Syllabus of 4 + 1 Year Integrated UG and PG Programme

w. e. f 2024-25 Academic Year

GRADUATE SCHOOL

Mahatma Gandhi University

P. D. Hills P O

Kottayam, Kerala

www.gs.mgu.ac.in

www.mgu.ac.in

Schools offering Majors

SL.No	School/Centre
1	School of Bio Sciences
2	School of Chemical Sciences
3	School of Computer Sciences
4	School of Environmental Sciences
5	School of Gandhian Thought and Development Studies
6	School of International Relations and Politics
7	School of Pure and Applied Physics
8	School of Social Sciences

Sl. No.	Major	Intake
SCIENCE		
1	Bio Sciences	6**
2	Chemistry	6
3	Computer Science	6
4	Environmental Science	6
5	Physics	6
SOCIAL SCIENCES		
1	Development Studies	5
2	Gandhian Studies	5
3	History	10
4	International Relations and Politics	10

Majors offered and Intake *1 seat shall be sanctioned over and above the intake in each major in the 3rd semester for students who opt for a change of major after two semesters.

**Progression to PG Shall be based on the specialization selected by students as Biochemistry (2 seats) Biotechnology (2 seats) and Microbiology (2 seats) based on merit.

Schools offering Minors/MDCs/AECs/VACs/SECs

SL.No	School/Centre
1	School of Artificial Intelligence And Robotics
2	School of Behavioural Sciences
3	School of Biosciences
4	School of Chemical Sciences
5	School of Computer Sciences
6	School of Data Analytics
7	School of Energy Materials
8	School of Environmental Sciences
9	School of Food Science And Technology
10	School of Gandhian Thought And Development Studies
11	School of Gender Studies
12	School of Indian Legal Thought
13	School of International Relations And Politics
14	School of Letters
15	School of Mathematics And Statistics
16	School of Nanoscience And Nano Technology
17	School of Pedagogical Sciences
18	School of Polymer Science And Technology
19	School of Pure And Applied Physics
20	School of Social Sciences
21	School of Tourism Studies
22	International and Inter University Centre for Nanoscience and Nanotechnology
23	K N Raj School of Economics

Scheme for 4 + 1 Integrated UG and PG Programme
Graduate School
Mahatma Gandhi University
School of Environmental Sciences

Course Code	Title	Credits	Hours per Week	Level	Type	
			Theory	Practical		
SEMESTER I						
MG1DSCUEN101	Introduction to Environmental Sciences	4	4		Foundation (100-199)	Major
MG1DSCUES121	Fundamentals of Environmental Science	4	4			Minor A
MG1DSCUES141	Natural disasters	4	4			Minor B
MG1MDCUES101	Environment and Development	3	3			MDC
	AEC (Eng)	3			"	
	AEC (Mal)	3			"	
SEMESTER II						
MG2DSCUEN101	Earth System Sciences	4	3	2	"	Major
MG2DSCUES121	Introduction to Ecosystems	4	4		"	Minor A
MG2DSCUES141	Concepts of Disaster Management	4	4		"	Minor B
MG2MDCUES101	Sanitation, Health and Environment	3	3			MDC

	AEC (Eng)	3			"	
	AEC (Mal)	3			"	
SEMESTER III						
MG3DSCUEN201	Ecology and Environment	4	3	2	Intermediate (200-299)	Major
MG3DSCUEN202	Environmental Chemistry	4	3	2	"	Major
MG3DSCUEN203	Environmental Pollution and Control	4	4		"	Major
MG3DSCUES221	Environmental Pollution	4	3	2	"	Minor A
MG3MDCUES201	Sustainable Development	3	3		"	MDC
MG3MDCUES202	Fundamentals of Disaster Management	3	3			MDC
MG3MDCUES203	Climate Change	3	3			MDC
MG3VACUES201	Carbon footprint analysis	3	3		"	VAC
SEMESTER IV						
MG4DSCUEN201	Environmental Monitoring and Assessment	4	3	2	"	Major
MG4DSCUEN202	Biodiversity & Conservation biology	4	4		"	Major
MG4DSCUEN203	Natural and Anthropogeni	4	4		"	Major

	c disasters					
MG4DSCUES241	Waste Management	4	4		"	Minor B
MG4SECUES201	Biodiversity Assessment	3	2	2	"	SEC
MG4VACUES201	Environmental Analysis	3	1	4	"	VAC
MG4INTUEN200	Internship/ Fieldwork	2				
SEMESTER V						
MG5DSCUEN301	Environment Management	4	4		Higher (300-399)	Major
MG5DSCUEN302	Analytical techniques and instrumentation	4	3	2	"	Major
MG5DSCUEN303	Environmental Biotechnology	4	4		"	Major
MG5DSCUEN304	Remote Sensing and GIS	4	3	2	"	Major
MG5SECUES301	Surveying and Mapping Techniques	3	1	4	"	SEC
MG5VACUES301	Elemental and Metal analysis	3	1	4	"	VAC
SEMESTER VI						
MG6DSCUEN301	Environmental Law, Policies, and Education	4	4		"	Major

