	Explain the analytical errors and describe clean analysis	R	3
2	Explain gravimetric, volumetric, spectroscopic and chromatographic analysis	R,U	3
3.	Do gravimetric, volumetric, spectroscopic and chromatographic analysis	Ap	3
7	Explain the applications of gravimetric and volumetric methods	U	3, 5
5	Describe the applications of spectroscopic methods	U	3,5
6	Explain radiation detectors	R	3
7	Describe the applications of chromatographic methods	U	3, 4, 5



MAHATMA GANDHI UNIVERSITY

Name of the Course: ES M21 C 11
Analytical Techniques and Instrumentation

Unit	Course Description	Hours	CO No.
1	Introduction		
1.1	Significant figures, Accuracy and precision	2	1
1.2	Types of errors- random and systematic errors, Standard deviation	3	1
2	Gravimetric methods		
2.1	Mechanism of formation of precipitates, Characteristics of ideal precipitate, Methods to improve filterability and minimizing adsorbed impurities	3	2,3
2.2	Precipitation from homogeneous solutions, Organic and inorganic precipitating agents,	3	2,3
2.3	Application of gravimetric methods	3	7
3	Volumetric methods		
3.1	Molarity, Normality, Standard solutions, End point	3	2,3
3.2	Acid-base titrations – titration curves, theory of indicators	2	2,3,7
3.3	Complexometric titrations-EDTA titrations-applications	3	2,3,7
3.4	Iodometry, Iodimetry, Colorimetric titrations	3	2,3,7
4	Spectrochemical methods		
4.1	Electromagnetic spectrum, Interaction of light with matter/molecule	3	2
4.2	Fundamentals of molecular spectroscopy	3	2
4.3	Wavelength selectors: Filters and Monochromators, Radiation detectors and Transducers	2	2
4.4	Mass spectrometry	3	2,3,5
4.5	Atomic Absorption spectroscopy (AAS), Inductively coupled plasma mass spectrometry (ICP-MS) -principle and applications	4	2,3,5



MAHATMA GANDHI UNIVERSITY

**Name of the Course: ES M21 C 11
Analytical Techniques and Instrumentation**

4.6	Microwave, IR, Electronic, Raman, NMR and ESR spectroscopy-principle	3	2,3,5
4.7	SEM, TEM- instrumentation and applications	2	2,3,5
5	Radiation detectors		
5.1	Dosimetry, Geiger Muller Counter, Scintillation Counter	4	6
5.2	Electrochemical Methods: pH meter- Glass and reference electrodes, Conductivity met	4	6
6	Chromatographic Techniques and environmental applications		
6.1	Paper Chromatography, Thin Layer Chromatography, Column Chromatography, Ion Chromatography	2	2,3,7
6.2	Gas Chromatography(GC), GC-MS	2	2,3,7
6.3	Liquid Chromatography, High Performance Liquid Chromatography (HPLC), LC-MS, LC-MS/MS	3	2,3,7

Teaching and Learning Approach	Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning (Video), interactive Instruction: Active co-operative learning, Seminars, Group Assignments Authentic learning, Library work and Group discussion, Presentation by individual student/ Group representative.
Assessment Types	<ol style="list-style-type: none"> Continuous Internal Assessment (CIA) <ul style="list-style-type: none"> Internal test Review of Book /Article Seminar Presentation Field visit report Semester End examination

References

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**Name of the Course: ES M21 C 11
Analytical Techniques and Instrumentation**

3. Skoog, D.A. and Leary, J.J. (1992), Principles of Instrumental Analysis, 4th edition, Saunder's College Publishing, Fortworth
4. Suchla, G (Ed.) (1987) Vogel's Qualitative Inorganic Chemistry, ELBS.
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8. Gary D. Christian. Analytical Chemistry, 5th edition, John Wiley and Sons.



MAHATMA GANDHI UNIVERSITY

**Name of the Course ES M21 C 12
Environmental Laws, Ethics, Education and Policy**

School Name	School of Environmental Sciences					
Programme	M.Sc. Environment Science and Management					
Course Name	Environmental Laws, Ethics, Education and Policy					
Type of Course	Core					
Course Code	ES M21 C12					
Names of Academic Staff & Qualifications	Adv. Somanathan, Dr. Mahesh Mohan , MSc., PhD;					
Course summary & Justification	The course deals with the history of environmental laws and their evolution to modern environmental laws. The course discusses various international treaties and conventions conducted for environmental protection. It also describes various policies and laws in India for the protection of the environment. The course explains the principles of international laws. Environmental education, its history and present status in India are also described in this course.					
Semester		2		Semester	2	
Total Student Learning Time (SLT)		Learning approach	Lecture	Tutorial	Practical	Others
						Total hrs
						60
Pre-requisite						

CO No.	At the end of the course, the student will be able to:	Taxonomic Level (TL)	PSO
1	Describe the history of environmental law	R	1,4
2	Articulate the environmental laws and policies in Kerala and India	U	1,2
3	Describe principles of international laws	R	1,9
4	Expound the forest laws in India	U	1,9,10
5	Describe environmental education	U	9,10



MAHATMA GANDHI UNIVERSITY

**Name of the Course ES M21 C 12
Environmental Laws, Ethics, Education and Policy**

6	Evaluate the development activities based on environmental laws	Ap	2,9
7	Do environmental awareness	Ap	9,10

Unit	Course Description	Hours	CO No.
1	Introduction		
1.1	History of Environmental Regulations	2	1
1.2	Emerging of NGOs like WWF	3	1
1.3	United Nations Conference on Human Environment (Stockholm Conference – 1972),	2	1
1.4	Environmental treaties before 1990	1	1
1.5	International literature and report on human environment – The limits to growth, Our common future,	3	1
1.5	General principles and concepts of international Environmental law: Precautionary principle; Polluter pays principle; Sustainable development; Public trust doctrine. Overview of legislations and basic concepts	2	3
2	Environmental Policy in India		
2.1	Environmental Legislation Protection Laws in India – Ancient and Pre- Independence.	3	2
2.2	Environmental Legislation in Post – Independence Period	3	2
2.3	Constitutional and Legislative Provisions in India. <ul style="list-style-type: none"> • Fundamental principle; 42nd Amendment Act; Direct Principles • Fundamental Rights, • Environmental Legislations (General) 	3	2



MAHATMA GANDHI UNIVERSITY

**Name of the Course ES M21 C 12
Environmental Laws, Ethics, Education and Policy**

	Environmental Protection Act of 1986		
2.4	Judicial Remedies and Procedures. <ul style="list-style-type: none">• Tort Law, Public Nuisance , Public Interest Litigation, Freedom of information	2	2
3	Laws Relating to control of Pollution and Environment in India		
3.1	Water Act and Related Acts, Rules and Regulations	3	2
3.2	Air Act – Related Acts, Rules and Regulations	2	2
3.3	Noise and Land Pollution Rules and Regulations	3	2
3.4	Rules and Notification made under Environmental (Protect) Act 1986 – Rules of Hazardous Microorganisms. Bio–medical waste, Recycled Plastics, Ozone Depleting Substances, Solid Waste Management, etc.	4	2
3.6	Environmental Laws and regulations in Kerala - Mining law, laws related to wetlands and other ecosystems	3	2
3.7	Case studies – Bhopal gas tragedy	1	2
4	Forest and Wild Life Protection Act and Rules.		
4.1	Forest policies and Legislation in Pre – independence Period.	2	2,4
4.2	Wildlife and Biodiversity: IFA, 1927; WLPA, 1972; FCA, 1980; Biological Diversity Act, 2002; Forest Rights Act, 2006.	3	2,4
4.3	Strategies for conservation–Project Tiger, Elephant, Rhino etc.	2	2,4,6
5	International Organisation, Conservations and Protocols		
4.1	United Nations, GEMS, UNEP, GEF, WCN etc.	3	3,7
4.2	Conventions after 1990: Rio, Rio+10, Rio+20, Kyoto protocol etc.	4	3,6,7



MAHATMA GANDHI UNIVERSITY

**Name of the Course ES M21 C 12
Environmental Laws, Ethics, Education and Policy**

6	Information, Education and Communication		
5.1	Environmental education/awareness, lifestyle changes and consumerism. Values and ethics	1	5,7
5.2	Environmental education in India, Information Networks – ENVIS Centers – INFOTERA etc.	2	5,7
5.3	Role of NGO's in the Implementation of Environmental Policies.	2	5,7
5.4	Communication and Management.	1	5,7

Teaching and Learning Approach	Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning (Video), interactive Instruction: Active co-operative learning, Seminars, Group Assignments Authentic learning, Library work and Group discussion, Presentation by individual student/ Group representative.
Assessment Types	<ol style="list-style-type: none"> 1. Continuous Internal Assessment (CIA) <ul style="list-style-type: none"> Internal test Review of Book /Article Seminar Presentation Field visit report 2. Semester End examination

References


1. Rosencrans, A., and divan, S. (2002), Environmental Law and Policy in India cases, Materials and Statutes, Oxford University Press.
2. Santhakumar, S., (2001), Environmental Law, Surya Publication, Chennai
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**Name of the Course ES M21 C 12
Environmental Laws, Ethics, Education and Policy**

7. Simon Bill and Stuart Bill (1995) Environmental Law, Blackstone Press Ltd, London.
8. United Nations International Environmental Law (1993) Emerging Trends & Implications for Transnational Corporations, United Nations, New York.

