

2020

SYLLABUS OF POSTGRADUATE PROGRAMMES



SCHOOL OF ENVIRONMENTAL SCIENCES
MAHATMA GANDHI UNIVERSITY

SCHEME OF THE SYLLABUS

MSc. Environment Science and Disaster Management

Credit and Semester System

2020 admission onwards

Semester I

Sl. No.	Course Code	Name of the Course	Credits	Credits Required	Total Credits
01	SES MP C 51	Introduction to Environment & Ecosystems	3	18	24
02	SES MP C 52	Earth’s systems processes and landforms	3		
03	SES MP C 53	Natural and anthropogenic disasters	3		
04	SES MP C 54	Pollution hazards and its Management	3		
05	SES MP C 05	Research Methodology and Statistics	3		
06	SES MP C 06	Lab course-1 (Environmental Chemistry, Geosciences and Ecology)	3		
07	SES MP E 10	Introduction to Remote Sensing, GNSSs and GIS	2	6	
08	SES MP E 55	Chemical systems in Environment	2		
09	SES MP E 56	Basic Life Skills/First Aid for Disaster Management	2		
10	SES MP 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	SES MP C 11	Analytical Techniques and Instrumentation	3	12	22
12	SES MP C 12	Environmental Biotechnology and Waste Management	3		
13	SES MP C 13	Biodiversity and Conservation Biology	3		

14	SES MP C 14	Lab course-II (Environmental Chemistry, Environmental Biotechnology, RS & GIS)	3	12/10	
15	SES MP E 15	Environmental Laws, Ethics, Education and Policy	2		
16	SES MP E 17	Ecotoxicology	2		
17	SES MP E 58	Public health aspects and emergency services in disaster management	2		
18	SES MP E 59	Disaster Risk Reduction and Sustainable Development	2		
19	SES MP E 60	Applications of Science and Technology for Disaster Management	2		
20	SES MP E 61	Social Work Approaches and Practices	2		

Semester III

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

Semester IV

Sl.No.	Course Code	Name of the Course	Credits	Credits Required	Total Credits
29	SES MP C 66	Internship (Community/Institution) – One month	4	4	16
30	SES MP C 67	Project	12	12	

SYLLABUS

M.Sc. Environment Science and Disaster Management

Credit and Semester System

2020 admission onwards



MAHATMA GANDHI UNIVERSITY

Name of the Course: SES MP 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	SES MP 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					

Unit	Course Description	Hours
1.0	Introduction	11
1.1	Basic concepts of Environment –	2
1.2	Multidisciplinary approach	2
1.3	Basic concepts - Science, Matter and Energy	2
1.4	Evolution of earth, origin of species, diversity and distribution of species	3
	Global environmental issues – an introduction	2
2.0	Ecology	12
2.1	Definition,History of ecology,Subdivisions,Ecologyand others subjects.	2
	Fundamental ecological variables	2
2.2	Ecosystems:Definition,Components,Structureandfunction,Sizeof Ecosystem,	3
2.3	Classificationof ecosystems	3
2.4	ComparativeEcosystemEcology	2
3.0	PopulationEcology	10
3.1	Definition,StructureandMeasures	2
3.2	PopulationGrowth,Population	2
3.3	Regulation Strategiesofspecies	2
3.4	Survivability PopulationGenetics	2
3.5	HumanPopulation	2
4.0	CommunityEcology	10



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Name of the Course: SES MP C 51 Introduction to Environment & Ecosystems

4.1	Concepts, Community gradients, Characters of community	2
4.2	Ecological Succession and climax Community	3
4.3	Organization Interactions between species	3
4.4	Stress Ecology and Adaptation	2
5.0	Applied Ecology	11
5.1	Estimating Abundance Species diversity measures	2
5.2	Diversity indices	2
5.3	Mathematical ecology : Eco-informatics	2
5.4	Museology	1
5.5	Taxonomy and Biosystematics	2
5.6	Biomass productivity and estimation techniques	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) <ul style="list-style-type: none"> Internal test Assignments based on the theory Seminar Presentation Field visit report 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 McGraw Hill Publishing Company Ltd, New Delhi.
6. Odum, E. P. 1971. Fundamentals of ecology
7. Sutherland, W. J. 2004. 1997. Ecological Census Techniques - A Handbook. Cambridge University Press. P336.



MAHATMA GANDHI UNIVERSITY

Name of the course: SES MP 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	SES MP 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					

Unit	Course Description	Hours
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
1.2	Earth as a System of Interacting Components –Lithosphere, atmosphere, Hydrosphere	2
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
2	Materials of the earth	10
2.1	Introduction to Rock-forming minerals and their Physical	2



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Name of the course: SES MP C 52 Earth System Processes and Landforms

	properties	
2.2	Types of Rocks: igneous, metamorphic and sedimentary Major Rock types - Origin and composition– The rock cycle	3
2.3	Geological Structures: folds, faults and joints	3
2.4	Disintegration of rocks: Weathering: Types of weathering, Formation of Soil, Soil profile.	2
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
3.2	Geomorphology of India and Kerala: Brief description of different important units	3
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
4.2	Methods of ground water abstraction-undesirable side effects of over exploitation-threats to ground water system-physical 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
4.3	Sustainable ground water development and management	1
5	The Atmosphere	7
5.1	Structure and composition of the atmosphere	1
5.2	Interaction between lithosphere and atmosphere: Winds, Precipitation etc. Wind – types and formation, Precipitation – rainfall, snow fall.	3
5.3	Humidity and radiation Monsoon, El Nino, Droughts, Tropical Cyclones	3
6	Geological Resources and the Environment	10
6.1	Major geological resources- minerals, rocks, coal, oil and natural gas	2
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
6.3	Shoreline activities and its environmental impacts	2
6.4	Geological issues in the disposal of domestic waste and industrial waste	3



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Name of the course: SES MP C 52
Earth System Processes and Landforms

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

References

1. Grotzinger et al 2007 Understanding Earth WH Freeman New York 579 p
2. Soman K 2001 Geology of Kerala Geological Society of India Bangalore 430 p
3. Fetter CW 1990 Applied Hydrogeology CBS New Delhi 592 p
4. Krishnan MS 1976 Geology of India and Burma CBS New Delhi 433 p
5. Stewart RH 2007 Introduction to Physical Oceanography 353 p



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Name of the course: SES MP C 53
Natural and Anthropogenic Disasters

School Name	School of Environmental Sciences					
Programme	M.Sc. Environment Science and Disaster Management					
Course Name	Natural and Anthropogenic Disasters					
Type of Course	Elective					
Course Code	SES MP 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						

Unit	Course Description	Hours
1.	Environment and Disasters	10
1.1	Science and Facts of Natural Hazards. Earth's processes as disasters: Internal and external	4
1.2	Characteristics. Causal factors and characteristics of disasters.	3
1.3	Climate change and Disasters	3
2	Types and Classification of Disasters	10
2.1	Natural Disasters: Meteorological disasters, Geological disasters, Biological disasters	5
2.2	Anthropogenic Disasters: Chemical, Industrial and Nuclear related Disasters, Accident related Disasters	5
3.	Disaster Management Concepts	8
3.1	Introduction to key concepts, terminologies and their complexities (Hazard, vulnerability, Exposure, Risk, Crisis, emergencies, Vulnerability, Disasters, Resilience)	4
3.2	Disaster management Spectrum and its components Scope of DM and Disaster Management Cycle	4
4	International Disaster management System	10
4.1	Organizations, bodies and Finance. International Strategies and	4



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Name of the course: SES MP C 53
Natural and Anthropogenic Disasters

	functions. Role of United Nations in Disaster management.	
4.2	International Disaster management support system. Unified response strategy.	3
4.3	Mapping Disasters using global datasets. National and international information networks and inventories	3
5	Disaster Management in Indian Context	10
5.1	Major Disasters in India. National Vulnerability profile	3
5.2	National Disaster management Hierarchy and Institutionalisation	3
5.3	National Disaster Decision support system. Technological applications. Role of research organisations.	2
5.4	Challenges of disasters in India	2
6	Disasters and Development	6
6.1	Relationship between disasters and development, implications. History of disaster response strategies	2
6.2	Disasters, Poverty and Development. Global challenges and trends of Disasters	2
6.3	Disaster Risk Management - key concerns. Mainstreaming Disaster Risk Reduction to developmental efforts.	1
6.4	Geography and dimensions of Disasters- global out look.	1

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	3. Continuous Internal Assessment (CIA) 4. Internal test 5. Review of Book /Article 6. Seminar Presentation 7. Field visit report 8. Semester End examination



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**Name of the course: SES MP C 53
Natural and Anthropogenic Disasters**

References

1. Coppola D. P., 2007. Introduction to International Disaster management. Elsevier. Butterworth-Heinemann
2. Kapur A., Neeti, Meena, Deepthima, Roshani and Debanjali, Disasters in India Studies of Grim Reality. Rawat Publications, New Delhi
3. Keller E.D., and Blodgett R. H, 2006. Natural Hazards. Pearson Printice Hall
4. Peduzzi P., Dao H., and Herold C., 2005. Mapping Disastrous Natural Hazards Using Global Datasets Natural Hazards Volume 35, Number 2, 265-289,
5. Shaw R and Krishnamurthy R.R., (ed.) 2009. Disaster management Global Challenges and Local solutions. University Press, India.