MG6DSCUEN302	Environment Impact Assessment	4	4		"	Major
MG6DSCUEN303	Ecotoxicology	4	4		"	Major
MG6DSEUEN304	Energy Resources and Management	4	4		"	Major(E) (any 2)
MG6DSEUEN305	Solid waste management	4	4		"	
MG6DSEUEN306	Wildlife Protection and Management	4	4			
MG6SECUES301	Environment Management Plan	3	1	4	"	SEC
Total Credits	**133**					

SEMESTER VII						
MG7DSCUEN401	Research Methodology and Statistics	4	4		Advanced (400-499)	Major
MG7DSCUEN402	Wetland Management	4	4		"	Major
MG7DSEUEN403	Geoinformatics and environmental data analytics	4	3	2	"	Major(E) (any one)
MG7DSEUEN404	Environmental Microbiology	4	3	2		
MG7DSEUEN405	Disaster Risk Reduction for Sustainable	4	4			

	Development					
MG7DSCUES421	Remote sensing and GIS	4			"	Minor A
MG7DSEUES422	Climate change and Governance	4				Minor A (E)
MG7DSEUES441	Disaster Risk Management	4				MinorA/B (E)
SEMESTER VIII						
MG8DSCUEN401	Climate Change: Mitigation, Adaptation and Resilience	4	4		"	Major
MG8DSEUEN402	Environmental Economics for Sustainable Development	4	4		"	Major (E) (any one)
MG8DSEUEN403	Environmental Health and Safety	4	4			
MG8DSEUEN404	Standards in Humanitarian Aid, Relief and Rehabilitation	4	4			
MG8DSCUEN405	*Ecohydrology	4	4		"	Major*
MG8DSCUEN406	*Water Management	4	4		"	Major*
MG8DSCUEN407	*Hazardous Waste Management	4	4		"	Major*
MG8RPHUEN400	Research Project	12			"	

Total Credits		**44**				
SEMESTER IX						
ENVIRONMENT SCIENCE & MANAGEMENT (Specialization)						
MG9DSCUEN501	Environmental Engineering	4	4		PG Level (500-599)	Major
MG9DSCUEN502	Ecosystem Restoration	4	4		"	Major
MG9DSCUEN503	Advanced Geoinformatics	4	2	4	"	Major
MG9DSEUEN504	Ecoinformatics	4	3	2	"	Major (E)
MG9DSEUEN505	Advanced instrumentation techniques	4	2	4	"	Major (E)
ENVIRONMENT SCIENCE & DISASTER MANAGEMENT (Specialization)						
MG9DSCUEN511	Disaster Risk Assessment & Mitigation	4	4		PG Level (500-599)	Major
MG9DSCUEN512	Standards in Humanitarian Aid, Relief and Rehabilitation	4	4		"	Major
MG9DSCUEN513	Social Work Approaches and Practices	4	4		"	Major
MG9DSEUEN514	Governance, Law and Policies in Disaster Management	4	4		"	Major (E) (Any two)
MG9DSEUEN515	Public health aspects and emergency services in	4	4			

	disaster management					
MG9DSEUEN516	Advanced Geoinformatics	4	2	4		
MG9DSEUEN517	Advanced instrumentation techniques	4	2	4	"	
SEMESTER X						
MG10RPHUEN500	Research Project	20			"	
		4	4		"	Major**
		4	4		"	Major**
		4	4		"	Major**
		4	4		"	Major**
		4	4		"	Major**
Total Credits			**40**			

*Only for 4-Years Honours Students
**Only for students who opt for theory courses instead of Research Project

Note: General foundations courses shall be offered by different schools. Students can flexibly choose the courses across disciplines.

Level	Foundation (100-199	Intermediate (200-299)	Higher (300-399)	Advanced (400-499)	PG Level (500-599)

Type	Major	Minor	MDC	SEC	VAC	AEC

Scheme for 4 + 1 Integrated UG and PG Programme
Graduate School
Mahatma Gandhi University
School of Environmental Sciences

Course Code	Title	Credits	Hours per Week		Level	Type
			Theory	Practical		
SEMESTER I						
MG1DSCUEN101	Introduction to Environmental Sciences	4	4		Foundation (100-199)	Major
MG1DSCUES121	Fundamentals of Environmental Science	4	4			Minor A
MG1DSCUES141	Natural disasters	4	4			Minor B
MG1MDCUES101	Environment and Development	3	3			MDC
	AEC (Eng)	3			"	
	AEC (Mal)	3			"	
SEMESTER II						
MG2DSCUEN101	Earth System Sciences	4	3	2	"	Major
MG2DSCUES121	Introduction to Ecosystems	4	4		"	Minor A
MG2DSCUES141	Concepts of Disaster Management	4	4		"	Minor B
MG2MDCUES101	Sanitation, Health and Environment	3	3			MDC
	AEC (Eng)	3			"	
	AEC (Mal)	3			"	
SEMESTER III						
MG3DSCUEN201	Ecology and Environment	4	3	2	Intermediate (200-299)	Major
MG3DSCUEN202	Environmental Chemistry	4	3	2	"	Major
MG3DSCUEN203	Environmental Pollution and Control	4	4		"	Major
MG3DSCUES221	Environmental Pollution	4	3	2	"	Minor A
MG3MDCUES201	Sustainable Development	3	3		"	MDC
MG3MDCUES202	Fundamentals of Disaster Management	3	3			MDC
MG3MDCUES203	Climate Change	3	3			MDC
MG3VACUES201	Carbon footprint analysis	3	3		"	VAC
SEMESTER IV						
MG4DSCUEN201	Environmental Monitoring and Assessment	4	3	2	"	Major
MG4DSCUEN202	Biodiversity & Conservation biology	4	4		"	Major