	MAHATMA GANDHI UNIVERSITY
	Name of course : ES M21 C14 Environmental Biotechnology and Waste Management

School Name	School of Environmental Sciences						
Programme	M.Sc. Environment Science and Management M.Sc Environment Science and Disaster Management						
Course Name	Environmental Biotechnology and Waste Management						
Type of Course	Core						
Course Code	ES M21 C 14						
Names of Academic Staff & Qualifications	Dr. E.V.Ramasamy , M.Tech., Ph.D						
Course summary & Justification	<p>Course Summary: Application of Biotechnological methods in controlling air, water and soil pollution. Understanding the blend of Ecology and Engineering in wastewater remediation and solid waste management. New concept of Ecological Sanitation (ECOSAN) is introduced in this course.</p> <p>Justification : A thorough understanding of waste management (Both Solid and Liquid) with biological methods and information gain on emerging knowledge domains like : Zero waste concept including Design for Environment – Industrial Ecology (IE), Life Cycle Assessment (LCA), Extended Producer Responsibility , Servicing, Ecological sanitation based closing the loop concept (circular economy).</p>						
Semester		2	Credit			3	
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs	
						54	
Pre-requisite							

	MAHATMA GANDHI UNIVERSITY
	Name of course : ES M21 C14 Environmental Biotechnology and Waste Management

CO No.	<i>At the end of the course, the student will be able to:</i>	Taxonomic Level (TL)	PSO
1.	Describe the basics of molecular biology and environmental biotechnology and its relevance	U, R	1,
2	Understand the techniques involving Biotechnology applicable to combat air, soil and water pollution. To assess the efficiency of different wastewater treatment techniques.	U,A,E	1, 2
3.	Classify different kinds of biotechnological applications in Agriculture like organic fertilisers and biopesticides. Understand the concept Ecological Engineering – a blend of Ecology and Engineering to control water pollution. To apply the appropriate bioplastics producing technique to overcome the plastics menace	U,A	1, 2
4	Understand different solid waste management steps; to assess their potential at present and in future. To describe the need of zero waste concept	U,A,E,R	5, 6
5	Explain the importance of Ecological Sanitation – a new emerging concept of circular economy in sanitation sector.	U, R,C	3, 5

Unit	Course Description	Hours	CO No.
1	Cell Technology and Biotechnology	4	
1.1	Cell: Structure and function – Prokaryotes and Eukaryotes. Nucleic Acids, Central dogma - Protein synthesis, rDNA technology. Fermentation Technology.	2	1
1.2	Plant tissue culture techniques	1	1
1.3	Environmental Biotechnology: an overview.	1	1,2
2	Biotechnological Methods in Pollution Control	16	
2.1	Air pollution control: Bio-desulphurisation of coal, Green belts.	6	1,2
2.2	Water pollution control: Aerobic and Anaerobic wastewater treatment Systems.	6	2,3
2.3	Bioremediation : Soil / land contaminated with oil spills, PCBs,	2	1,2,3




MAHATMA GANDHI UNIVERSITY

**Name of course : ES M21 C14
Environmental Biotechnology and Waste Management**

	PAHs; Bioremediation technology; Phytoremediation		
2.4	Biosensors : Concept and principle ,Biosensors for environmental monitoring	2	1,2
3	Emerging Trends in Environmental Biotechnology	10	
3.1	Agrobiotechnology : Plant genetic engineering – role of rDNA technique; transgenic plants - GM crops, Biopesticides and Biofertilizers	6	2,3
3.2	Ecological Engineering: Constructed / Artificial wetlands, Nutrient Film Technique (NFT).	2	2,3
3.3	Biodegradable plastics – PHBs and PHAs	2	2,3
4	Solid Waste Management	16	
4.1	Municipal Solid Waste : Types, sources , properties and impacts	1	3,4
4.2	Techniques for treatment / processing: Concept of three ' R ' s, Thermal processes – incineration, Pyrolysis, RDF. Biological processes – Anaerobic digestion, Composting and vermicomposting.	8	4
4.3	Disposal techniques: Landfills – design, operation and management.	4	4
4.4	Hazardous waste management.	2	3,4
4.5	Concept of Zero waste	1	1,4
5	Ecological Sanitation	8	
5.1	Conventional sanitation : a linear flow system – its limitations	1	4, 5
5.2	Eco San –Circular flow and closing the loop : concept, goals and advantages	2	5
5.3	Eco San for human night soil management: Dry Toilets, Composting Toilets UDDT, UDFT.	2	5
5.4	Grey water management	2	3,5
5.5	Eco San - Human Health and Food Security	1	5


Teaching and Learning Approach	Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning (Video), interactive Instruction: Active co-operative learning, Seminars, Group Assignments Authentic learning, Library work and Group discussion, Presentation by individual student/ Group representative.
Assessment Types	<ol style="list-style-type: none"> Continuous Internal Assessment (CIA) <ul style="list-style-type: none"> Assignments Seminar Presentation on selected topics Quiz

	MAHATMA GANDHI UNIVERSITY
Name of course : ES M21 C14 Environmental Biotechnology and Waste Management	

	<ul style="list-style-type: none"> • Tutorials • Class tests <p>2. Semester End examination</p>
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References

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2. Abbasi, S.A., Ramasamy, E.V. 2001. Solid Waste Management with Earthworms Discovery Publishing house, New Delhi.
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Name of course : ES M21 C14 Environmental Biotechnology and Waste Management	

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MAHATMA GANDHI UNIVERSITY

**Name of the Course : ES M21 C 15
Biodiversity and Conservation Biology**

School Name	School of Environmental Sciences					
Programme	M.Sc.					
Course Name	Biodiversity and Conservation Biology					
Type of Course	Core					
Course Code	ES M21 C 15					
Course Summary & Justification	This course allows the students to learn the fundamentals of biodiversity and conservation biology. In environmental Science, biodiversity conservation is an important topic due to extinction and loss of biodiversity due to human activities. Since the subject includes the conservation biology, students will get some basic knowledge for the measures to protect the biodiversity.					
Semester	2			Credit		3
Total Student Learning Time (SLT)	Learning Approach	Lecture	Tutorial	Practical	Others	Total Learning Hours
	Authentic learning Collaborative learning Case based learning	40	5	-	10	55
Pre-requisite	As per the requirement of the course					
<i>Others- Case studies , Library, field work, seminar and assignment preparations, test, research article/ case reports discussion etc.</i>						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PSO No.
	<i>Upon completion of this course, students will be able to;</i>		
1	Understand the basic concepts of Biodiversity and conservation biology	A	1, 2, 6
2	Study the distribution, significance and threats of biodiversity	U, An	2,4,6, 10
3	Understand and evaluate the various initiatives for biodiversity conservation	U, E	4,6,9,10



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4	Understand and explain the concept of human ecology and natural history.	U, An	1,6, 10
5	Understand and analyse the legal and policy aspects of conservation science	U, An	1,6,9, 10

***Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

COURSE CONTENT


		Hrs	CO. No.
Unit 1 Biodiversity - An introduction		5Hrs	
1.1	The evolution of biodiversity	1	1
1.2	Theories and Concepts of Biodiversity	1	1, 2
1.3	Origin of species/speciation	1	1
1.4	The distribution of biodiversity in macroscale	1	1
1.5	Species interactions and biodiversity	1	1
Unit 2 - Biodiversity		12 Hrs	
2.1	Levels of Biodiversity	1	1, 2
2.2	Genetic diversity, species diversity, Eco-system diversity, alpha, beta, gamma	1	1,2
2.3	Global and Regional biodiversity	1	1, 2
2.4	Threats to Biological Diversity – Habitat Degradation, Fragmentation, Global Climate Change, over extraction, over abundance, alien and invasive species, diseases, pollution	6	2
2.5	Endangered and Threatened species, IUCN, Red Data Book	3	2, 3
Unit 3 Biodiversity Conservation in Practice		10 Hrs	
3.1	Global Conservation initiatives – Biodiversity hot spots, Conservation in South and Southeast Asia,	2	1, 2, 5