MAHATMA GANDHI UNIVERSITY

Name of the course: SES MP 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	SES MP 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							

Unit	Course Description	Hours
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
1.2	Factors affecting air pollution, Transport and diffusion of pollutants. Gas laws governing the behaviour of pollutants in the atmosphere.	3
1.3	Indoor air pollution – Types and sources of pollutants	2
1.4	Effects of pollutants on human beings, plants, animals, materials and on climate. Identification of aeroallergens. Air-borne diseases and allergies.	3
1.5	Air pollution control	2
1.6	Noise Pollution and control : Characteristics of noise, sources,	2



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Name of the course: SES MP C 54
Pollution hazards and its Management

	Effects of noise, Standards, Measurement and control	
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
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
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
2.4	Coastal and Marine pollution-Oil spills, Thermal pollution, Impacts of water pollution	2
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
2.6	Management of point and non-point sources of water pollution, water pollution control, Role of State and Central Pollution Control Boards	2
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
3.2	Sedimentation rate and contamination profile, sediment pollution indices	2
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
4	Environmental Pollution monitoring	
4.1	Monitoring-online and offline, Environmental sampling and analysis – stages (sampling, treatment, detection and interpretation), scope and	4



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Pollution hazards and its Management

	criteria , Sampling – water, air and soil, equipment for air, water and soil sampling. Analysis – types and methods, Speciation, Certified reference materials,	
4.2	Water quality parameters-physical, chemical and biological, analysis, Water quality standards, Tracers – dyes and isotopes in pollution monitoring	4
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
4.4	Soil/sediment sampling and monitoring. soil quality standards. Methods for assessing pollutant contamination profile in the sediments – chronology and pollutant detection	2
5	Radioactive Pollution	
5.1	Radioactivity in the environment, Radioactive Pollution: Radionuclides- sources, types of radiation, Radioactive fallout,	2
5.2	Ecological risks from radiation, effects on humans, exposure standards.	2
5.3	Control measures: radioactive waste treatment.	2
6	Emerging contaminants	
6.1	Emerging contaminants – definition, types and sources Sources and health impacts of PPCPs, POPs, PCCDS, PFAs, Dioxins, PCBs etc.	2
6.2	Plastics pollution in the freshwater and marine ecosystems Natural disasters and Pollution –	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) <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: SES MP C 54
Pollution hazards and its Management

References

1. Baxter, M. (2013). Social and Ethical Aspects of Radiation Risk Management, Vol.19, Editors: Deborah Oughton Sven Hansson. Elsevier (Pub.). Series: Radioactivity in the Environment.
2. Brady, N.C. (1996). The Nature and Properties of Soil, 10th Ed., Prentice Hall of India Pvt. Ltd.
3. Cherimisinoff, N.P. (2001). Biotechnology for Waste and wastewater treatment, Prentice Hall of India Pvt. Ltd.
4. Helmut Meuser (2010). Contaminated Urban Soils, Springer.
5. Luyben, W. L. Process Modeling Simulation and Controls for Chemical Engineers, Mc. Graw Hill Book Co.
6. Mahajan, S.P. (1998). Pollution control in process industries, Tata McGraw Hill, New Delhi.
7. Masters, G.M. (1998). Introduction to Environmental Engineering and Science 3rd ed. Prentice Hall of India Pvt. Ltd.
8. Metcalf and Eddy (2003). Wastewater engineering: Treatment, Disposal, Reuse, 4th edition. Tata McGraw Hill, New Delhi.
9. Miller R.W. and Donalvee, R.L. (1997). Soils in Our Environment, 7th Ed, Prentice Hall of India Pvt. Ltd.
10. Nathanson, J.A. (2003). Basic Environmental Technology, 4th Ed., Prentice Hall of India Pvt. Ltd.
11. Parsons, S.A. and Jefferson, B. (2006). Introduction to potable water treatment processes, Blackwell Publishing.
12. Poonia and Sharma (2018)., Environmental Engineering, Khanna Books, ISBN: 9789386173577, 9386173573.
13. Rao, C.S. (1995). Environmental Pollution Control Engineering, 3rd Ed., Wiley Eastern Ltd. New Age International Pvt. Ltd.
14. Sharma, B.K. (2001). Water Pollution. Goel Pub. House. Meerut. Wadhwa, Y. (2009). Air Pollution: Causes and Control. Cyber Tech Publications, New Delhi

Suggested readings

1. http://echo2.epfl.ch/VICAIRE/mod_2/chapt_9/main.htm
2. <http://www.bis.org.in/>
3. <http://www.science.uwaterloo.ca/~cchieh/cact/applychem/watertreatment.html>
4. <http://www.sciencedirect.com/science/journal/02697491?sdc=1>
5. <http://www.water-pollution.org.uk/types.html>
6. https://en.wikipedia.org/wiki/Water_pollution
7. <https://link.springer.com/journal/11270>



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Name of the course: SES MP C 54
Pollution hazards and its Management

8. <https://www.journals.elsevier.com/atmospheric-pollution-research/>
9. <https://www.journals.elsevier.com/environmental-pollution/>
10. https://www.sciencedaily.com/terms/water_pollution.htm



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Name of the course : SES MP C 05
Research Methodology and Statistics

School Name	School of Environmental Sciences					
Programme	M.Sc. ENVIRONMENT SCIENCE & MANAGEMENT & M.Sc. ENVIRONMENT SCIENCE & DISASTER MANAGEMENT					
Course Name	Research Methodology and Statistics					
Type of Course	Elective					
Course Code	SES MP 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
			40	7		7
Pre-requisite	Basic research aptitude and knowledge in statistics					


Unit	Course Description	Hours
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	Selection of the problem: Criteria for selection of problem and evaluating problems, Statement of problem formulation and definition.	2
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
1.4	Survey of literature: Different methods of surveying literature, different sources of information, internet, search engines, web sites, recording surveying information.	2



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Name of the course : SES MP C 05
Research Methodology and Statistics

1.5	Hypothesis: Nature, types and sources of hypothesis, characteristics of a good hypothesis.	2
1.6	Sampling: Unit of sampling, population: techniques, characteristics of good samples, different types of sample, sampling errors and ways to reduce them.	3
1.7	Collection and analysis and interpretation of data: Procedure of data collection, scoring of data, tabulation, editing and analysis and interpretation of data.	3
1.8	Research Report: Composition, pagination, Title pages, Systems of indicating references, Bibliography, Appendices.	3
1.9	Mini project for data analysis	4
	II. Statistics	20
2	Fundamental Statistics	
2.1	Introduction – Importance and limitation.	1
2.2	Classification and Tabulation of data	1
2.3	Graphical Representation	2
2.4	Measures of Central Tendencies – Mean, Median and Mode	2
2.5	Measures of Dispersion - Range, Standard Deviation and Co-efficient of Variation	2
2.6	Moments, Skewness and Kurtosis	2
2.7	Correlation and Regression – Scatter diagrams – Karl Pearson's Coefficient of correlation – Rank correlation – Linear and Curvilinear regressions.	3
2.8	Probability – Frequency approach- Addition and multiplication theorems- Binomial, Poisson and Normal Distribution- Probit analysis (Graphic Method only)	3
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

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	Name of the course : SES MP C 05 Research Methodology and Statistics

3	Application of Computer in Statistics	8
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	1. Continuous Internal Assessment (CIA) Internal test Assignment Seminar Presentation Mini project for data analysis 2. Semester End examination