MG4DSCUEN203	Natural and Anthropogenic disasters	4	4		"	Major
MG4DSCUES241	Waste Management	4	4		"	Minor B
MG4SECUES201	Biodiversity Assessment	3	2	2	"	SEC
MG4VACUES201	Environmental Analysis	3	1	4	"	VAC
MG4INTUEN200	Internship/Fieldwork	2				
SEMESTER V						
MG5DSCUEN301	Environment Management	4	4		Higher (300-399)	Major
MG5DSCUEN302	Analytical techniques and instrumentation	4	3	2	"	Major
MG5DSCUEN303	Environmental Biotechnology	4	4		"	Major
MG5DSCUEN304	Remote Sensing and GIS	4	3	2	"	Major
MG5SECUES301	Surveying and Mapping Techniques	3	1	4	"	SEC
MG5VACUES301	Elemental and Metal analysis	3	1	4	"	VAC
SEMESTER VI						
MG6DSCUEN301	Environmental Law, Policies, and Education	4	4		"	Major
MG6DSCUEN302	Environment Impact Assessment	4	4		"	Major
MG6DSCUEN303	Ecotoxicology	4	4		"	Major
MG6DSEUEN304	Energy Resources and Management	4	4		"	Major(E) (any 2)
MG6DSEUEN305	Solid waste management	4	4		"	
MG6DSEUEN306	Wildlife Protection and Management	4	4			
MG6SECUES301	Environment Management Plan	3	1	4	"	SEC
Total Credits		**133**				

SEMESTER VII						
MG7DSCUEN401	Research Methodology and Statistics	4	4		Advanced (400-499)	Major
MG7DSCUEN402	Wetland Management	4	4		"	Major
MG7DSEUEN403	Geoinformatics and environmental data analytics	4	3	2	"	Major(E) (any one)
MG7DSEUEN404	Environmental Microbiology	4	3	2		
MG7DSEUEN405	Disaster Risk Reduction for Sustainable Development	4	4			
MG7DSCUES421	Remote sensing and GIS	4			"	Minor A
MG7DSEUES422	Climate change and Governance	4				Minor A (E)
MG7DSEUES441	Disaster Risk Management	4				MinorA/ B (E)

SEMESTER VIII						
MG8DSCUEN401	Climate Change: Mitigation, Adaptation and Resilience	4	4		"	Major
MG8DSEUEN402	Environmental Economics for Sustainable Development	4	4		"	Major (E) (any one)
MG8DSEUEN403	Environmental Health and Safety	4	4			
MG8DSEUEN404	Standards in Humanitarian Aid, Relief and Rehabilitation	4	4			
MG8DSCUEN405	*Ecohydrology	4	4		"	Major*
MG8DSCUEN406	*Water Management	4	4		"	Major*
MG8DSCUEN407	*Hazardous Waste Management	4	4		"	Major*
MG8RPHUEN400	Research Project	12			"	
Total Credits		**44**				
SEMESTER IX						
ENVIRONMENT SCIENCE & MANAGEMENT (Specialization)						
MG9DSCUEN501	Environmental Engineering	4	4		PG Level (500-599)	Major
MG9DSCUEN502	Ecosystem Restoration	4	4		"	Major
MG9DSCUEN503	Advanced Geoinformatics	4	2	4	"	Major
MG9DSEUEN504	Ecoinformatics	4	3	2	"	Major (E)
MG9DSEUEN505	Advanced instrumentation techniques	4	2	4	"	Major (E)
ENVIRONMENT SCIENCE & DISASTER MANAGEMENT (Specialization)						
MG9DSCUEN511	Disaster Risk Assessment & Mitigation	4	4		PG Level (500-599)	Major
MG9DSCUEN512	Standards in Humanitarian Aid, Relief and Rehabilitation	4	4		"	Major
MG9DSCUEN513	Social Work Approaches and Practices	4	4		"	Major
MG9DSEUEN514	Governance, Law and Policies in Disaster Management	4	4		"	Major (E) (Any two)
MG9DSEUEN515	Public health aspects and emergency services in disaster management	4	4			
MG9DSEUEN516	Advanced Geoinformatics	4	2	4		
MG9DSEUEN517	Advanced instrumentation techniques	4	2	4	"	
SEMESTER X						
MG10RPHUEN500	Research Project	20			"	
		4	4		"	Major**
		4	4		"	Major**
		4	4		"	Major**
		4	4		"	Major**
		4	4		"	Major**
Total Credits		**40**				

*Only for 4-Years Honours Students
**Only for students who opt for theory courses instead of Research Project

Note: General foundations courses shall be offered by different schools. Students can flexibly choose the courses across disciplines.