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3.2	National Conservation Action Plan,	2	2, 5
3.3	Landscape-level Conservation	2	2, 3, 4
3.4	Conservation Strategies	2	2, 3
3.5	In situ and ex situ conservation	2	2, 3
Unit 4 Introduction to Conservation Biology		12 Hrs	
4.1	History, Concepts and Background	2	1, 4
4.2	Biogeography of India	2	1, 2, 4
4.3	Western Ghats	2	1, 2, 3,4, 5
4.4	Wild life biology	3	3,5
4.5	Restoration biology	3	2, 3, 4, 5
Unit 5 Natural History		12Hrs	
5.1	Natural History in India	2	1,4
5.2	Animal Behavior	4	1,4
5.3	General Entomology, Ornithology, Mamma logy, Ichthyology, Herpetology	4	1,2, 3
5.4	Basic understanding of common flora in Southern Western Ghats	2	4, 5
Unit 6 Human Ecology		9 Hrs	
6.1	Environmental History and Conservation Movements	2	4
6.2	People and Nature: Ecosystem services	2	2,4
6.3	Indigenous communities and Ethnobiology	2	2,4,5
6.4	Human-wildlife Conflict	2	2,4,5

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Unit 7 : Conservation – Legal and policy framework		6 Hrs	
7.1	International treaties - Convention on Biological diversity, CITES, TRAFFIC	2	2,5
7.2	Legal aspects of conservation in India.	2	5
7.3	Biopiracy – causes and effects	2	2,4,5

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Authentic learning, case-based learning, collaborative learning, seminar, group activities.
Assessment Types	Mode of Assessment 5. Continuous Internal Assessment (CIA) 6. Seminar Presentation – 7. Assignments B. Semester End examination

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**Name of the Course: ES M21 C 58
Public health aspects and emergency services in disaster management**

School Name	School of Environmental Sciences					
Programme	M.Sc. Environment Science and Disaster Management					
Course Name	Public health aspects and emergency services in disaster management					
Type of Course	Core					
Course Code	ES M21 C 58					
Names of Academic Staff & Qualifications	Dr. Baiju K.R. MSc., PhD					
Course summary & Justification	Public health emergency management is multidisciplinary field and with tremendous scope and potential to work with. The course will integrate the challenging dimensions of emergency medicine and disaster management. The students will be able to apply the ability to think generally outside of specializations using a broad and integrative approach. The learners also can improve their intellectual and practical skills such as critical thinking, problem solving, and demonstrate effective skills in the sector of public health and disaster management.					
Semester		2	Credit			3
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs
		30	12		12	54
Pre-requisite						

CO No.	At the end of the course, the student will be able to:	Taxonomic Level (TL)	PSO
1.	Explain the relation between Disaster Medicine and its importance in Public Health Care	U	2,4, 5, 6, 7
2	Understand the role of hospitals in disaster management	U	3, 5
3.	Analyse the public health issues during disasters	An	4,5, 7
4	Asses the public health preparedness for disasters	E	2, 4, 6
5	Developing Disaster Health management plan	C	4, 5,6, 7



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Public health aspects and emergency services in disaster management

Unit	Course Description	Hours	CO No.
1.	Introduction to Disaster Medicine, Public Health and Disasters	15	1, 2
1.1	Disaster Medicine, Introduction to public health, Public Health Response Cycle, Operating public health – principles to guide public health response	4	1
1.2	The role of Emergency Medical Services (EMS) in disasters	2	2
1.3	Public health preparedness history and policy	2	1,2
1.4	The role of hospitals in disaster – The effect of disaster on hospitals, health system role in disasters, sources of hospital vulnerability, surge capacity, critical elements in hospital preparedness	4	2
1.5	Psychological impact of disasters – Common responses to disasters, Post Traumatic Stress Disorder (PTSD), Critical Incident Stress Management (CISM) Disaster Mental Health	3	1
2	Public Health Response in Disasters	14	1,3
2.1	Local, national and international public health response during major disasters	4	1,3
2.2	Mass casualty management and potential health issues in mass gatherings	4	1,3
2.3	Epidemics after Natural Disasters	2	3
2.4	Disasters and their consequences for public health	2	3
2.5	Global case studies on public health preparedness and response	2	1, 3
3.	Public health and community	13	1,3, 4
3.1	Public health preparedness capabilities	3	4
3.2	Healthcare facility Hazard and Vulnerability Analysis	3	3
3.3	Community disaster resilience for public health preparedness	3	4
3.4	Public health and risk populations and surge planning matrix	2	1, 3, 4
3.5	Disaster behaviour health	2	3
4	Unit 4 - Disaster health management	12	4, 5
4.1	Rapid assessment of emergency health care needs and triage	3	4
4.2	The Incident Command System – ICS Organization, Concepts and Principles of ICS, Hospital Emergency Incident Command system	3	4, 5
4.3	Disaster Medical Teams (DMT)	3	5
4.4	Managing volunteers and donations	3	4,5



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**Name of the Course: ES M21 C 58
Public health aspects and emergency services in disaster management**

Teaching and Learning Approach	Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning (Video), interactive Instruction: Active co-operative learning, Seminars, Group Assignments Authentic learning, Library work and Group discussion, Presentation by individual student/ Group representative.
Assessment Types	<ol style="list-style-type: none"> 1. Continuous Internal Assessment (CIA) <ul style="list-style-type: none"> Internal test Review of Book /Article Seminar Presentation Field visit report 2. Semester End examination

References


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Name of the Course: ES M21 C 58
Public health aspects and emergency services in disaster management

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	MAHATMA GANDHI UNIVERSITY
	Name of the Course: ES M21 C 16 Lab Course II


School Name	School of Environmental Sciences						
Programme	M.Sc. Environment Science and Management						
Course Name	Lab Course II (Environmental Chemistry, Microbiology, Biotechnology, RS & GIS)						
Type of Course	Core						
Course Code	ES M21 C16						
Names of Academic Staff & Qualifications	Dr. Mahesh Mohan; Dr. Syllas V.P.; Dr. E.V. Ramasamy; Dr. Abin Varghese						
Course summary & Justification	The course will enable students to understand various physico-chemical parameters determining water, air and soil quality and to carry out environmental sampling and analysis. It will also enable students to identify microbial pollution of water and soil environment. The students will also get acquainted with the RS & GIS technique and become able to do map preparation and other applications of GIS.						
Semester		2	Semester			2	
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs	
			20	40		60	
Pre-requisite							

CO No.	At the end of the course, the student will be able to:	Taxonomic Level (TL)	PSO
1	Understand the basic principles of the analysis of water, air, soil quality parameters	R	3,8
2	Analysis of physico-chemical parameters of air, water and soil	Ap	3,5,8
3	Do air pollution Monitoring	Ap	3,8
4	Explain applications of advanced geospatial technologies for disaster management	Ap	3,8

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5	Apply GIS in disaster management	Ap	3,6,8
6	Create map using GIS platform and assess remote sensing data	U, Ap, An, E, C	3,6,8
7	Do environmental pollution monitoring	Ap	3,4,6,8

Unit	Course Description	Hours	CO No.
1	Water quality		
1.1	Analysis of COD, Sulphate, Sulphide, Potassium, Iron	4	1,2,3,7
1.2	Nutrient analysis (Nitrite, Nitrate, TN, Phosphate)	4	1,2,3,7
1.3	Total and dissolved metals in water	1	1,2,3,7
2	Soil/sediment quality		
2.1	Available Nitrogen, Total Nitrogen, Available Phosphorous, Available potassium	4	1,2,3,7
2.2	Trace metals	2	1,2,3,7
3	Air quality		
3.1	Ambient Gaseous pollutant analysis –SO _x , NO _x , CO,	4	1,2,3,7
3.2	Ambient particulate monitoring –SPM, RPM	3	1,2,3,7
3.3	Online monitoring of ambient air quality	1	1,2,3,7
4	RS and GIS		
4.1	Understanding base map (Toposheet, Geology map, cadastral map etc.)	3	4,5,6
4.2	Understanding various Software's in GIS (ArcGIS, QGIS),	3	4,5,6
4.3	Georeferencing base map	3	4,5,6
4.4	Creation of Spatial and Non spatial data(Geodatabase, Shapefiles, Attribute data)	4	4,5,6
4.5	Creating and editing of Point, Line and Polygon	3	4,5,6


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4.6	Vector data analysis (Explore, Report generations, Geometry calculations, SQL (Arithmetic and Boolean Operators), Overlay analysis (Clip, Erase, Split, Union, Identity, Intersect))	3	4,5,6
4.7	Remote Sensing Open data web portals (Earth Explorer, Bhuvan etc) Understanding various Satellite Missions and Sensors Learn how to download data	4	4,5,6
4.8	Creation of Triangular Irregular Network (TIN)	4	4,5,6
4.9	Adding various bands of data to Image Processing Software, Understanding various resolution data, Dn values of Pixels	4	4,5,6
4.10	Layer Stacking	3	4,5,6
4.11	Preparation of Various Color Composites (True Color Composite, False Color Composite)	3	4,5,6