References


1. Ahuja Ram, Research Methods, Rawath Jaipur.
2. Babbie Earl, Research methods in sociology, Cengage Learning Australia.
3. Denscombe Martyn, The good research guide: for small scale social research projects, Viva Books New Delhi.
4. Devendra Thakur, Research methodology in social science, Deep & Deep Publications New Delhi
5. Gurumani N, Research methodology for Biological Sciences, MJP Publishers Chennai
6. Holmes Debbie Moody Peter Dine Diana, Research methods for the biosciences, Oxford Newyork.
7. Kothari C R, Research methodology: methods and techniques, WiswaPrakashan New Delhi.
8. Mohankumar P S , Handbook on research methodology, Right Publishers Kudanechoor
9. Narwal S S Dahiya S S Singh J P, Research methods in Plant science, Allelopathy Vol 1, Soil analysis, Scientific Publishers Jodhpur.
10. Prabhakar V K, Research methodology and system analysis, Anmol NewDelhi
11. Santosh Gupta, Research methodology and statistical techniques, Deep & Deep Publications New Delhi
12. Barnett Vic, Environmental statistics, methods and applications. JhonWiley& Sons NewYork.
13. Gupta S P, Statistical methods, Sultan Chandh New Delhi



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Name of the course : SES MP C 05
Research Methodology and Statistics

14. Kozak Antal Kozak Robert A Staudhammer Christina L Watts Susan B, Introductory Probability and Statistics, applications for forestry and the natural sciences, Cab International Wallingford.
15. Levin Richard I Rubin David S, Statistics for Management, Edition 7, P H I New Delhi
16. Miller Jane, Statistics for advanced level, Ed.2, University Press Cambridge.

	MAHATMA GANDHI UNIVERSITY
	Name of the course: SES MP C 06 Lab course-I (Environmental Chemistry, Geosciences and Ecology)

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, Geosciences and Ecology)					
Type of Course	Core					
Course Code	SES MP 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					

Unit	Course Description	Hours
1	Environmental Chemistry	13
1.1	Volumetric Analysis: Basic Principles	4
1.2	Acidimetry and Alkalimetry—Estimation of hydrochloric acid, sodium carbonate, oxalic acid	3
1.3	Permanganometry- Mohrs salt, potassium permanganate	4
1.4	Gravimetric analysis	2
2	Water and Noise quality	12
2.1	Colour, turbidity, conductivity, TDS, TSS, TS, pH, acidity, alkalinity, chloride, salinity, hardness, DO, BOD	10


	MAHATMA GANDHI UNIVERSITY
	Name of the course: SES MP C 06 Lab course-I (Environmental Chemistry, Geosciences and Ecology)

2.2	Noise analysis	2
3	Ecology	14
3.1	Biodiversity assessment : Quadrature method	6
3.2	Plankton analysis	4
3.3	Zooplankton analysis	4
4	Environmental Geosciences	21
4.1	Identification of rocks and minerals	6
	Soil analysis- Physical (Texture, Bulk density, moisture content) and chemical parameters (pH, OC/OM, EC)	8
4.2	Rose diagrams- Wind rose	4
4.3	Measuring strike and dip of rock formations. Basic map reading.	3


Teaching and Learning Approach	Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning (Video), interactive Instruction:, Practical lab sessions
Assessment Types	1. Continuous Internal Assessment (CIA) Practical tests 2. Semester End examination

References

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2. APHA (1995).Standard methods for the examination of water and wastewater. 19th edition American Public Health Association, Washington, DC.
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4. Conklin Alfred R. Introduction to Soil chemistry, analysis and Instrumentation, Jhonwiley&SonsNewyork
5. Maiti, S.K. (2003) Handbook of methods in environmental studies, Vol. 2: Air, noise, soil, overburden, solid waste and ecology. ABD Publishers, Jaipur.
6. MamataTomar, Quality Assessment of Water and Waste Water, Lewis Publishers London
7. Marc Pansu, Jacques Gautheyrou, Hand book of soil analysis- Minerological, organic and inorganic methods, Springer, New York


	<p align="center">MAHATMA GANDHI UNIVERSITY</p>
	<p align="center">Name of the course: SES MP C 06 Lab course-I (Environmental Chemistry, Geosciences and Ecology)</p>

8. Maria Csuros and CsabaCsuros, Environmental Sampling and Analysis for Metals, Lewis Publishers
9. MiroslavRadojevic and Vladimir N Bashkin, Practical Environmental Analysis, RSC Publishing
10. NEERI , Air quality monitoring, A course manual (Photostat), NEERI Nagpur


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

School Name	School of Environmental Sciences					
Programme	M.Sc. Environment Science and Management M.Sc. Environment Science and Disaster Management					
Course Name	Introduction to Remote Sensing, GNSSs and GIS					
Type of Course	Core					
Course Code	SES MP 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 has 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
		30	10	0	0	40
Pre-requisite						

Unit	Course Description	Hours
1	Geodetical aspects, mapping concepts and surveying	10
1.1	Earth System – Geodesy: Datum/Spheroids and coordinate systems, map projection - different projections and their characteristics	4
1.2	Features on the earth's surface: their basic properties – discrete vs continuous and geometries of representation	2
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 Map reading and interpretation	4

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Name of the course: SES MP E 10 Introduction to Remote Sensing, GNSSs and GIS	

	Global, national and state mapping agencies and their authorized reference maps – general & thematic	
2	Remote sensing: Introduction	10
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
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
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	Digital Image Processing	10
3.1	Various image formats, loading and visualization – panchromatic and multispectral colour visualization – TCC and FCCs	3
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
3.3	Image interpretation – visual and digital; visual interpretation elements and key Digital image classification – unsupervised and supervised; accuracy assessment	3
4	Geographical Information System (GIS): Basics	10
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
4.2	Non-spatial/attribute Database Management Systems (DBMS), significance of DBMS, principles, data types, models – RDBMS, data storage, query and retrieval	3
4.3	Basic GIS functions: data inputting methods & various data sources, data management, data manipulation and geographic analysis and output presentation	3
5	Global Navigational Satellite Systems: Basics	6
5.1	Basic concepts of Global Navigational Satellite Systems (GNSSs):	3

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

	History and timeline, overview. Components of GNSSs (Space Segment, Control Segment, User Segment), GPS working principle, -	
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
6	Geographic analysis and modelling	8
6.1	Exploration, query, vector spatial analysis & geoprocessing – extraction, proximity, overlay Network analysis – route, trace, closest facility, allocation	3
6.2	Raster based spatial modeling and analysis – density, distance, map algebra – arithmetic & weighted overlay: multi-criteria decision making	3
6.3	Surface modeling and analysis: DEM creation – input sources, interpolation; slope, aspect, volume, profile, hillshade, viewshed, visibility, contouring	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	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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2. Agarwal N. K. 2004. Essentials of GPS. Spatial Networks Pvt. Ltd., Hyderabad
3. Anji Reddy M. 2004. Geoinformatics for Environmental Management. B. S. Publications
4. Burrough P.A. and McDonnell A. R. 1998. Principles of Geographic information Systems. Spatial information systems and Geostatistics. Oxford university press.
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MAHATMA GANDHI UNIVERSITY

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

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12. Jensen J. R. 1996. Introductory Digital Image Processing. Prentice Hall Series
13. John Wainwright and Mark Mulligan (Eds). 2004. Environmental modeling - finding simplicity in complexity. John Wiley & Sons Ltd.
14. Jorgensen S. E., Chon T. S. and Recknagel F. A., 2009. Handbook of Ecological Modeling and Informatics. WIT Press, 448 pages, ISBN-13: 978-1845642075
15. Kang-tsung Chung. 2002. Introduction to Geographical Information System. McGraw Hill Companies, International edition.
16. Lillesand T. M., Kiefer R. W. and Chipman J. W. 2008. Remote Sensing and Image Interpretation (Sixth Edition). John Wiley & Sons, USA.
17. Maguire D., Batty M. and Goodchild M. (Eds.) 2005. GIS, Spatial Analysis, and Modeling. Esri Press, 496 pages, ISBN-13: 978-1589481305.
18. Peng Z. P. and Tsou M. H. 2003. Internet GIS: Distributed Geographic Information Services for the Internet and Wireless Networks. Wiley, Hoboken, NJ.
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23. Steven E. Franklin. 2001. Remote Sensing for Sustainable forest management. Lewis publishers.
24. Wise S. 2002. GIS Basics. Taylor Publications.
25. Zeleny M. 1982. Multiple Criteria Decision Making, Mc-Graw Hill