Level	Foundation (100-199)	Intermediate (200-299)	Higher (300-399)	Advanced (400-499)	PG Level (500-599)

Type	Major	Minor	MDC	SEC	VAC	AEC

****

List of Minor, MDC, VAC and SEC offered by School of Environmental Sciences

Semester	***Course***	***Type***
Semester - 1	Fundamentals of Environmental Science	Minor
	Natural disasters	Minor
	Environment and Development	MDC
Semester - 2	Introduction to Ecosystems	Minor
	Concepts of Disaster Management	Minor
	Sanitation, Health and Environment	MDC
Semester - 3	Environmental Pollution	Minor
	Sustainable Development	MDC
	Fundamentals of Disaster Management	MDC
	Climate Change	MDC
	Carbon footprint analysis	VAC
Semester -4	Waste Management	Minor
	Biodiversity Assessment	SEC
	Environmental Analysis	VAC
Semester -5	Surveying and Mapping Techniques	SEC
	Elemental and Metal analysis	VAC
Semester - 6	Environment Management Plan	SEC
Semester -7	Remote sensing and GIS	Minor
	Climate change and Governance	Minor
	Disaster Risk Management	Minor

Syllabus of Major Courses

Programme Specific Outcome (PSO)

PSO 1	To understand the basic concepts of environment, interactions with the earth and various ecosystems associated with it
PSO 2	Capable of analysing, evaluating, and interpreting the causes and effects of various environmental problems at local, regional, and global scales to develop management strategies.
PSO 3	Developing specific analytical skills in determining the magnitude of different kinds of environmental pollution and their sources using analytical and computational techniques.
PSO 4	Gaining a thorough knowledge of research methodology in general; specific ideas on understanding a research problem, identifying the research gaps, developing suitable research techniques/ methods including research design, data collection, data analysis with suitable statistical tools, interpretation of the findings leading to the perfect solution to the research problem undertaken.
PSO 5	Capacity to develop and apply treatment technology for water, wastewater, air, soil and solid waste and the ability to use different tools and techniques for environment management and develop skills in environment and disaster management
PSO 6	Mastering the core concepts and methods of economic, political, and social analysis, which are essential in designing and evaluating of environmental policies; conducting environmental/green auditing
PSO 7	Gaining a deep knowledge of ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems. Thus to evolve as an entrepreneur, a consultant with leadership skills necessary for the conservation of the environment

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme **ENVIRONMENTAL SCIENCE**

School	**Graduate School**		
Programme	**4 + 1 Integrated UG and PG Programme**		
Course Title	**Introduction to Environmental Science**		
Course Type	**Major**		
Course Level	100-199		
Course Code	**MG1DSCUEN101**		
Course Overview	The course introduces environmental science, exploring its definition, scope, and multidisciplinary nature. It covers the history of environmental protection, significant global issues, and key environmental movements. Additionally, it delves into environmental ethics, highlighting the importance of resource consumption and conservation.		
Semester	1	**Credit**	4
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work/fieldwork**	
	60	15	
Pre-requisite	A foundational understanding of basic science concepts and familiarity with current environmental issues		

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PSO
	Upon completion of this course, students will be able to;		
1	Dilate upon the scope and importance of Environmental Science and its multidisciplinary nature.	U	1
2	Comment on the history and origin of environmental protection initiatives and key international conferences.	R	1
3	Identify and classify major types of natural resources	U	1

4	Analyze the developmental issues and their environmental impacts.	An	2
5	Apply principles of environmental ethics to address the issues of equity and disparity.	A	1

COURSE CONTENT

		CO NO.
Module 1: Introduction to Environmental Science & Conservation History	15 Hours	1, 2
Definition, scope, and importance of Environmental Science, Multidisciplinary nature of environmental science; Significance of Environmental Education; Components of Environment. Origin of conservation NGOs like WWF, UNEP, etc., Silent Spring, Our Common Future. International initiatives for environmental protection – Ramsar convention, Stockholm conference, Rio Conferences, Conferences for reducing greenhouse gases and Ozone depleting substances, COPs; Major Environmental movements		
Module 2: Natural Resources	15 Hours	1,3
Introduction to natural resources; Types of natural resources- Renewable and Non-renewable resources; Types of natural resources- Forest resources, Water and soil resources, Mineral Resources, Energy Resources		
Module 3: Global Environmental Issues	15 Hours	3,4,5
Developmental issues and related impacts such as ecological degradation; environmental pollution; development-induced displacement, resettlement, and rehabilitation: problems, concerns, and compensative mechanisms; discussion on Project Affected People (PAPs). Production and consumption-oriented approaches to environmental issues in Indian and global context; impact of industry and technology on the environment; urban sprawl, traffic congestion, and social-economic problems; conflict between economic and environmental interests. Historical case studies of environmental crisis Climate Change, Global Warming, Acid Rain, Ozone Depletion, Nuclear Incidents, and Environmental Catastrophes – Case Analyses; Case Studies: Consumerism and Waste Management Practices.		
Module 4: Environmental Ethics	15 Hours	4,5

Aldo Leopold's Land Ethics and Gross National Happiness, Resource consumption patterns and the need for their equitable utilisation; Equity – Disparity in the Northern and Southern countries; Urban-rural equity issues; The need for Gender Equity; Preserving resources for future generations; The rights of animals; The ethical basis of environment education and awareness; The conservation ethic and traditional value systems of India; Anthropocentrism and Ecocentrism	

Mode of Transaction	**Classroom activities** **Field activities** **Lab based activities**
Mode of Assessment	**Assignment/Quiz/Discussion/Seminar** **Internal Exam (40%)** **Final Exam (70%)**