Teaching and Learning Approach	Laboratory Practical
Assessment Types	<ol style="list-style-type: none"> 1. Continuous Internal Assessment (CIA) Internal test Review of Book /Article Seminar Presentation Field visit report 2. Semester End examination

References

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	MAHATMA GANDHI UNIVERSITY
	Name of the Course: ES M21 C 17 Ecotoxicology


School Name	School of Environmental Sciences
Programme	M.Sc. Environment Science and Management
Course Name	Ecotoxicology
Type of Course	Elective
Course Code	ES M21 E17
Names of Academic Staff & Qualifications	Dr. Mahesh Mohan , MSc., PhD
Course summary & Justification	The course's major goal is to provide students with the knowledge and skills necessary to assess the destiny of pollutants in the environment and their impacts on various biological organisation levels. To that goal, the conceptual framework established throughout the ecotoxicology course will be expanded and applied.
Semester	2
Total Student Learning Time (SLT)	40
Learning approach	Lecture
	Tutorial
	Practical
	Others
Pre-requisite	

CO No.	<i>At the end of the course, the student will be able to:</i>	Taxonomic Level (TL)	PSO
1	Describe sources and fates of chemicals in the environment	R	2
2	Explain mechanisms for adverse effects of chemicals	U	2,3
3	Estimate the risk for adverse effects of a chemical on different biological organisation levels based on knowledge about the toxicity, degradability, and bioavailability of the chemical	E	2
4	Do toxicological testing of environmental pollutants	Ap	3
5	Explain the significance of sanitation and carryout	E,Ap	2,3


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	Name of the Course: ES M21 C 17 Ecotoxicology

	awareness on awareness on sanitation and health		
6	Explain food security in terms of contamination of food and control measures	A	2
7	Explain the toxicokinetics and toxicodynamics	Ap	2

Unit	Course Description	Hours	CO No.
1	Toxicants and ecosystem		
1.1	Toxicants – organic and inorganic	1	1,7
1.2	Toxicants – entry into the environment, cycles and residence time	2	1
1.3	Transboundary movement of pollutants- factors affecting	1	1
1.4	Global environmental pollutants	2	1
1.5	Routes of exposure to humans – food, occupation, environment	3	2
2	Toxicants and their effects		
2.1	Effects of toxicants on populations and communities	2	2
2.2	Toxicity of pesticides, metals, radioactive minerals, fluorides, chemical fertilizers and air pollutants – cellular and molecular level	2	2,7
2.3	Damage process and action of toxicants – exposure, uptake, transport, storage, mechanism of action in plants and mammals	2	2,7
2.4	Toxicants in the food chain- Accumulation and magnification Multilevel trophic interactions and non-trophic interactions	1	2,3
2.5	Acute and chronic effects	1	2,3
2.6	Occupational hazards and diseases	2	2,3
2.7	Toxicity of biohazards	1	2,3
3	Toxicity testing and indicators		

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3.1	Principles of toxicity testing, Factors to be considered in toxicity testing	2	4
3.2	Methods of toxicity evaluation at cellular and molecular level by in vitro and in vivo methods	1	4
3.3	Ecotoxicological testing methods – single species testing, microcosms etc.	2	4
3.4	Bioindicators , lacustrine communities as indicators of ecosystem stress Biosensors– concept and approach Biomarkers- classification, relationship of biomarkers to adverse effects	2	3,4
4	Sanitation, Health and Hygiene		
4.1	Sanitation and Health- introduction and Current situation	2	5
4.2	Water and sanitation related diseases, respiratory infections, under nutrition	2	3,5
4.3	Successful approaches to sanitation-strategies Role of health sector Global experience in improving sanitation and hygiene	2	5
4.4	Climate change and diseases Epidemiology and health ecology Epidemiological diseases due to pollution problems	1	3,5
	Health effects of cosmetics and drugs Health risk assessment of toxic chemicals Ecological risk assessment	2	3,5
5	Food Security		
5.1	Concept of food security, food systems and public health	1	6


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5.2	Interrelation between diet, food production, the environment, population and resources	1	6
5.3	Toxicants in food	2	2,6


Teaching and Learning Approach	Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning (Video), interactive Instruction: Active co-operative learning, Seminars, Group Assignments Authentic learning, Library work and Group discussion, Presentation by individual student/ Group representative.
Assessment Types	<ol style="list-style-type: none"> 1. Continuous Internal Assessment (CIA) <ul style="list-style-type: none"> Internal test Review of Book /Article Seminar Presentation Field visit report 2. Semester End examination

References

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	MAHATMA GANDHI UNIVERSITY
	Name of the course: ES M21 E 59 Disaster Risk Reduction and Sustainable Development

School Name	School of Environmental Sciences					
Programme	M.Sc. Environment Science and Disaster Management					
Course Name	Disaster Risk Reduction and Sustainable Development					
Type of Course	Elective					
Course Code	ES M21 E 59					
Names of Academic Staff & Qualifications	Dr. Baiju K.R. MSc., PhD					
Course summary & Justification						
Semester		2	Credit			2
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs
		30	6			36
Pre-requisite						


CO No.	<i>At the end of the course, the student will be able to:</i>	Taxonomic Level (TL)	PSO
1.	Interpret the vulnerability concept in disaster management	U	2, 4, 5
2	Understand the basic theories of disaster and its relation to development	U	2, 3
3.	Determine the political and economic facets of disasters	E	5
4	Appraise the relationship between disasters and sustainable development	E	3, 5
5	Evaluate the social, political and economic constraints in preventing disasters for sustainable development	E	3, 5



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**Name of the course: ES M21 E 59
Disaster Risk Reduction and Sustainable Development**

Unit	Course Description	Hours	CO No.
1.	Social Vulnerability	8	1,5
1.1	Disaster Vulnerability- Concept and Dimensions- Geographical, Social, Economic, Cultural, Technological.	2	1
1.2	Social Structure; Cleavage of Caste, Class, Gender, race and ethnicity, Refugees, Migrants, Children and Women, aged, unorganized labor, Persons with Disability	3	1,5
1.3	Changing society to reduce social vulnerability. Professionals' social position and resulting vulnerability and privilege.	3	1,5
2	Theories of Disasters:	8	2, 5
2.1	Sociological Analysis and Critical Thinking about disasters	2	2, 5
2.2	Theories and perspectives- Conflict theory, Development theory, Risk and Uncertainty Theories (Ulrich Back and Giddens), Feminist theories.	3	2
2.3	Social Work Theories- The systems theory, Person-in-environment, Empowerment and Strength-based approaches. Integration of theories and perspectives.	3	2
3.	Political Economy of Disasters:	10	2,3, 5
3.1	Economic impacts of disasters- long and short-term. The Schumpeterian model and arguments against it.	3	3
3.2	Economic Assessment post-disaster- quantification approaches and challenges.	2	3
3.3	Factors affecting vulnerability and promoting resilience.	2	2,3
3.4	The politics of international aid. Community Power: power structure-sources of power, Leadership concepts, Culture and Disasters	3	3, 5
4	Disasters and Sustainable Development:	10	1,4, 5
4.1	Definition and Meaning of Sustainable Development. The Sustainable Development Goals. Indicators and Measures of Development.	3	4
4.2	Hyogo and Sendai Frameworks and Disasters	1	4
4.3	Impact of Development projects such as dams, embankments, changes in Land-use etc	2	1, 4
4.4	Climate Change Adaptation in sustainable development	2	4
4.5	Relationship between sustainable development and disasters.	2	1, 4, 5


	MAHATMA GANDHI UNIVERSITY
	Name of the course: ES M21 E 59 Disaster Risk Reduction and Sustainable Development

	Prevention of Disasters aiming to sustainable development		
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Teaching and Learning Approach	Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning (Video), interactive Instruction: Active co-operative learning, Seminars, Group Assignments Authentic learning, Library work and Group discussion, Presentation by individual student/ Group representative.
Assessment Types	1. Continuous Internal Assessment (CIA) <ul style="list-style-type: none"> Internal test Review of Book /Article Seminar Presentation Field visit report 2. Semester End examination

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Name of the Course: ES M21 E 60
Applications of Science and Technology in Disaster Management

School Name	School of Environmental Sciences					
Programme	M.Sc. Environment Science and Disaster Management					
Course Name	Applications of Science and Technology in Disaster Management					
Type of Course	Elective					
Course Code	ES M21 E 60					
Names of Academic Staff & Qualifications	Dr. Baiju K.R. MSc., PhD					
Course summary & Justification	This course is aimed to give the students a concise picture on the advanced applications of science and technology in various fields of disaster management.					
Semester		2	Credit			2
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs
		30	6			36
Pre-requisite						