MAHATMA GANDHI UNIVERSITY

Name of the course SES MP 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	SES MP 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							

Unit	Course Description	Hours
1	Man and environment	
1.2	Water and the hydrosphere, Air and the atmosphere	3
1.3	Energy and cycles of energy, Chemical fate and transport.	4
2	Chemistry of the environment - basics	
2.1	Mass and Energy transfer across the various interfaces, material balance.	4
2.2	First and Second law of thermodynamics. heat transfer' processes, Chemical potential; chemical equilibria, acid· base reaction.	4




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Name of the course SES MP E 55
Chemical systems in Environment

2.3	Solubility product, solubility of gases in water, the carbonate system.	3
2.4	Unsaturated and saturated hydrocarbons, radionuclide's	3
3	Atmospheric chemistry	
3.1	The atmosphere Composition of Air : Classification of elements, chemical speciation. Particles, ions and radicals in the atmosphere.	4
3.2	Chemical and photochemical reactions in the atmosphere, reactions of atmospheric oxygen,	4
3.3	Chemical processes for formation of inorganic and organic particulate matter. Chemistry of air pollutants, Photochemical smog.	4
3.4	Energy transfer in atmosphere, Global climate and microclimate,	3
4	Aquatic chemistry	
4.1	Fundamentals of aquatic chemistry, The importance of water, The properties of water, gases in water	4
4.2	Calcium and other metals in water, Polyphosphates and phosphonates in water	3
4.3	Concept of DO, BOD, COD, sedimentation, coagulation, filtration, Redox potential.	4
5	Soil Chemistry	3
5.1	Nature and decomposition of soil, Inorganic and organic components of soil,	3
5.2	Acid base and ion exchange reactions in soils, macro and micronutrients in soil, Nitrogen pathways, NPK in soils.	3

Teaching and Learning Approach	
Assessment Types	1. Continuous Internal Assessment (CIA) Internal test

	MAHATMA GANDHI UNIVERSITY
	Name of the course SES MP E 55 Chemical systems in Environment

	Review of Book /Article Seminar Presentation Field visit report 2. Semester End examination
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References

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2. James Girard, Principles of Environmental Chemistry
3. Manahan Stanley E ., Environmental chemistry, Lewis Publishers London
4. Nyle C Brady, Nature and Properties of Soil, Macmillan
5. Phyllis Buell , Chemistry Fundamentals: An Environmental Perspective (2nd Edition)
6. Rao M. N. and Rao H V N, Air Pollution, McGRAW HILL



MAHATMA GANDHI UNIVERSITY

Name of the course SES MP 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	SES MP 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
			30			6
Pre-requisite						36

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	
2	First aid in various Emergencies	10	
2.1	The ABC Bites and Stings. Breathing. Bleeding. Fractures. Burns. Choking	2	
2.2	Cold and Heat related illnesses. Convulsions and Seizures, Dizziness and Fainting.	2	
2.3	Eye and Ear injuries. Head, neck and spine injuries	2	
2.4	Poison. Shock. Stroke and Tooth injuries	2	
2.5	Drowning, Dizziness and Fainting	2	
3	Basic Methods in First Aid	10	
3.1	Concept of Basic Life Support. Bandaging, Slings and Binders.	3	
3.2	Checking Pulse. Cardiopulmonary resuscitation (CPR).	3	



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

3.3	Automated External Defibrillator (AED). Ventilation.	2	
3.4	Clearing Air-way obstruction. Using the Fire-extinguisher.	2	
4	Psychological First Aid (PFA)	10	
4.1	Definition of PFA, objectives, PFA identification, history of PFA, post-traumatic stress disorder (PTSD) types of PFA.	4	
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	

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

Reference

- Allen; et al. (2010). "Perceptions of PFA Among Providers". Journal of Traumatic Stress. 23 (4): 509–513. doi:10.1002/jts.20539. PMID 20623598.
- Bowman, W. D., Backer, H. D., Paton, B. C. (2005). Wilderness First Aid: Emergency Care for Remote Locations. United States: Jones and Bartlett Publishers.
- Everly, G. S.; Lating, J. M. (2017). The Johns Hopkins guide to psychological first aid. Johns Hopkins University Press. OCLC 957724673.
- 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.
- Indian first aid manual, 2016 (7th edition), authorized manual – English version, St. John ambulance and Indian red cross society.
- Jack Pinkowski. 2008. Disaster Management Handbook. CRC Publication
- Jefferson's County Sheriff's Office.(2018). Jeffereson County Family emergency Preparedness Handbook. Oregon: Jefferson's County Sheriff's Office. Retrieved from:



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Name of the course SES MP E 56
Basic Life Skills/First Aid for Disaster Management

https://www.jeffco.net/sites/default/files/fileattachments/public_safety/page/5629/preparedness_handbook.pdf

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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 SES MP E 57
FieldSkills 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	SES MP 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						

Unit	Course Description	Hours
1.	Importance of field works in disaster management	8
1.1	Field oriented subjects, real-time disaster fieldwork,	3
1.2	Challenge of disaster fieldwork, Data collection in disaster setting	2
1.3	Field works in different disaster management spectrum and advantages of field work in disaster management education.	3
2	Field skills	8
2.1	Skills in observation, understanding, data collection and gathering background information,	3
2.2	Skills in public relations and crisis communication, Planning and coordination	3
2.3	Logistics management, time and other resource management, appropriate generalization.	2
3	Qualitative and quantitative methods in field work	8
3.1	Qualitative and quantitative data, issues with biased data, primary and	2



MAHATMA GANDHI UNIVERSITY

Name of the course **SES MP E 57** **FieldSkills and Techniques in Disaster Management**

	secondary data collection,	
3.2	Sampling techniques- Simple random sampling, systematic sampling, clustered sampling, Convenience sampling, judgment (or Purposive) sampling, quota sampling, Questionnaire survey, questionnaire design	4
3.3	Basic data analysis techniques for disaster management.	2
4	Working with vulnerable communities	6
4.1	Ethnographic field work, focused group discussions with vulnerable communities	3
4.2	Local disaster Management Committees- membership and roles, knowledge, skills and resources required for task forces,	3
5	Ethics in field work	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
5.2	Non-discrimination, Respect of dignity, respect of person, neutrality, territorial sovereignty, professional behavior, safety in field works, fair representation of samples,	2
5.3	Cultural and cognitive biases, code of conduct in disaster response.	1

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

Reference

- Allen; et al. (2010). "Perceptions of PFA Among Providers". Journal of Traumatic Stress. 23 (4): 509–513. doi:10.1002/jts.20539. PMID 20623598.



MAHATMA GANDHI UNIVERSITY

**Name of the course SES MP E 57
FieldSkills and Techniques in Disaster Management**

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). Jefferses 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
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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: SES MP 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	SES MP C 11						
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 be 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							

Unit	Course Description	Hours
1	Introduction	
1.1	Significant figures, Accuracy and precision	2
1.2	Types of errors- random and systematic errors, Standard deviation	3
2	Gravimetric methods	
2.1	Mechanism of formation of precipitates, Characteristics of ideal precipitate, Methods to improve filterability and minimizing adsorbed impurities	3
2.2	Precipitation from homogeneous solutions, Organic and inorganic precipitating agents,	3
2.3	Application of gravimetric methods	3



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Name of the Course: SES MP C 11 Analytical Techniques and Instrumentation

3	Volumetric methods	
3.1	Molarity, Normality, Standard solutions, End point	3
3.2	Acid-base titrations – titration curves, theory of indicators	2
3.3	Complexometric titrations-EDTA titrations-applications	3
3.4	Iodometry, Iodimetry, Colorimetric titrations	3
4	Spectrochemical methods	
4.1	Electromagnetic spectrum, Interaction of light with matter/molecule	3
4.2	Fundamentals of molecular spectroscopy	3
4.3	Wavelength selectors: Filters and Monochromators, Radiation detectors and Transducers	2
4.4	Mass spectrometry	3
4.5	Atomic Absorption spectroscopy (AAS), Inductively coupled plasma mass spectrometry (ICP-MS) -principle and applications	4
4.6	Microwave, IR, Electronic, Raman, NMR and ESR spectroscopy-principle	3
4.7	SEM, TEM- instrumentation and applications	2
5	Radiation detectors	
5.1	Dosimetry, Geiger Muller Counter, Scintillation Counter	4
5.2	Electrochemical Methods: pH meter- Glass and reference electrodes, Conductivity met	4
6	Chromatographic Techniques and environmental applications	
6.1	Paper Chromatography, Thin Layer Chromatography, Column Chromatography, Ion Chromatography	2
6.2	Gas Chromatography(GC), GC-MS	2
6.3	Liquid Chromatography, High Performance Liquid Chromatography (HPLC), LC-MS, LC-MS/MS	3