Learning Resources

1. Basu, M., & Xavier Savarimuthu, S. J. (2017). Fundamentals of environmental studies. Cambridge University Press.
2. Chawla, S. (2013). A Textbook of Environmental Studies. McGraw Hill Education (India) Private Limited.
3. Chokkan, K.B., Pandya, H. & Raghunathan, H. (eds). 2004. Understanding Environment. Sagar Publication India Pvt. Ltd., New Delhi
4. Elliot, D. 2003. Energy, Society & Environment, Technology for a Sustainable Future. Routledge Press.
5. Guha, R. 1989. Ecological change and peasant resistance in the Himalaya. Unquiet Woods, Oxford University Press, Delhi.
6. Miller, T.G. 2012. Environmental Science. Wadsworth Publishing Co
7. National Research Council (NRC). 1996. Linking Science and Technology to Society's Environmental Goals. National Academy Press.

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme **ENVIRONMENTAL SCIENCE**

School	**Graduate School**		
Programme	**4 + 1 Integrated UG and PG Programme**		
Course Title	**Earth System Sciences**		
Course Type	**Major**		
Course Level	**100-199**		
Course Code	**MG2DSCUEN101**		
Course Overview	This course covers the Earth's formation, structure, and processes, including the formation of the solar system, geological time scale, plate tectonics, earthquakes, volcanoes, atmospheric circulation, and surface processes. It also examines mineral and rock formation and the impact of human activities on landscapes.		
Semester	**2**	**Credit**	**4**
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work// fieldwork**	
	60	15	
Pre-requisite	Basic knowledge about Earth		

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PSO No.
	Upon completion of this course, students will be able to;		
1	Explain the formation of the Solar System, Earth's structure, and the origin of life.	R	1

2	Describe the geological processes occurring on Earth.	U	1
3	Understand the dynamics of Earth's atmosphere	U	1
4	Analyze different types and properties of rocks and minerals	An	1
5	Interpret surface and groundwater hydrology	U	1

COURSE CONTENT

		CO No.
Module 1: History of the Earth	15 Hours	1
Formation of Solar system and planetary differentiation; formation of the Earth: formation and composition of core, mantle, crust, atmosphere, and hydrosphere; chemical composition of the earth; geological time scale and major changes on the Earth with time.		
Module 2: Endogenic Processes and Exogenic Processes	15 Hours	2, 3
Movement of lithospheric plates; mantle convection and plate tectonics, major plates and hot spots, plate boundaries; continental drift and seafloor spreading. Introduction to Atmosphere and atmospheric processes- Atmospheric Structure, Clouds, Thermodynamics, Atmospheric circulations. Land surface processes: Aeolian, fluvial, and glacial processes, Weathering, erosional, and depositional landscapes; coastal processes. Groundwater hydrology.		
Module 3: Minerals and rocks	15 Hours	4
Minerals; atomic structure, physical properties, major rock-forming minerals; Rocks-classification, form, texture, and mineralogy of common Igneous, Metamorphic, Sedimentary, Rock cycle; Rock deformation: folds, faults and joints		
Module 4: Hydrology	15 Hours	2, 5
Surface water hydrology: Hydrological cycle, Factors affecting hydrological cycle. Groundwater hydrology: Aquifers – types and properties; Groundwater recharge; Methods of groundwater abstraction- undesirable side effects of over-exploitation. Sustainable groundwater development and management.		

Mode of Transaction	**Classroom activities** **Field activities** 1. Local Geological Fieldwork 2. Identifying common minerals and rocks in the field 3. Identification of common rock structures in the field **Lab based activities**

	1. Identification of Minerals and Rocks
Mode of Assessment	Continuous Evaluation **Assignment/Quiz/Discussion/Seminar** **Internal Exam (40%)** **Final exam (70%)**

Learning Resources

1. Bridge, J., &Demicco, R. 2008. Earth Surface Processes, Landforms & Sediment deposits. Cambridge University Press.
2. Duff, P. M. D., & Duff, D. (Eds.). 1993. Holmes' Principles of Physical Geology. Taylor & Francis.
3. Gupta, A. K., Anderson, D. M., &Overpeck, J. T. 2003. Abrupt changes in the Asian southwest monsoon during
   the Holocene and their links to the North Atlantic Ocean. Nature 421: 354-357.
4. Keller, E.A. 2011. Introduction to Environmental Geology (5th edition). Pearson Prentice Hall.
5. Leeder, M., Arlucea, M.P. 2005. Physical Processes in Earth & Environmental Sciences. Blackwell Publishing.
6. Pelletier, J. D. 2008. Quantitative Modeling of Earth Surface Processes (Vol. 304). Cambridge: Cambridge University Press. Chicago.
7. Grotzinger et al 2007 Understanding Earth, WH Freeman New York, 579 p

Syllabus of Minor Courses

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme **Environmental Science**

School	**Graduate School**		
Programme	**4 + 1 Integrated UG and PG Programme**		
Course Title	**Fundamentals of Environmental Science**		
Course Type	**Minor**		
Course Level	100-199		
Course Code	**MG1DSCUES121**		
Course Overview	The course introduces environmental science, exploring its definition, scope, and multidisciplinary nature. It covers the history of environmental protection, significant global issues, and key environmental movements. Additionally, it delves into environmental ethics, highlighting the importance of resource consumption and conservation.		
Semester	1	**Credit**	4
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work// fieldwork**	
	60	15	
Pre-requisite	A foundational understanding of basic science concepts and familiarity with current environmental issues		