CO No.	At the end of the course, the student will be able to:	Taxonomic Level (TL)	PSO
1.	Explain the applications of science and technology in disaster management.	U	3, 4,7
2	Understand the basic knowledge about various data management systems and its use in humanitarian operations	U	10
3.	Identify the sources of information that can be used in humanitarian operations	A	4, 7
4	Distinguish various aid models and systems for humanitarian logistics	An	7
5	Compare the early warning systems in disaster management	E	4, 7
6	Determine the best practices and models for disaster management	E	2, 3, 4, 7



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Unit	Course Description	Hours	CO No.
1.	Applications of information technology in humanitarian operations	10	1,2
1.1	Sources of information, digital data mining in disaster response, hazard and risk communication, big data and big data analytics, data mining software, characteristics of big data, crowd source data, type of social media and crisis communication, big data analytics and social media in disaster management cycle	6	1, 2
1.2	Selected case studies of data analytics based crisis management - Chennai floods in India, 2015, Tohoku earthquake and tsunami, 2011 and typhoon Morakot, 2009, challenges of data analytics in disaster management.	4	1, 2
2	Decision aid models and systems for humanitarian logistics	10	1,3,4
2.1	Assessment models (Tovia simulation model, multiple linear regression by Kung and “cry wolf syndrome” model by Uchida) , Facility location models, supply chain designs models, distribution planning models, evacuation models, inventory planning models, models for last mile distribution, evacuation models, large scale distribution models, models for power system restoration and recovery planning. Models for economic recovery and models for donations and funding. <i>(Several models include complex mathematical structure, only familiarization needed)</i>	10	1, 3, 4
3.	Early warning systems and disaster communications	10	1,3, 5
3.1	Standard operation procedures and emergency operation centers	2	1, 3
3.2	Communications Principles & Systems- Analog & Digital, Satellite & Terrestrial Communications, Radio Broadcast Systems-AM Radio Systems-FM Systems-telecommunications Networks, Effect of disasters on wire line and wireless communication links under catastrophe, 1G,2G,3G Systems-Toll Free Nos-Hot Line- Wireless Telephony- WLL-Morse Code- HAM radio.	6	3, 5
3.3	Early warning systems for various natural and anthropogenic disasters	2	5
4	Best practices and models local/national and international disaster management	6	1, 6
4.1	Uses of disaster models. Kelly’s circular model, the crunch model	2	1, 6
4.2	Best practices in disaster management at various levels <i>(case study models)</i>	4	1, 6

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Teaching and Learning Approach	Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning (Video), interactive Instruction: Active co-operative learning, Seminars, Group Assignments Authentic learning, Library work and Group discussion, Presentation by individual student/ Group representative.
Assessment Types	1. Continuous Internal Assessment (CIA) <ul style="list-style-type: none"> Internal test Review of Book /Article Seminar Presentation Field visit report 2. Semester End examination

Reference

1. Bozorgi-Amiri, M. Jabalameli, and S. A. e Hashem. A multi-objective robust stochastic programming model for disaster relief logistics under uncertainty. *OR spectrum*, 35(4):905–933, 2013.
2. Decision Aid Models for Disaster Management and Emergencies by Alfonso J. Pedraza-Martinez (auth.), Begoña Vitoriano, Javier Montero, Da Ruan (eds.)
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	Name of the Course: ES M21 E 60 Applications of Science and Technology in Disaster Management

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	MAHATMA GANDHI UNIVERSITY
	Name of the Course: ES M21 E 61 Social Work Approaches and Practices

School Name	School of Environmental Sciences					
Programme	M.Sc. Environment Science and Disaster Management					
Course Name	Social Work Approaches and Practices					
Type of Course	Elective					
Course Code	ES M21 E 61					
Names of Academic Staff & Qualifications	Dr. Baiju K.R. MSc., PhD					
Course summary & Justification	In the context of disasters, social work should be a process that includes helping the emotionally and physically wounded while strengthening local communities. It includes working with the most vulnerable members of a community while strengthening the community as a whole to help with the disaster recovery. This course equips the students to demonstrate the ability to apply available tools and fundamental principles of social work in emergency management.					
Semester		2	Credit			2
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs
		30	6			36
Pre-requisite						


CO No.	<i>At the end of the course, the student will be able to:</i>	Taxonomic Level (TL)	PSO
1.	Explain the role of social work in disaster management	U	3, 4, 6, 9
2	Understand the basic concepts of social work	U	9
3.	Elaborate on the work of communities in social action	An	6, 9
4	Identify the strategies in rural appraisal	A	9
5	Illustrate social welfare administration	U	4, 9
6	Evaluate role of NGO's in disaster management	E	4, 6, 9



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**Name of the Course: ES M21 E 61
Social Work Approaches and Practices**

Unit	Course Description	Hours	CO No.
1.	Unit 1: Social work: Theory and Practice	9	1,2
1.1	Basic concept, purpose, goals, principles and objectives. History of Social Work, Development of Social Work as a profession, relationship between social work and other professions	3	2
1.2	Social work methods	2	2
1.3	Social Case Work: Meaning, scope, components, processes and client- worker relationship; social casework process	2	1, 2
1.4	Social group work: Definition, types of groups, group work process, working with vulnerable groups	2	1, 2
2	Work with communities – Community Organization and Social Action	9	1, 3
2.1	Concept of community: Definition, types, characteristics and basic problems of the community, Sociological, cultural and social work perspective of community	4	1, 3
2.2	Principles of Community Organization and Social Action, concept, Community organisation in rural and urban communities, social action movements case studies	5	3
3.	Strategies and Techniques in Community Organization- Participatory Rural Appraisal (PRA)	7	1, 4
3.1	Understanding Participatory Rural Appraisal, Comparison of PRA and RRA	3	4
3.2	Different PRA methods and Tools – participatory mapping, participatory modeling, transects, mobility map, Venn diagrams, Flow diagrams	4	1, 4
4	Social Welfare Administration	7	5
4.1	Skills for social welfare administration	2	5
4.2	Concept, nature and types of Social Welfare organizations, Administration of social welfare services; Structure and functions of social welfare organizations, Principles of administration in social welfare; Monitoring and evaluation; Manpower Planning and Development of Social Welfare Personnel	5	5
5	NGOs and their Importance in Disaster Management	4	6
5.1	Non-governmental organizations and registration process, type of NGOs, General structure and working principles - Public relations, Funding & Legal status, Administrative and financial management	4	6


	MAHATMA GANDHI UNIVERSITY
	Name of the Course: ES M21 E 61 Social Work Approaches and Practices

	of NGOs, NGOs and disaster management		
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Teaching and Learning Approach	Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning (Video), interactive Instruction:, Active co-operative learning, Seminars, Group Assignments Authentic learning, , Library work and Group discussion, Presentation by individual student/ Group representative; Field work and field visits
Assessment Types	1. Continuous Internal Assessment (CIA) Internal test Review of Book /Article Seminar Presentation Field visit report 2. Semester End examination


Reference

1. Chahar, S. S. (2005). Governance of Grassroots Level in India. Kanishka Publishers
2. Chowdhry, P. D. (2000). Social Welfare Administration, Atma Ram Sons., Delhi,
3. Coppola D., P. (2007). Introduction to International Disaster Management. Butterworth-Heinemann.
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5. Gangrade, K., D. (1971). Community Organization in India. Popular Prakashan
6. Goel, S L & Kumar, Ram. (2001). Disaster Management, Deep and Deep Publications,
7. Govt. of India: Encyclopaedia of Social work in India.
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	Name of the Course: ES M21 E 61 Social Work Approaches and Practices

13. Mathew, G. (1992). An Introduction to Social Case Work. Mumbai: Tata Institute of Social Science
14. Narayanasamy, N. (2009). Participatory Rural Appraisal. Sage Publications.
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16. Parson, R., J., Jorgenson, J., D. The Integration of Social Work Practice.
17. Ross, Murray & Lappin, Ben. (1967). Community Organization; Theory, Principles, and Practice, Harper & Row
18. Somesh Kumar. (2002). Methods for Community Participation: A complete guide for practitioners, Sage Publication.
19. Women as Equal Partners: Gender dimensions of Disaster Risk Management Programme- Compilation of Good practices. 2008. GOI-UNDP DRM Programme

SEMESTER III

	MAHATMA GANDHI UNIVERSITY
	Name of the Course: ES M21 C 62 Disaster Risk Assessment & Mitigation

School Name	School of Environmental Sciences						
Programme	M.Sc. Environment Science and Disaster Management						
Course Name	Disaster Risk Assessment & Mitigation						
Type of Course	Core						
Course Code	ES M21 C 62						
Names of Academic Staff & Qualifications	Dr. Baiju K R: MSc, PhD						
Course summary & Justification	The comprehensive understanding of disaster risk assessment is crucial in the modern disaster management and professional development of students. It involves is a process to determine the nature and extent of such risk, by analysing hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend. This paper covering an overview of disaster risk assessment, disaster risk reduction: global policies and practices, risk insurance and risk communication.						
Semester		3	Credit			3	
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs	
		30	20		4	54	
Pre-requisite							