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Name of the Course: SES MP C 11
Analytical Techniques and Instrumentation

Teaching and Learning Approach	
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

1. APHA (1998), Standard Methods for the Examination of Water and Waste water, 20th edition, Washington DC
2. McBride, M.B. (1994), Environmental Chemistry of Soils, Oxford University Press, New York
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.
5. Willard, H.H., Merrit, L.L., Deen, J.A. and Settle, F.A. (1986), Instrumental Methods of Analysis, (Indian Reprint), CBS Publishers and Distributors, New Delhi
6. Skoog, West, Holler Crouch, Fundamentals of Analytical Chemistry, 8th edition, Cengage Learning
7. J.Throck Watson, Introduction to Mass Spectrometry, 3rd edition, Lippincott-Raven publishers, Philadelphia, New York
8. Gary D. Christian. Analytical Chemistry, 5th edition, John Wiley and Sons



MAHATMA GANDHI UNIVERSITY

Name of the Course SES M II C 20 12
Environmental Laws, Ethics, Education and Policy

1.

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	SES MP C 12						
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 , Servicising, 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							

Unit	Course Description	Hours
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
1.2	Plant tissue culture techniques	1

1.3	Environmental Biotechnology: an overview.	1
2	Biotechnological Methods in Pollution Control	16
2.1	Air pollution control : Bio-desulphurisation of coal, Green belts.	6
2.2	Water pollution control : Aerobic and Anaerobic wastewater treatment Systems.	6
2.3	Bioremediation : Soil / land contaminated with oil spills, PCBs, PAHs; Bioremediation technology; Phytoremediation	2
2.4	Biosensors : Concept and principle ,Biosensors for environmental monitoring	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
3.2	Ecological Engineering : Constructed / Artificial wetlands, Nutrient FilmTechnique (NFT).	2
3.3	Biodegradable plastics – PHBs and PHAs	2
4	Solid Waste Management	16
4.1	Municipal Solid Waste : Types, sources , properties and impacts	1
4.2	Techniques for treatment / processing : Concept of three ' R ' s, Thermal processes – incineration, Pyrolysis, RDF. Biological processes – Anaerobicdigestion, Composting and vermicomposting.	8
4.3	Disposal techniques : Landfills – design , operation and management.	4
4.4	Hazardous waste management.	2
4.5	Concept of Zero waste	1
5	Ecological Sanitation	8
5.1	Conventional sanitation : a linear flow system – its limitations	1
5.2	Eco San –Circular flow and closing the loop : concept, goals and advantages	2
5.3	Eco San for human night soil management : Dry Toilets, Composting Toilets UDDT,UDFT.	2
5.4	Grey water management	2
5.5	Eco San - Human Health and Food Security	1

Teaching and Learning Approach	
Assessment Types	<p>1. Continuous Internal Assessment (CIA)</p> <ul style="list-style-type: none"> • Assignments • Seminar Presentation on selected topics • Quiz • Tutorials • Class tests <p>2. Semester End examination</p>

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MAHATMA GANDHI UNIVERSITY

Name of the Course : SES MP C 13
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	SES MP C 13					
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					60
Pre-requisite	As per the requirement of the course					
Others- Case studies , Library, field work, seminar and assignment preparations, test, research article/ case reports discussion etc.						

COURSE CONTENT

		Hrs
Unit 1 Biodiversity - An introduction		
1.1	The evolution of biodiversity	1
1.2	Theories and Concepts of Biodiversity	1
1.3	Origin of species/speciation	1
1.4	The distribution of biodiversity in macroscale	1



MAHATMA GANDHI UNIVERSITY

Name of the Course : SES MP C 13 Biodiversity and Conservation Biology

1.5	Species interactions and biodiversity	1
Unit 2 - Biodiversity		
2.1	Levels of Biodiversity	1
2.2	Genetic diversity, species diversity, Eco-system diversity, alpha, beta, gamma	1
2.3	Global and Regional biodiversity	1
2.4	Threats to Biological Diversity – Habitat Degradation, Fragmentation, Global Climate Change, overextraction, overabundance, alien and invasive species, diseases, pollution	6
2.5	Endangered and Threatened species, IUCN, Red Data Book	3
Unit 3 Biodiversity Conservation in Practice		
3.1	Global Conservation initiatives – Biodiversity hotspots, Conservation in South and Southeast Asia,	2
3.2	National Conservation Action Plan,	2
3.3	Landscape-level Conservation	2
3.4	Conservation Strategies	2
3.5	In situ and ex situ conservation	2
Unit 4 Introduction to Conservation Biology		
4.1	History, Concepts and Background	2
4.2	Biogeography of India	2
4.3	Western Ghats	2
4.4	Wild life biology	3
4.5	Restoration biology	3
Unit 5 Natural History		
5.1	Natural History in India	2
5.2	Animal Behaviour	4



MAHATMA GANDHI UNIVERSITY

Name of the Course : SES MP C 13 Biodiversity and Conservation Biology

5.3	General Entomology, Ornithology, Mammalogy, Ichthyology, Herpetology	4
5.4	Basic understanding of common flora in Southern Western Ghats	2
Unit 6 Human Ecology		
6.1	Environmental History and Conservation Movements	2
6.2	People and Nature: Ecosystem services	2
6.3	Indigenous communities and Ethnobiology	2
6.4	Human-wildlife Conflict	2
Unit 7 : Conservation – Legal and policy framework		
7.1	International treaties - Convention on Biological diversity, CITES, TRAFFIC	2
7.2	Legal aspects of conservation in India.	2
7.3	Biopiracy – causes and effects	2

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Authentic learning, case-based learning, collaborative learning, seminar, group activities.
Assessment Types	Mode of Assessment 2. Continuous Internal Assessment (CIA) 3. Seminar Presentation – 4. Assignments B. Semester End examination

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**Name of the Course : SES MP C 13
Biodiversity and Conservation Biology**

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MAHATMA GANDHI UNIVERSITY

Name of the Course: SES M II C 20 58
Public health aspects and emergency services in disaster management

	MAHATMA GANDHI UNIVERSITY
	Name of the course: SES MP C 14 Lab course -II (Environmental Chemistry, Environmental Biotechnology, RS&GIS)


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	SES MP C 14					
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
						60
Pre-requisite						

Unit	Course Description	Hours
1	Water quality	
1.1	Analysis of COD, Sulphate, Sulphide, Potassium, Iron	4
1.2	Nutrient analysis (Nitrite, Nitrate, TN, Phosphate)	4
1.3	Total and dissolved metals in water	1
2	Soil/sediment quality	
2.1	Available Nitrogen, Total Nitrogen, Available Phosphorous, Available potassium	4
2.2	Trace metals	2
3	Air quality	

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	Name of the course: SES MP C 14 Lab course -II (Environmental Chemistry, Environmental Biotechnology, RS&GIS)


3.1	Ambient Gaseous pollutant analysis –SO _x , NO _x , CO,	4
3.2	Ambient particulate monitoring –SPM, RPM	3
3.3	Online monitoring of ambient air quality	1
4	RS and GIS	
4.1	Understanding base map (Toposheet, Geology map, cadastral map etc.)	3
4.2	Understanding various Software's in GIS (ArcGIS, QGIS),	3
4.3	Georeferencing base map	3
4.4	Creation of Spatial and Non spatial data(Geodatabase, Shapefiles, Attribute data)	4
4.5	Creating and editing of Point, Line and Polygon	3
4.6	Vector data analysis (Explore, Report generations, Geometry calculations, SQL (Arithmetic and Boolean Operators), Overlay analysis (Clip, Erase, Split, Union, Identity, Intersect)	3
4.7	Remote Sensing Open data web portals (Earth Explorer, Bhuvanetc) Understanding various Satellite Missions and Sensors Learn how to download data	4
4.8	Creation of Triangular Irregular Network (TIN)	4
4.9	Adding various bands of data to Image Processing Software, Understanding various resolution data, Dn values of Pixels	4
4.10	Layer Stacking	3
4.11	Preparation of Various Color Composites (True Color Composite, False Color Composite)	3