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome *Upon completion of this course, students will be able to;*	Learning Domains	PSO No.
1	Dilate upon the scope and importance of Environmental Science and its multidisciplinary nature.	U	1
2	Comment on the history and origin of environmental protection initiatives and key international conferences.	R	1

3	Identify and classify major types of natural resources	U	1
4	Analyze the developmental issues and their environmental impacts.	An	2
5	Apply principles of environmental ethics to address the issues of equity and disparity.	A	1

COURSE CONTENT

		CO NO.
Module 1: Introduction to Environmental Science & Conservation History	15 Hours	1, 2
Definition, scope, and importance of Environmental Science, Multidisciplinary nature of environmental science; Significance of Environmental Education. Origin of conservation NGOs like WWF, UNEP, etc., Silent Spring, Our Common Future. International initiatives for environmental protection; Major Environmental movements		
Module 2: Natural Resources	15 Hours	3
Introduction to natural resources; Types of natural resources- Renewable and Non-renewable resources; Types of natural resources- Forest resources, Water and soil resources, Mineral Resources, Energy Resources		
Module 3: Global Environmental Issues	15 Hours	4
Developmental issues and related impacts such as ecological degradation; environmental pollution; Project Affected People (PAPs). Environmental Challenges and Urbanization: Production and Consumption Perspectives, Industry and Technology Impacts, Economic-Environmental Conflicts Climate Change, Global Warming, Acid Rain, Ozone Depletion, Nuclear Incidents, and Environmental Catastrophes; Case Studies: Consumerism and Waste Management Practices.		
Module 4: Environmental Ethics	15 Hours	5
Aldo Leopold's Land Ethics and Gross National Happiness, Resource consumption patterns and the need for their equitable utilisation; Equity – Disparity in the Northern and Southern countries; Urban-rural equity issues; The need for Gender Equity; Preserving resources for future generations; The rights of animals; The ethical basis of environment education and awareness; The conservation ethic and traditional value systems of India; Anthropocentrism and Ecocentrism		

Mode of Transaction	**Classroom activities** **Field activities** **Lab based activities**

Mode of Assessment	**Assignment/Quiz/Discussion/Seminar** **Internal Exam (40%)** **Final exam (70%)**

Learning Resources

1. Basu, M., & Xavier Savarimuthu, S. J. (2017). Fundamentals of environmental studies. Cambridge University Press.
2. Chawla, S. (2013). A Textbook of Environmental Studies. McGraw Hill Education (India) Private Limited.
3. Chokkan, K.B., Pandya, H. & Raghunathan, H. (eds). 2004. Understanding Environment. Sagar Publication India Pvt. Ltd., New Delhi
4. Elliot, D. 2003. Energy, Society & Environment, Technology for a Sustainable Future. Routledge Press.
5. Guha, R. 1989. Ecological change and peasant resistance in the Himalaya. Unquiet Woods, Oxford University Press, Delhi.
6. Miller, T.G. 2012. Environmental Science. Wadsworth Publishing Co
7. National Research Council (NRC). 1996. Linking Science and Technology to Society's Environmental Goals. National Academy Press

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	**Graduate School**		
Programme	**4 + 1 Integrated UG and PG Programme**		
Course Title	**Natural disasters**		
Course Type	**Minor**		
Course Level	**100-199**		
Course Code	**MG1DSCUES141**		
Course Overview	This course covers an overview of disasters of natural origin. Students will gain an in-depth understanding of various types of disasters, including their physical, social, economic, and environmental dimensions. Through case studies, theoretical frameworks, and practical applications, the course aims to equip students with the knowledge and skills to effectively analyse, mitigate, and respond to natural disaster events.		
Semester		**Credit**	**4**
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work// fieldwork**	
	60	15	
Pre-requisite	Basic knowledge about Geology		

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PSO No.
	Upon completion of this course, students will be able to;		
1	Explain the characteristics of natural disasters and understand their respective characteristics and dynamics.	R	1

2	Describe the short-term and long-term impacts of disasters on communities, economies, and environments.	U	1,2
3	Understand emerging challenges of disasters in the contemporary world including climate change	U	2
4	Analyze the factors that contribute to the vulnerability of various natural disasters	An	1,2
5	Understand the historical and contemporary case studies of disasters to identify lessons learned and best practices	U	1

COURSE CONTENT

		CO NO.
Module 1: Introduction to Natural Hazards	10 Hours	1, 2
Science and facts of natural hazards, Causal factors and characteristics of natural disasters, major natural hazards across the world, natural hazard profile of India		
Module 2: Water and Climate Related Disasters	15 Hours	1, 2
Cause, effects, types and measurements of Floods, Cyclones, Tornadoes, Hail storm, Hot wave , Cold wave, Snow avalanches, Droughts, Acid rain, Sea erosion, Thunder and lightning		
Module 3: Geologically Related Disasters	15 Hours	1, 2
Geological factors for various disasters, Cause, effects, types and measurements of Landslides, Earthquakes, Mine fires, Groundwater contamination,Volcanic eruptions and Tsunamis		
Module 4: Significant Historical Natural Disasters	20 Hours	3, 4, 5
Introduction to historical disasters, global disaster databases - CRED and EMDAT, Case studies of notable international, national and regional disasters		