CO No.	<i>At the end of the course, the student will be able to:</i>	Taxonomic Level (TL)	PSO
1.	Understand the disaster risk, relief and recovery management	U	3, 4
2	Distinguish various types of global policies and practices in disaster risk reduction	An	3, 4, 6
3	Identifying the economic impacts of disasters and to demonstrate different assets for its management	A	5, 6




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**Name of the Course: ES M21 C 62
Disaster Risk Assessment & Mitigation**

4	Deduct better management strategies for natural and anthropogenic hazards	E	6
5	Explore the risk communication strategies and to analyse various early warning systems	An	7
6	Compare various risk management ,methods of natural hazards	E	6, 7
7	Articulate knowledge in the dimensions of disaster risk management	An	10

Unit	Course Description	Hours	CO No.
1.	Introduction to disaster risk reduction and management	10	1, 2, 4
1.1	Disaster risk management; Disaster relief management; Economic impacts of disasters	4	1
1.2	Basic strategies of disaster risk reduction and risk management frame work	4	2
1.3	Integrated disaster risk management and post disaster response	2	4
2	Risk insurance	4	3
2.1	Insurance and Risk Management; Insurance Policies; role of micro finance in disaster management	4	3
3	Risk communication systems	8	4, 5
3.1	Communication- Principles & Systems- analog, digital, satellite and terrestrial ;Radio Broadcast Systems; 1G,2G,3G Systems-Toll Free Nos-Hot Line- Wireless Telephony- WLL-Morse Code-HAM radio.	4	4
3.2	Risk and crisis communication systems, its role, challenges and applications in preparedness activities	4	5
4	Emergency Operation Centre and Incident Management System	12	4, 6, 7
4.1	Emergency operation Centre (EOC) and their role in Incident Management System (IMS)	6	4,6, 7
4.2	EOC and command post interface; EOC design, layout and management; Standard Operating Procedure (SOP); Exercising and evaluating EOC and SOPs.	6	4,6, 7
5	Risk management for natural and anthropogenic disasters	12	6,7
5.1	Risk management- Flood; Cyclone; Drought; Earthquake;	7	6


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	Name of the Course: ES M21 C 62 Disaster Risk Assessment & Mitigation

	Tsunami; major anthropogenic disasters		
5.2	Climate change risk reduction; Millennium Development Goals (MDGs) and disaster risk reduction; Civil Disturbance and other anthropogenic disasters	5	7
6	Essentials of urban risk reduction	8	1, 7
6.1	Understanding urban risk and reduction strategies- Urban structures; urban setting; urban primacy; urban built environment; urban economic imbalances	8	1,7

Teaching and Learning Approach	Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning (Video), interactive Instruction:, Active co-operative learning, Seminars, Group Assignments Authentic learning, , Library work and Group discussion, Presentation by individual student/ Group representative; Field work and field visits
Assessment Types	<ol style="list-style-type: none"> 1. Continuous Internal Assessment (CIA) <ul style="list-style-type: none"> Internal test Review of Book /Article Seminar Presentation Field visit report 2. Semester End examination

References

1. Agarwal. D.K. 2008. Text Book of Logistics and Supply Chain Management. McMillan India Pvt Ltd.
2. Charry. S.N. 2005. “Production & Operation Management”, Tata McGraw Hill.
3. Humanitarian Charter and Minimum Standards in Humanitarian Assistance, Sphere Project, 2011.
4. Krajewski & Ritzman. “Operation Management Strategy & Analysis”, Prentice Hall of India.
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6. Walter, Jonathan, ed. 2002. World Disaster Report: Focus on Reducing Risk. ISBN 92-9139-082-8.
7. World Refugee Survey 2002: An Annual Assessment to Conditions Affecting Refugees, Asylum Seekers, and Internally Displaced Persons. US Committee for Refugees. ISBN: 0936548134.

	MAHATMA GANDHI UNIVERSITY
	Name of the course: ES M21 C 63 Standards in Humanitarian Aid, Relief and Rehabilitation

School Name	School of Environmental Sciences					
Programme	M.Sc. Environment Science and Disaster Management					
Course Name	Standards in Humanitarian Aid, Relief and Rehabilitation					
Type of Course	Core					
Course Code	ES M21 C 63					
Names of Academic Staff & Qualifications	Dr. Joice K Joseph: MSc, MSW, PhD					
Course summary & Justification	Humanitarian aid is seen as "a fundamental expression of the universal value of solidarity between people and a moral imperative" and is an essential component in disaster management. Humanitarian aid is material or logistical assistance provided for humanitarian purposes, typically in response to humanitarian crises including natural and man-made disasters. In this course, students will get the primary objective of humanitarian aid such as to save lives, alleviate suffering, and maintain human dignity. The learners of this module also can improve their intellectual and practical skills such as critical thinking, problem solving, and demonstrate effective skills to explore career opportunities in the sector of humanitarian logistics relief and rehabilitation					
Semester		3	Credit			3
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs
						54
Pre-requisite						

CO No.	At the end of the course, the student will be able to:	Taxonomic Level (TL)	PSO
1.	Understand the interlinks of humanitarian assistance and disaster relief	U	2,3,4, 5
2	Distinguish various types of international humanitarian standards	An	2. 4. 5. 6.



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**Name of the course: ES M21 C 63
Standards in Humanitarian Aid, Relief and Rehabilitation**

3.	Illustrate the key concepts of operation management in emergencies	U	3, 4, 5
4	Analyse the International humanitarian logistics system	An	3, 4, 5
5	Compare various humanitarian standards and best practices	E	5, 6, 7, 8
6	Analyse the ethical considerations of humanitarian system	An	6, 7, 8

Unit	Course Description	Hours	CO No.
1.	Humanitarian Assistance and Disaster Relief	14	1, 3
1.1	The concept of humanitarian aid	5	1
1.2	Origin and development of humanitarian aid	3	3
1.3	Humanitarian principles	3	1
1.4	Initiatives for global standards in humanitarian assistance, Sphere project, HAP, ALNAP and People in aid.	3	3
2	The Sphere Project	10	2,3
2.1	Introduction - The Sphere Project philosophy	1	2
2.2	The Humanitarian Charter - Common principles, rights and duties	1	2
2.3	Protection Principles	2	3
2.4	The Core Standards	2	3
2.5	Minimum Standards	2	3
2.6	Humanitarian relief to the vulnerable groups	2	3
3.	The Code of Conduct	8	3
3.1	Principles of Conduct for the International Red Cross and Red Crescent movement and NGOs in Disaster Response Programmes	4	3
3.2	Recommendations to the governments of disaster affected	4	3



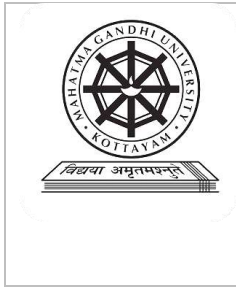
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**Name of the course: ES M21 C 63
Standards in Humanitarian Aid, Relief and Rehabilitation**

	countries		
3.3	Recommendations to inter-governmental organizations		
4	HAP benchmarks	10	3,4
4.1	Introduction to Humanitarian Accountability Partnership	2	4
4.2	The imbalance of power in humanitarian action	2	3,4
4.3	HAP services and activities	3	4
4.4	HAP benchmarks	3	3,4
5	Operation Management in Emergencies	12	3, 5,6
5.1	Introduction to operation management,	3	1,3
5.2	Supply Chain Management	3	5,6
5.3	Managing supply chain in disaster situation	2	3, 5
5.4	Logistics framework	2	3,5
5.5	Disaster Relief Logistics	2	1,5
Teaching and Learning Approach	Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning (Video), interactive Instruction: Active co-operative learning, Seminars, Group Assignments Authentic learning, Library work and Group discussion, Presentation by individual student/ Group representative.		
Assessment Types	1. Continuous Internal Assessment (CIA) Internal test Review of Book /Article Seminar Presentation Field visit report 2. Semester End examination		

References


1. Humanitarian Charter and Minimum Standards in Humanitarian Assistance, Sphere Project, 2011.
2. Walter, Jonathan, ed. 2002. World Disaster Report: Focus on Reducing Risk. ISBN 92-9139-082-8.



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Name of the course: ES M21 C 63
Standards in Humanitarian Aid, Relief and Rehabilitation

3. World Refugee Survey 2002: An Annual Assessment to Conditions Affecting Refugees, Asylum Seekers, and Internally Displaced Persons. US Committee for Refugees. ISBN: 0936548134.
4. Agarwal.D.K. 2008.Text Book of Logistics and Supply Chain Management. McMillan India Pvt Ltd.
5. Krajewski & Ritzman. "Operation Management Strategy & Analysis", Prentice Hall of India.
6. Chary. S.N. 2005. "Production & Operation Management", Tata McGraw Hill.