Teaching and Learning Approach	
Assessment Types	1. Continuous Internal Assessment (CIA) Internal test 2. Semester End examination

	MAHATMA GANDHI UNIVERSITY
	Name of the course: SES MP C 14 Lab course -II (Environmental Chemistry, Environmental Biotechnology, RS&GIS)

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	MAHATMA GANDHI UNIVERSITY
	Name of the course: SES MP E 15 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	SES MP C 15						
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
							40
Pre-requisite							


Unit	Course Description	Hours
1	Introduction	
1.1	History of Environmental Regulations	1
1.2	Emerging of NGOs like WWF	2
1.3	United Nations Conference on Human Environment (Stockholm Conference – 1972),	2
1.4	Environmental treaties before 1990	1
1.5	International literature and report on human environment – The	2



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Name of the course: SES MP E 15
Environmental Laws, Ethics, Education and Policy

	limits to growth, Our common future,	
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
2	Environmental Policy in India	
2.1	Environmental Legislation Protection Laws in India – Ancient and Pre- Independence.	2
2.2	Environmental Legislation in Post – Independence Period	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) Environmental Protection Act of 1986	2
2.4	Judicial Remedies and Procedures. <ul style="list-style-type: none"> • Tort Law, Public Nuisance , Public Interest Litigation, Freedom of information 	1
3	Laws Relating to control of Pollution and Environment in India	
3.1	Water Act and Related Acts, Rules and Regulations	1
3.2	Air Act – Related Acts, Rules and Regulations	2
3.3	Noise and Land Pollution Rules and Regulations	2
3.4	Rules and Notification made under Environmental (Protect) Act 1986 – Rules of Hazardous Microorganisms. Bio–medical waste, Recycled Plastics, Ozone Depleting Substances, SolidWaste Management, etc.	2
3.6	Environmental Laws and regulations in Kerala - Mining law, laws related to wetlands and other ecosystems	2

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	Name of the course: SES MP E 15 Environmental Laws, Ethics, Education and Policy

3.7	Case studies – Bhopal gas tragedy	1
4	Forest and Wild Life Protection Act and Rules.	
4.1	Forest policies and Legislation in Pre – independence Period.	1
4.2	Wildlife and Biodiversity: IFA, 1927; WLPA, 1972; FCA, 1980; Biological Diversity Act, 2002; Forest Rights Act, 2006.	2
4.3	Strategies for conservation–Project Tiger, Elephant, Rhino etc.	1
5	International Organisation, Conservations and Protocols	
4.1	United Nations, GEMS, UNEP, GEF, WCN etc.	1
4.2	Conventions after 1990: Rio, Rio+10, Rio+20, Kyoto protocol etc.	2
6	Information, Education and Communication	
5.1	Environmental education/awareness, lifestyle changes and consumerism. Values and ethics	1
5.2	Environmental education in India, Information Networks – ENVIS Centers – INFOTERA etc.	1
5.3	Role of NGO's in the Implementation of Environmental Policies.	2
5.4	Communication and Management.	1

Teaching and Learning Approach	
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: SES MP E 17 Ecotoxicology

School Name	School of Environmental Sciences					
Programme	M.Sc. Environment Science and Management M.Sc. Environment Science and Disaster Management					
Course Name	Ecotoxicology					
Type of Course	Elective					
Course Code	SES MP E 17					
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	Semester		2	
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs
						40
Pre-requisite						

Unit	Course Description	Hours
1	Toxicants and ecosystem	
1.1	Toxicants – organic and inorganic	1
1.2	Toxicants – entry into the environment, cycles and residence time	2
1.3	Transboundary movement of pollutants- factors affecting	1
1.4	Global environmental pollutants	2
1.5	Routes of exposure to humans – food, occupation, environment	3
2	Toxicants and their effects	
2.1	Effects of toxicants on populations and communities	2
2.2	Toxicity of pesticides, metals, radioactive minerals, fluorides, chemical fertilizers and air pollutants – cellular and molecular level	2

	MAHATMA GANDHI UNIVERSITY
	Name of the Course: SES MP E 17 Ecotoxicology

2.3	Damage process and action of toxicants – exposure, uptake, transport, storage, mechanism of action in plants and mammals	2
2.4	Toxicants in the food chain- Accumulation and magnification Multilevel trophic interactions and non-trophic interactions	1
2.5	Acute and chronic effects	1
2.6	Occupational hazards and diseases	2
2.7	Toxicity of biohazards	1
3	Toxicity testing and indicators	
3.1	Principles of toxicity testing, Factors to be considered in toxicity testing	2
3.2	Methods of toxicity evaluation at cellular and molecular level by in vitro and in vivo methods	1
3.3	Ecotoxicological testing methods – single species testing, microcosms etc.	2
3.4	Bioindicators , lacustrine communities as indicators of ecosystem stress Biosensors– concept and approach Biomarkers- classification, relationship of biomarkers to adverse effects	2
4	Sanitation, Health and Hygiene	
4.1	Sanitation and Health- introduction and Current situation	2
4.2	Water and sanitation related diseases, respiratory infections, under nutrition	2
4.3	Successful approaches to sanitation-strategies Role of health sector Global experience in improving sanitation and hygiene	2
4.4	Climate change and diseases Epidemiology and health ecology Epidemiological diseases due to pollution problems	1

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	Name of the Course: SES MP E 17 Ecotoxicology

	Health effects of cosmetics and drugs Health risk assessment of toxic chemicals Ecological risk assessment	2
5	Food Security	
5.1	Concept of food security, food systems and public health	1
5.2	Interrelation between diet, food production, the environment, population and resources	1
5.3	Toxicants in food	2

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

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**Name of the Course: SES MP E 17
Ecotoxicology**

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	MAHATMA GANDHI UNIVERSITY
	Name of the Course: SES MP E 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	SES MP E 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
			30	12		42
Pre-requisite						

Unit	Course Description	Hours
1.	Introduction to Disaster Medicine, Public Health and Disasters	
1.1	Disaster Medicine, Introduction to public health, Public Health Response Cycle, Operating public health – principles to guide public health response	3
1.2	The role of Emergency Medical Services (EMS) in disasters	2
1.3	Public health preparedness history and policy	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	3
1.5	Psychological impact of disasters – Common responses to disasters, Post Traumatic Stress Disorder (PTSD), Critical Incident Stress Management (CISM) Disaster Mental Health	2
2	Public Health Response in Disasters	

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	Name of the Course: SES MP E 58 Public health aspects and emergency services in disaster management

2.1	Local, national and international public health response during major disasters	3
2.2	Mass casualty management and potential health issues in mass gatherings	3
2.3	Epidemics after Natural Disasters	2
2.4	Disasters and their consequences for public health	2
2.5	Global case studies on public health preparedness and response	2
3.	Public health and community	
3.1	Public health preparedness capabilities	2
3.2	Healthcare facility Hazard and Vulnerability Analysis	2
3.3	Community disaster resilience for public health preparedness	2
3.4	Public health and risk populations and surge planning matrix	2
3.5	Disaster behaviour health	2
4	Unit 4 - Disaster health management	
4.1	Rapid assessment of emergency health care needs and triage	2
4.2	The Incident Command System – ICS Organization, Concepts and Principles of ICS, Hospital Emergency Incident Command system	2
4.3	Disaster Medical Teams (DMT)	2
4.4	Managing volunteers and donations	2

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

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Name of the Course: SES MP E 58
Public health aspects and emergency services in disaster management


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	MAHATMA GANDHI UNIVERSITY
	Name of the course: SES MP 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	SES MP 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
			30	6		Total hrs
						36
Pre-requisite						