Mode of Transaction	**Classroom activities** 2. Practice safety procedures during natural disasters 3. In-depth analysis of specific natural disaster events 4. Plan and organize study trips local natural disaster affected cites
Mode of Assessment	Continuous Evaluation **Assignment/Quiz/Discussion/Seminar** **Internal Exam (40%)** **Final exam (70%)**

Learning Resources

1. Keller E.D., and Blodgett R. H, 2006. Natural Hazards. Pearson Printice Hall

2. Natural Hazards, Unnatural Disasters: The Economics of Effective Prevention" by the World Bank and United Nations
4. Kapur A., Neeti, Meena, Deepthima, Roshani and Debanjali, Disasters in India Studies. Rawat Publications, New Delhi
5. Peduzzi P., Dao H., and Herold C., 2005. Mapping Disastrous Natural Hazards Using Global Datasets Natural Hazards Volume 35, Number 2, 265-289.

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	**Graduate School**		
Programme	**4 + 1 Integrated UG and PG Programme**		
Course Title	**Introduction to Ecosystems**		
Course Type	**Minor**		
Course Level	**100-199**		
Course Code	**MG2DSCUES121**		
Course Overview	This course provides insight into the basics of ecosystems and their processes, including biogeochemical cycles, as well as an overview of various ecosystems of the world, their characteristics, and their significance. It also explains the various ecosystem services and their relevance to human and other well-being.		
Semester	1	**Credit**	4
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work// fieldwork**	
	45 hrs	15	
Pre-requisite	Basic understanding about science concepts, interest in ecological studies and affection to nature.		

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PSO No.
	Upon completion of this course, students will be able to;		

1	Understand the basic concepts of ecosystems and their processes	U	1
2	Identify the key components of ecosystems and understand their roles	An, U	1
3	Analyse the threats of various ecosystems of world	An	1
4	Evaluate the various services offered by the ecosystems	E	1,2

COURSE CONTENT

		CO NO.
Module 1: Ecosystems	10 Hours	1, 2
Ecosystem : Concept , Biotic and Abiotic components; Ecosystem processes – Photosynthesis and decomposition; Food chain, Food web, Ecological pyramids, Trophic structure and levels. Flow of energy, Ecological efficiencies . Concepts of productivity and homeostasis. Biogeochemical cycles - Gaseous and Sedimentary cycles – Carbon, Nitrogen, Sulphur, Phosphorus cycles. Anthropogenic activities and its impacts of biogeochemical cycles.		
Module 2: Terrestrial ecosystems	12 Hours	1, 2
Terrestrial biomes of the world : Various types of tropical forest ecosystems : Characteristics, distribution, climate; stratification, floral-faunal interactions; Conservation aspects Desert ecosystem: Characteristics, vegetation, adaptations; Savanna woodlands: Temperate ecosystems : Boreal forests, tundra, Case studies : Overview of Forest types in India		
Module 3: Freshwater and Marine ecosystems	15 Hours	1, 2
Aquatic biomes of the world Freshwater ecosystems – Lentic water bodies : Pond, Lakes - Types based on origin; based on thermal stratification; Reservoirs. Lotic water bodies: streams, springs, Rivers – abiotic parameters and biotic communities. Marine ecosystems : Coastal zones, Mangroves, Coral reefs, Salt marshes, Intertidal zone, Rocky shore, Lagoons, Sea grass and Kelp forests, Large marine areas, Polar marine environment Wetlands: Freshwater and Marine Case studies : Over view of Aquatic ecosystems of India;		
Module 4: Ecosystem – Significance and Conservation	8 Hours	3, 4, 5
Ecosystem services (Provisioning, Regulating, Cultural, and Supporting); Ecosystem preservation and conservation strategies; Basics of Ecosystem restoration		

Mode of Transaction	**Classroom activities** Library reference and Video screening **Field activities :** Field visits to near by terrestrial and aquatic ecosystems **Lab based activities** : Assessment of primary productivity

Mode of Assessment	**Quiz, Seminar, Assignment** **Internal Exam (40%)** **Final exam (70%)**

Learning Resources

1. Odum, E. P. & Barrett, G. W. 2006. Fundamentals of Ecology (Cengage)
2. Smith R. L & Smith, T. M. Ecology and Field Biology. Benjamin Cummings/Addition Wesley
3. Dash, M. C. & S. P. Dash, Fundamental of Ecology. Tata Mcgraw Hill Publication.
4. Singh, J. S., Singh, S. P. & Gupta, S. 2006. Ecology, Environment and Resource Conservation. Anamaya Publications, New Delhi.

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	**Graduate School**		
Programme	**4 + 1 Integrated UG and PG Programme**		
Course Title	**Concepts of disaster management**		
Course Type	**Minor**		
Course Level	**100-199**		
Course Code	**MG2DSCUES141**		
Course Overview	This course introduces the basic principles and practices of disaster management. Students will explore the various phases of disaster management; mitigation, preparedness, response, and recovery- while gaining insights into hazard assessment, risk analysis, and community resilience. Students will learn to apply theoretical knowledge to real-world scenarios through case studies and practical applications.		
Semester		**Credit**	**4**
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work// fieldwork**	
	60	15	
Pre-requisite	Basic knowledge about Geography		

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PSO No.