	MAHATMA GANDHI UNIVERSITY
	Name of the course: ES M21 C 64 Community Based Disaster Management

School Name	School of Environmental Sciences						
Programme	M.Sc. Environment Science and Disaster Management						
Course Name	Community Based Disaster Management						
Type of Course	Core						
Course Code	SES MP C 64						
Names of Academic Staff & Qualifications	Dr. Joice K Joseph: MSc, MSW, PhD						
Course summary & Justification	Active community engagement is the key for every disaster risk reduction activity. Community-based disaster management (CBDM) is an approach to building the capacity of communities to assess their vulnerability to both human induced and natural hazards and develop strategies and resources necessary to prevent and/or mitigate the impact of identified hazards as well as respond, rehabilitate, and reconstruct following its onset. This paper entitled “community-based disaster management” will cover all the major aspects of CBDM such as Social Dimensions of Disaster Management, Origin and development of Social Work in India, Participatory approaches to disaster risk assessment and DRR planning and Community oriented disaster planning.						
Semester		3	Credit			3	
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs	
						54	
Pre-requisite							

CO No.	At the end of the course, the student will be able to:	Taxonomic Level (TL)	PSO
1.	Articulate knowledge about CBDRM process and techniques	U	
2	Distinguish various societal dimensions of disaster management	An	




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**Name of the course: ES M21 C 64
Community Based Disaster Management**

3.	Understand various risk reduction practices for vulnerable groups	U	
4	To familiarize the origin and development of social work in India	U	
5	Build a perspective on community oriented disaster planning	E	
6	To expertise in participatory approaches in DRR	An	


Unit	Course Description	Hours	CO No.
1.	Community Based Disaster Risk Management	10	1, 2
1.1	CBDRM frame work	5	1
1.2	Factors and criteria's Influencing Selection of a Community, Understanding the community: rapport building	3	2
1.3	Building disaster resilient communities	2	1
2	Social Dimensions of Disaster Management	8	2,3
2.1	Gender and social Issues in Disaster Management	4	2
2.2	School safety and practices: Equipping School students, Hospital safety plans	2	2
2.3	Disaster preparedness for vulnerable groups: Social Class, Elderly and Disabled	1	3
2.4	Linking Disaster Risk Reduction and Poverty Reduction	1	3
3.	Origin and development of Social Work in India	8	1,4
3.1	Evolution of social work practice in India	2	1
3.2	Social work education in India	2	4
3.3	Environmental movements	2	1
3.4	Religious contributions in risk reduction	1	4
3.5	Gandhian Concepts	1	4
4	Participatory approaches to disaster risk assessment and DRR planning	10	4,6
4.1	Participatory Disaster Risk Assessment (PDRA): Conceptual Frame work	5	4
4.2	PRA Tools Used in Disaster Risk Assessment	2	6,4
4.3	Capacities and Vulnerabilities frame work	3	4
5	Community oriented disaster planning	10	1,3, 5
5.1	Building and Training a Community Disaster Risk Management	3	1,3

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	Name of the course: ES M21 C 64 Community Based Disaster Management

	Organization		
5.2	Village contingency planning	5	5
5.3	Mainstreaming Disaster Risk Reduction into Community Development	2	3, 5
6	Businesses and disasters – vulnerability, impacts and recovery	8	2, 5
6.1	Business vulnerability to extreme events	2	5
6.2	Disaster impacts on businesses	1	2
6.3	Business disaster recovery and longer- term impacts	1	5
6.4	Corporate Social Responsibility, Public Private Partnership	2	2
6.5	Globalization, Localization and disaster vulnerability	2	2,5
Teaching and Learning Approach	Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning (Video), interactive Instruction: Active co-operative learning, Seminars, Group Assignments Authentic learning, Library work and Group discussion, Presentation by individual student/ Group representative.		
Assessment Types	1. Continuous Internal Assessment (CIA) Internal test Review of Book /Article Seminar Presentation Field visit report 2. Semester End examination		

References

1. Humanitarian Charter and Minimum Standards in Humanitarian Assistance, Sphere Project, 2011.
2. Walter, Jonathan, ed. 2002. World Disaster Report: Focus on Reducing Risk. ISBN 92-9139-082-8.
3. World Refugee Survey 2002: An Annual Assessment to Conditions Affecting Refugees, Asylum Seekers, and Internally Displaced Persons. US Committee for Refugees. ISBN: 0936548134.
4. Agarwal. D.K. 2008. Text Book of Logistics and Supply Chain Management. McMillan India Pvt Ltd.
5. Krajewski & Ritzman. "Operation Management Strategy & Analysis", Prentice Hall of India.
6. Chary. S.N. 2005. "Production & Operation Management", Tata McGraw Hill

	MAHATMA GANDHI UNIVERSITY
	Name of the course: ES M21 C 25 Lab course -III

School Name	School of Environmental Sciences						
Programme	M.Sc. Environment Science and Disaster Management						
Course Name	Governance, Law and Policies in Disaster Management						
Type of Course	Core						
Course Code	ES M21 C 65						
Names of Academic Staff & Qualifications	Dr. Baiju K.R.						
Course summary & Justification	Deals with the general laws and policies of Disaster Management in India						
Semester		3	Credit			3	
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs	
						54	
Pre-requisite							


CO No.	<i>At the end of the course, the student will be able to:</i>	Taxonomic Level (TL)	PSO
1.	Explain the basics of Public Administration	U	3
2	Summarize the Disaster Management act of India	U	3, 7
3.	Distinguish the different facets of decision making in Disaster Management	An	3, 7
4	To familiarize with different policies in Disaster Management	U	3, 7
5	Interpret the pros and cones of about the role of five year plans in Disaster Management	E	3, 4
6	Elaborate and development of new policies in Disaster Management	C	3,4, 10



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**Name of the course: ES M21 C 25
Lab course -III**

Unit	Course Description	Hours	CO No.
1.	Public Administration	12	1, 3, 4
1.1	Introduction. meaning, scope and significance, Evolution and Status of the discipline, comparative public administration and development administration, public and private administration	4	1
1.2	Basic concepts and principles, theories of administration, administrative behaviour accountability and control, financial administration	3	3
1.3	Union Government and administration in India, state and district administration, local government	4	3, 4
1.4	Social welfare administration Public administration and disaster management	2	1, 4
2	Rules and Regulations in Disaster management	10	2,3, 4
2.1	Disaster management Act, 2005 – Institutional arrangements for Disaster Management, Role of the Union and the States in Disaster Management, Role of Local self-Government	5	2
2.2	Loss Assessment Standards, Public budgeting and finance systems; National, state and local finances – National, State and District Disaster Mitigation Fund; National, State and District Disaster Response fund, CMDRF(Chief Ministers Disaster Relief Fund)- Norms	4	3
2.3	International disaster response treaties	1	4
3.	Disaster Decision Making	11	3,4, 6
3.1	Disaster Planning, Incident Command System, Training, Need Analysis and Human Resource Development	4	3
3.2	Corporate/public agency coordination, Contingency Planning for business and industry, Corporate Social Responsibility.	4	3,4
3.3	Community Relations for Environmental and Emergency Managers	3	4, 6
4	Disaster Management Policies	7	2, 3, 4
4.1	Policies in Disasters- its significance, principles, policy options and approaches, essential components, formulation, development and execution	5	2, 3
4.2	National and State Disaster Management Policies	2	4
5	Disaster Management Plans	14	4, 5, 6
5.1	Five year Plans and Disaster Management	3	5
5.2	The Planning process- Why Plan- Legal Basis for Planning-	4	4, 5


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	Components of Disaster Management Plan- risk analysis, Resource identification, vulnerability assessment		
5.3	Introduction to Advanced Planning Techniques-Use of Plan Evaluation Instrument, Organizational Involvement Criteria for review of completed plans- Methods for testing and evaluating plans- Public accountability.	4	4, 5, 6
5.3	National, State and District Disaster Management Plans, NDMA Guidelines Community contingency planning	2	4
5.4	Major welfare schemes by Government of India	1	4

Teaching and Learning Approach	Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning (Video), interactive Instruction: Active co-operative learning, Seminars, Group Assignments Authentic learning, Library work and Group discussion, Presentation by individual student/ Group representative.
Assessment Types	<ol style="list-style-type: none"> 2. Continuous Internal Assessment (CIA) 3. Internal test 4. Review of Book /Article 5. Seminar Presentation 6. Field visit report 3. Semester End examination


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	Name of the course: ES M21 C 25 Lab course -III