Unit	Course Description	Hours
1.	Social Vulnerability	8
1.1	Disaster Vulnerability- Concept and Dimensions- Geographical, Social, Economic, Cultural, Technological.	2
1.2	Social Structure; Cleavage of Caste, Class, Gender, race and ethnicity, Refugees, Migrants, Children and Women, aged, unorganized labour, Persons with Disability	3
1.3	Changing society to reduce social vulnerability. Professionals' social position and resulting vulnerability and privilege.	3
2	Theories of Disasters:	8
2.1	Sociological Analysis and Critical Thinking about disasters	2
2.2	Theories and perspectives- Conflict theory, Development theory, Risk and Uncertainty Theories (Ulrich Back and Giddens), Feminist theories.	3
2.3	Social Work Theories- The systems theory, Person-in-environment, Empowerment and Strength-based approaches. Integration of theories and perspectives.	3


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Name of the course: SES MP E 59 Disaster Risk Reduction and Sustainable Development	

3.	Political Economy of Disasters:	10
3.1	Economic impacts of disasters- long and short-term. The Schumpeterian model and arguments against it.	3
3.2	Economic Assessment post-disaster- quantification approaches and challenges.	2
3.3	Factors affecting vulnerability and promoting resilience.	2
3.4	The politics of international aid. Community Power: power structure- sources of power, Leadership concepts, Culture and Disasters	3
4	Disasters and Sustainable Development:	10
4.1	Definition and Meaning of Sustainable Development. The Sustainable Development Goals. Indicators and Measures of Development.	3
4.2	Hyogo and Sendai Frameworks and Disasters	1
4.3	Impact of Development projects such as dams, embankments, changes in Land-use etc	2
4.4	Climate Change Adaptation in sustainable development	2
4.5	Relationship between sustainable development and disasters. Prevention of Disasters aiming to sustainable development	2


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

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	<p style="text-align: center;">Name of the course: SES MP E 59 Disaster Risk Reduction and Sustainable Development</p>

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	<p style="text-align: center;">MAHATMA GANDHI UNIVERSITY</p> <hr/> <p style="text-align: center;">Name of the Course: SES MP E 60 Applications of Science and Technology in Disaster Management</p>
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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	SES MP 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
			30	6		36
Pre-requisite						

Unit	Course Description	Hours
1.	Applications of information technology in humanitarian operations	10
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	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
2	Decision aid models and systems for humanitarian logistics	10
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,</i>	10


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	Name of the Course: SES MP E 60 Applications of Science and Technology in Disaster Management

	<i>only familiarization needed)</i>	
3.	Early warning systems and disaster communications	10
3.1	Standard operation procedures and emergency operation centers	2
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
3.3	Early warning systems for various natural and anthropogenic disasters	2
4	Best practices and models local/national and international disaster management	6
4.1	Uses of disaster models. Kelly's circular model, the crunch model	2
4.2	Best practices in disaster management at various levels (<i>case study models</i>)	4


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

Reference

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	Name of the Course: SES MP E 60 Applications of Science and Technology in Disaster Management

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	MAHATMA GANDHI UNIVERSITY
	Name of the course: SES MP 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	SES MP 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
			30	6		36
Pre-requisite						

Unit	Course Description	Hours
1.	Unit 1: Social work: Theory and Practice	9
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
1.2	Social work methods	2
1.3	Social Case Work: Meaning, scope, components, processes and client-worker relationship; social casework process	2
1.4	Social group work: Definition, types of groups, group work process, working with vulnerable groups	2
2	Work with communities – Community Organization and Social Action	9
2.1	Concept of community: Definition, types, characteristics and basic problems of the community, Sociological, cultural and social work perspective of community	4


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	Name of the course: SES MP E 61 Social Work Approaches and Practices

2.2	Principles of Community Organization and Social Action, concept, Community organisation in rural and urban communities, social action movements case studies	5
3.	Strategies and Techniques in Community Organization- Participatory Rural Appraisal (PRA)	7
3.1	Understanding Participatory Rural Appraisal, Comparison of PRA and RRA	3
3.2	Different PRA methods and Tools – participatory mapping, participatory modeling, transects, mobility map, Venn diagrams, Flow diagrams	4
4	Social Welfare Administration	7
4.1	Skills for social welfare administration	2
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	NGOs and their Importance in Disaster Management	4
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 of NGOs, NGOs and disaster management	4


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

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	MAHATMA GANDHI UNIVERSITY
	Name of the Course: SES MP 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	SES MP 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 analyzing 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						

Unit	Course Description	Hours
1.	Introduction to disaster risk reduction and management	10
1.1	Disaster risk management; Disaster relief management; Economic impacts of disasters	4
1.2	Basic strategies of disaster risk reduction and risk management frame work	4
1.3	Integrated disaster risk management and post disaster response	2
2	Risk insurance	4
2.1	Insurance and Risk Management; Insurance Policies; role of micro finance in disaster mangement	4
3	Risk communication systems	8
3.1	Communication- Principles & Systems- analog, digital, satellite and terrestrial ;Radio Broadcast Systems; 1G,2G,3G Systems-Toll Free	4


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	Name of the Course: SES MP C 62 Disaster Risk Assessment & Mitigation

	Nos-Hot Line- Wireless Telephony- WLL-Morse Code- HAM radio.	
3.2	Risk and crisis communication systems, its role, challenges and applications in preparedness activities	4
4	Emergency Operation Centre and Incident Management System	12
4.1	Emergency operation Centre (EOC) and their role in Incident Management System (IMS)	6
4.2	EOC and command post interface; EOC design, layout and management; Standard Operating Procedure (SOP) ; Exercising and evaluating EOC and SOPs.	6
5	Risk management for natural and anthropogenic disasters	12
5.1	Risk management- Flood; Cyclone; Drought; Earthquake; Tsunami; major anthropogenic disasters	7
5.2	Climate change risk reduction; Millennium Development Goals (MDGs) and disaster risk reduction; Civil Disturbance and other anthropogenic disasters	5
6	Essentials of urban risk reduction	8
6.1	Understanding urban risk and reduction strategies- Urban structures; urban setting; urban primacy; urban built environment; urban economic imbalances	8


Teaching and Learning Approach	
Assessment Types	A. Continuous Internal Assessment (CIA) <ol style="list-style-type: none"> 1. Internal test 2. Review of Book /Article 3. Seminar Presentation 4. Field visit report B. Semester End examination

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	<p align="center">Name of the Course: SES MP C 62 Disaster Risk Assessment & Mitigation</p>

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	MAHATMA GANDHI UNIVERSITY
	Name of the Course: SES MP 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	SES MP 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 leaners 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							

Unit	Course Description	Hours
1.	Humanitarian Assistance and Disaster Relief	14
1.1	The concept of humanitarian aid	5
1.2	Origin and development of humanitarian aid	3
1.3	Humanitarian principles	3
1.4	Initiatives for global standards in humanitarian assistance, Sphere	3

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	Name of the Course: SES MP C 63 Standards in Humanitarian Aid, Relief and Rehabilitation


	project, HAP, ALNAP and People in aid.	
2	The Sphere Project	10
2.1	Introduction - The Sphere Project philosophy	1
2.2	The Humanitarian Charter - Common principles, rights and duties	1
2.3	Protection Principles	2
2.4	The Core Standards	2
2.5	Minimum Standards	2
2.6	Humanitarian relief to the vulnerable groups	2
3.	The Code of Conduct	8
3.1	Principles of Conduct for the International Red Cross and Red Crescent movement and NGOs in Disaster Response Programmes	4
3.2	Recommendations to the governments of disaster affected countries	4
3.3	Recommendations to inter-governmental organizations	
4	HAP benchmarks	10
4.1	Introduction to Humanitarian Accountability Partnership	2
4.2	The imbalance of power in humanitarian action	2
4.3	HAP services and activities	3
4.4	HAP benchmarks	3
5	Operation Management in Emergencies	12
5.1	Introduction to operation management,	3
5.2	Supply Chain Management	3
5.3	Managing supply chain in disaster situation	2
5.4	Logistics framework	2
5.5	Disaster Relief Logistics	2

	MAHATMA GANDHI UNIVERSITY
	Name of the Course: SES MP C 63 Standards in Humanitarian Aid, Relief and Rehabilitation

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


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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
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4. Krajewski&Ritzman."Operation Management Strategy & Analysis", Prentice Hall of India.
5. Walter, Jonathan, ed. 2002. World Disaster Report: Focus on Reducing Risk. ISBN 92-9139-082-8.
6. 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: SES MP 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							

Unit	Course Description	Hours
1.	Community Based Disaster Risk Management	10
1.1	CBDRM frame work	5
1.2	Factors and criteria's Influencing Selection of a Community, Understanding the community: rapport building	3
1.3	Building disaster resilient communities	2
2	Social Dimensions of Disaster Management	8
2.1	Gender and social Issues in Disaster Management	4
2.2	School safety and practices: Equipping School students, Hospital	2

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	Name of the course: SES MP C 64 Community Based Disaster Management


	safety plans	
2.3	Disaster preparedness for vulnerable groups: Social Class, Elderly and Disabled	1
2.4	Linking Disaster Risk Reduction and Poverty Reduction	1
3.	Origin and development of Social Work in India	8
3.1	Evolution of social work practice in India	2
3.2	Social work education in India	2
3.3	Environmental movements	2
3.4	Religious contributions in risk reduction	1
3.5	Gandhian Concepts	1
4	Participatory approaches to disaster risk assessment and DRR planning	10
4.1	Participatory Disaster Risk Assessment (PDRA): Conceptual Frame work	5
4.2	PRA Tools Used in Disaster Risk Assessment	2
4.3	Capacities and Vulnerabilities frame work	3
5	Community oriented disaster planning	10
5.1	Building and Training a Community Disaster Risk Management Organization	3
5.2	Village contingency planning	5
5.3	Mainstreaming Disaster Risk Reduction into Community Development	2
6	Businesses and disasters – vulnerability, impacts and recovery	8
6.1	Business vulnerability to extreme events	2
6.2	Disaster impacts on businesses	1
6.3	Business disaster recovery and longer- term impacts	1
6.4	Corporate Social Responsibility, Public Private Partnership	2
6.5	Globalization, Localization and disaster vulnerability	2

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

	<p align="center">MAHATMA GANDHI UNIVERSITY</p>
	<p align="center">Name of the course: SES MP C 64 Community Based Disaster Management</p>


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.
5. Walter, Jonathan, ed. 2002. World Disaster Report: Focus on Reducing Risk. ISBN 92-9139-082-8.
6. 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: SES MP C 65 Governance, Law and Policies in Disaster Management


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	SES MP C 65					
Names of Academic Staff & Qualifications	Dr. Baiju K.R.MSc. Ph.D					
Course summary & Justification						
Semester		3	Credit			3
Total Student Learning Time (SLT)	Learning approach	Lecture	Tutorial	Practical	Others	Total hrs
						54
Pre-requisite						

Unit	Course Description	Hours
1.	Public Administration	12
1.1	Introduction. meaning, scope and significance, Evolution and Status of the discipline, comparative public administration and development administration, public and private administration	4
1.2	Basic concepts and principles, theories of administration, administrative behaviour accountability and control, financial administration	3
1.3	Union Government and administration in India, state and district administration, local government	4
1.4	Social welfare administration	2
	Public administration and disaster management	
2	Rules and Regulations in Disaster management	10
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	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

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2.3	International disaster response treaties	1
3.	Disaster Decision Making	11
3.1	Disaster Planning, Incident Command System, Training, Need Analysis and Human Resource Development	4
3.2	Corporate/public agency coordination, Contingency Planning for business and industry, Corporate Social Responsibility.	4
3.3	Community Relations for Environmental and Emergency Managers	3
4	Disaster Management Policies	7
4.1	Policies in Disasters- its significance, principles, policy options and approaches, essential components, formulation, development and execution	5
4.2	National and State Disaster Management Policies	2
5	Disaster Management Plans	14
5.1	Five year Plans and Disaster Management	3
5.2	The Planning process- Why Plan- Legal Basis for Planning- Components of Disaster Management Plan- risk analysis, Resource identification, vulnerability assessment	4
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
5.3	National, State and District Disaster Management Plans, NDMA Guidelines Community contingency planning	2
5.4	Major welfare schemes by Government of India	1

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


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	<p style="text-align: center;">Name of the Course: SES MP C 65 Governance, Law and Policies in Disaster Management</p>

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3. Laxmikanth, M. 2009. Public Administation. Tata McGraw hills Ltd.
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	MAHATMA GANDHI UNIVERSITY
	Name of the course: SES MP C 25 Lab course -III (RS & GIS and Instrumental analysis)


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	SES MP C 25					
Names of Academic Staff & Qualifications	Dr. Mahesh Mohan; Dr. Baiju K.R., Dr. Syllas 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 to 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						

	MAHATMA GANDHI UNIVERSITY
	Name of the course: SES MP C 25 Lab course -III (RS & GIS and Instrumental analysis)

Unit	Course Description	Hours
1	Spectroscopy	
1.1	Spectrophotometer- UV, Vis, FTIR	3
1.2	ICP-MS	3
1.3	Mercury analyser – CVAAS, Direct Mercury Analyser, CVAFS	3
2	Chromatography	
2.1	LC	3
2.2	IC	3
2.3	LC-MS, LC-QToF	3
2.4	GC-TCD,ECD,FID	3
2.5	GC-MS	3
3	Other equipment &Online monitoring instruments	
3.1	TOC	2
3.2	Ambient Air Quality Monitoring System	2
3.3	Portable Water Quality Analyser	2
3.4	Portable Green House Gas analyser	3
4	GIS	

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	Name of the course: SES MP C 25 Lab course -III (RS & GIS and Instrumental analysis)


4.1	Creation of Digital Elevation Model, Understanding various freely available global DEMs	2
4.2	Raster Analysis in GIS (3D analysis tools- Line of sight, Line/ Area Elevation profile)	2
4.3	Generation of Slope, Aspect, Hillshade, Viewshed, Curvature	2
4.4	Reclassification and Ranking	2
4.5	Raster Calculator	1
4.6	Weighted Overlay analysis	3
4.7	Raster Interpolations (IDW, Kriging)	1
4.8	Weighted Overlay	1
	RS& Image processing	
5.1	Understanding Geometric and Radiometric Errors	1
5.2	Geometric and Radiometric Corrections	2
5.3	Subsetting the Image	2
5.4	Visual Interpretation of satellite image	3
5.4	Digital Image Classification (Supervised/ Unsupervised)	3
5.5	Image Enhancement Techniques (EVI, NDVI)	2

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

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	Name of the course: SES MP C 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	SES MP 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						

Unit	Course Description	Hours
1	Basic definitions	
1.1	Climate and weather; climate change; greenhouse gases; radiative forcing; warming potential	2
1.2	climate modelling; global and regional circulation models; IPCC modelling scenarios.	2
2	Observed and projected changes in the climate system	
2.1	Land surface temperature; ocean surface temperature; precipitation; cryosphere; sea level	2
2.2	Greenhouse gas (GHG) concentrations (CO ₂ and Non CO ₂ gases); and extreme climatic events.	2

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3	Drivers of climate change	
3.1	Natural and anthropogenic radiative forcing; solar irradiance; aerosols, water vapour and clouds; volcanic eruption	2
3.2	GHG emissions from energy, industries, and transport; and gross and net emissions from agriculture, forestry and other land use.	2
4	Impacts of climate change	
4.1	Physical systems (Glaciers, snow, iceand/or permafrost;Rivers, lakes, floodsand/or drought; Coastal erosion and/or sea level effects)	2
4.2	Biological systems (Terrestrial ecosystems; aquatic ecosystems); Human and managed systems (Food production; Livelihoods, healthand/or economics)	2
5	Greenhouse gas inventorying	
5.1	IPCC guidelines on national greenhouse gas inventorying; general guidance and reporting; guidance specific to energy	2
5.2	Industrial processes and product use (IPPU), agriculture, forestry and other land use (AFOLU), and waste; activity data	2
5.3	Emission factors; key categories; tiered approach; stock-difference and gain-loss methods; principles of reporting; measurement, reporting and verification (MRV) system.	2
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
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

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7	Climate change adaptation	
7.1	Social, ecological asset and infrastructure development	1
7.2	Technological process optimization;integrated natural resources management;institutional, educational and behavioural change or reinforcement	2
7.3	financial services including risk transfer;information systems to support early warning and proactive planning.	1
8.	Climate change institutions and governance	
8.1	UNFCCC - Conference of Parties (COP); International Climate Agreement;Policy approaches for adaptation andmitigation, technology and finance;	2
8.2	National Communications; Biennial Update Report; Intended Nationally Determined Contributions	2
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

Teaching and Learning Approach	
Assessment Types	<p>C. Continuous Internal Assessment (CIA)</p> <ul style="list-style-type: none"> • Assignments • Seminar Presentation on selected topics • Quiz • Class tests <p>D. Semester End examination</p>


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