School Name	School of Environmental Sciences						
Programme	M.Sc. Environment Science and Management						
Course Name	Lab Course III (RS & GIS and Instrumental analysis)						
Type of Course	Core						
Course Code	ES M21 C25						
Names of Academic Staff & Qualifications	Dr. Mahesh Mohan; Dr. Baiju K.R., Dr. Sylas V.P., Dr. Abin Varghese						
Course summary & Justification	The course will enable students to understand the instrumental analysis. The students will get hands on training on the sophisticated chromatographic and spectrometric equipment. The students will also get acquainted with the RS & GIS technique and become able do the Satellite processing and environmental application of GIS.						
Semester		2	Semester			2	
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs	
						60	
Pre-requisite							

CO No.	<i>At the end of the course, the student will be able to:</i>	Taxonomic Level (TL)	PSO
1	Explain the basic principles of the analytical equipment	R	3,5,8

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2	Do environmental analysis using spectroscopic and chromatographic techniques	Ap	3,5,8
3	Do air pollution Monitoring using online equipment	Ap	3,8
4	Explain the sample processing techniques for the instrumental analysis	U	3,8
5	Do satellite imagery processing	Ap	3,6
6	Assess environmental changes using GIS platform	Ap	3,6
7	Explain advanced methods in RS & GIS	U, Ap, An, E, C	3,6,8


Unit	Course Description	Hours	CO No.
1	Spectroscopy		
1.1	Spectrophotometer- UV, Vis, FTIR	3	1,2,4
1.2	ICP-MS	3	1,2,4
1.3	Mercury analyser – CVAAS, Direct Mercury Analyser, CVAFS	3	1,2,4
2	Chromatography		
2.1	LC	3	1,2,4
2.2	IC	3	1,2,4
2.3	LC-MS, LC-QToF	3	1,2,4
2.4	GC-TCD,ECD,FID	3	1,2,4



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Lab course -III**

2.5	GC-MS	3	1,2,4
3	Other equipment & Online monitoring instruments		
3.1	TOC	2	1,2,4
3.2	Ambient Air Quality Monitoring System	2	3
3.3	Portable Water Quality Analyser	2	1,2,4
3.4	Portable Green House Gas analyser	3	1,2,4
4	GIS		
4.1	Creation of Digital Elevation Model, Understanding various freely available global DEMs	2	5,6,7
4.2	Raster Analysis in GIS (3D analysis tools- Line of sight, Line/ Area Elevation profile)	2	5,6,7
4.3	Generation of Slope, Aspect, Hillshade, View shed, Curvature	2	5,6,7
4.4	Reclassification and Ranking	2	5,6,7
4.5	Raster Calculator	1	5,6,7
4.6	Weighted Overlay analysis	3	5,6,7
4.7	Raster Interpolations (IDW, Kriging)	1	5,6,7
4.8	Weighted Overlay	1	5,6,7
	RS& Image processing		


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5.1	Understanding Geometric and Radiometric Errors	1	5,6,7
5.2	Geometric and Radiometric Corrections	2	5,6,7
5.3	Sub setting the Image	2	5,6,7
5.4	Visual Interpretation of satellite image	3	5,6,7
5.4	Digital Image Classification (Supervised/ Unsupervised)	3	5,6,7
5.5	Image Enhancement Techniques (EVI, NDVI)	2	5,6,7


Teaching and Learning Approach	Practical Lab sessions
Assessment Types	1. Continuous Internal Assessment (CIA) Internal test Review of Book /Article Seminar Presentation Field visit report 2. Semester End examination

References

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	MAHATMA GANDHI UNIVERSITY
	Name of the course: ES M21 C E 27 Climate Change & Governance

School Name	School of Environmental Sciences						
Programme	M.Sc. Environment Science and Management M.Sc Environment Science and Disaster Management						
Course Name	Climate Change & Governance						
Type of Course	Elective						
Course Code	ES M21 E 27						
Names of Academic Staff & Qualifications	Dr. E.V.Ramasamy , M.Tech., Ph.D Dr.C.T.Aravindakumar , PhD						
Course summary & Justification	Course Summary: This course is designed to provide a comprehensive idea on climate change including the drivers, impacts, mitigation and governance strategies. Justification: An in depth knowledge on Climate Change and the governance strategies is essential for the students of both Environment and Disaster Management students.						
Semester		3	Credit			2	
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs	
						40	
Pre-requisite							

CO No.	At the end of the course, the student will be able to:	Taxonomic Level (TL)	PSO
1.	Describe the basics of Climate Change and explains the changes occurred so far and prediction of the future changes	U, R,	1,2
2	Explain the causes of climate change and analyses the impacts of climate change	U,R,A	2,4
3.	Explain various procedures of inventorying the greenhouse gas emissions (GHG).	U,A,E	3,4
4	Evaluate long term mitigation pathways.	A	3,4

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5	Explain various climate change adaptation methods, integrated natural resource management systems; evaluate various information systems including early warning systems.	U,A,R	4
6	Explain the global action and governance for climate change mitigation	U, R,C	9
7	Describe various technical and financial aids for climate change mitigation and adaptation	U	9


Unit	Course Description	Hours	CO No.
1	Basic definitions		
1.1	Climate and weather; climate change; greenhouse gases; radiative forcing; warming potential	2	1
1.2	climate modelling; global and regional circulation models; IPCC modelling scenarios.	2	1
2	Observed and projected changes in the climate system		
2.1	Land surface temperature; ocean surface temperature; precipitation; cryosphere ;sea level	2	1,2
2.2	Greenhouse gas (GHG) concentrations (CO ₂ and Non CO ₂ gases); and extreme climatic events.	2	1,2
3	Drivers of climate change		
3.1	Natural and anthropogenic radiative forcing; solar irradiance; aerosols, water vapour and clouds; volcanic eruption	2	2
3.2	GHG emissions from energy, industries, and transport; and gross and net emissions from agriculture, forestry and other land use.	2	2



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Climate Change & Governance**


4	Impacts of climate change		
4.1	Physical systems (Glaciers, snow, ice and/or permafrost; Rivers, lakes, floods and/or drought; Coastal erosion and/or sea level effects)	2	2
4.2	Biological systems (Terrestrial ecosystems; aquatic ecosystems); Human and managed systems (Food production; Livelihoods, health and/or economics)	2	2
5	Greenhouse gas inventorying		
5.1	IPCC guidelines on national greenhouse gas inventorying; general guidance and reporting; guidance specific to energy	2	2,3
5.2	Industrial processes and product use (IPPU), agriculture, forestry and other land use (AFOLU), and waste; activity data	2	2,3
5.3	Emission factors; key categories; tiered approach; stock-difference and gain-loss methods; principles of reporting; measurement, reporting and verification (MRV) system.	2	2,3
6	Climate change mitigation		
6.1	Decarbonizing energy production; use of clean energy and enhancing the energy efficiency in industries, transport, and buildings; carbon dioxide storage and capture	3	4
6.2	Bioeconomy or low carbon economy; enhancing the carbon sequestration capacity of forests and land use; climate smart agriculture; REDD+, long term mitigation pathways.	3	4
7	Climate change adaptation		
7.1	Social, ecological asset and infrastructure development	1	3,4
7.2	Technological process optimization; integrated natural resources management; institutional, educational and behavioural change or	2	3,4,5

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	reinforcement		
7.3	Financial services including risk transfer; information systems to support early warning and proactive planning.	1	3,5
8.	Climate change institutions and governance		
8.1	UNFCCC - Conference of Parties (COP); International Climate Agreement; Policy approaches for adaptation and mitigation, technology and finance;	2	6
8.2	National Communications; Biennial Update Report; Intended Nationally Determined Contributions	2	6,7
8.3	Funding streams – Green Climate Fund, Forest Carbon Partnership Facility, Global Environment Facility, Adaptation fund, Bilateral and multilateral funds, and official development assistance fund, voluntary and compliance markets; global think tanks in climate change.	4	7

Teaching and Learning Approach	Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning (Video), interactive Instruction: Active co-operative learning, Seminars, Group Assignments Authentic learning, Library work and Group discussion, Presentation by individual student/ Group representative.
Assessment Types	<ol style="list-style-type: none"> 1. Continuous Internal Assessment (CIA) <ul style="list-style-type: none"> • Assignments • Seminar Presentation on selected topics • Quiz • Class tests 2. Semester End examination


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 <p>The logo of Mahatma Gandhi University is circular, featuring a central geometric design with a wheel-like structure. The text 'MAHATMA GANDHI UNIVERSITY' is written around the top inner edge, and 'KOTTAYAM' is at the bottom. Below the circle is a banner with the Sanskrit motto 'विद्यया अमृतमश्नुते'.</p>	<p style="text-align: center;">MAHATMA GANDHI UNIVERSITY</p> <hr/> <p style="text-align: center;">Name of the course: ES M21 C E 27 Climate Change & Governance</p>
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