	Upon completion of this course, students will be able to;		
1	Explain fundamental concepts and principles of disaster management, including the different phases and their importance.	R	1
2	Understand the mechanisms for effective disaster response.	U	1,2
3	Understanding key principles and phases of disaster management	U	1
4	Perform vulnerability assessments and analyze potential impacts to determine risk levels.	An	1,2
5	Understand the role of international organizations in disaster management.	U	1

COURSE CONTENT

		CO NO.
Module 1: Introduction to Disaster Management	10 Hours	1, 2
Introduction to key concepts, terminologies and their complexities (Hazard, vulnerability, Exposure, Risk, Crisis, emergencies, Vulnerability, Disasters, Resilience)		
Module 2: Disaster Management Spectrum	15 Hours	2, 3
The disaster management cycle- Mitigation (structural and non structural), mitigation goals, Preparedness (planning, training and exercises,Public awareness and education), Response (emergency operations centers, search and rescue operations, incident command system , medical care and shelter management) , Recovery (damage assessment , reconstruction and rehabilitation)		
Module 3: Risk Assessment and Vulnerability Analysis	15 Hours	3, 4
Disasters and development, hazard identification, vulnerability analysis, exposure assessment, risk analysis, evaluation and mitigation, physical, socioeconomic, environmental and institutional vulnerability		
Module 4: Disaster Management Administration	20 Hours	3, 4, 5
International disaster management system, international disaster response laws, Disaster Management Act, NDMA, NIDM, NDRF, SDMA and DDMA. Role of various stakeholders in disaster management administration		

Mode of Transaction	**Classroom activities** Vulnerability assessment role-play Risk matrix analysis Disaster mock drill- tabletop exercises
Mode of Assessment	Continuous Evaluation **Assignment/Quiz/Discussion/Seminar** **Internal Exam (40%)** **Final exam (70%)**

Learning Resources

1. Shaw R and Krishnamurthy R.R., (ed.)2009. Disaster management Global Challenges and Local solutions. University Press, India.
2. Disaster Management: A Disaster Manager's Handbook" by Asian Development Bank
3. Principles of Emergency Management and Emergency Operations Centers (EOC)" by Michael J. Fagel
4. Coppola D. P., 2007.Introduction to International Disaster Management. Elsevier. Butterworth-Heinemann

Syllabus of MDC courses

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	**Graduate School**		
Programme	**4 + 1 Integrated UG and PG Programme**		
Course Title	**Sanitation, Health and Environment**		
Course Type	**MDC**		
Course Level	**100-199**		
Course Code	**MG2MDCUES101**		
Course Overview	The course explores sanitation and health issues, waste management techniques, and ecological sanitation methods. It also analyzes the impacts of pollutants on organisms and food contamination, considering exposure routes and toxicity testing. Furthermore, it helps to understand the interplay between sanitation practices, human health, and environmental sustainability.		
Semester	2	**Credit**	3
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work// fieldwork**	
	45		

Pre-requisite	Interest in public health and environmental concepts, including sanitation, waste management, and pollutants.

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PSO No.
	Upon completion of this course, students will be able to;		
1	Understand the role of sanitation in Public health	U	1
2	Comprehend ecological sanitation principles and their impact on human health and food security.	U	1
3	Analyze the effects of pollutants on organisms and food contamination	An	1,2
4	Compare successful sanitation strategies and understand the health sector's role in sanitation improvement.	E	1

COURSE CONTENT

		CO NO.
Module 1: Sanitation and Health	10 Hours	1
Sanitation and Health- introduction and Current situation, Water and sanitation related diseases, respiratory infections, under-nutrition; Successful approaches to sanitation strategies; Role of the health sector; Global experience in improving sanitation and hygiene; Climate change and diseases; Occupational health		
Module 2: Waste Management	12 Hours	1, 2
Solid and liquid waste: Types, sources, properties, and impacts; Treatment/ processing techniques for solid wastes: Thermal and Biological processes; Disposal techniques: Landfills – design, operation, and management; Hazardous waste management; Wastewater treatment: an overview; Concept of Zero waste		
Module 3: Ecological Sanitation	11 Hours	1, 2,
Conventional sanitation: a linear flow system – its limitations; Eco San –Circular flow and closing the loop: concept, goals, and advantages; Eco San for human night soil management: Dry Toilets, Composting Toilets. Grey water management; Eco San - Human Health and Food Security		
Module 4: Pollutants and individual organisms	12 Hours	2, 3, 4
Routes and types of exposure to toxic substances; Toxicity of pollutants such as metals, pesticides, radioactive minerals, etc.; Effects of pollutants on individual organisms. Contaminants in food; Occupational exposure to toxins; Toxicity from substances used in daily life: cosmetics, cleansing agents etc. Toxicity testing		

Mode of Transaction	**Classroom activities** **Field activities** **Lab based activities**
Mode of Assessment	**Assignment/Quiz/Discussion/Seminar** **Internal Exam (40%)** **Final exam (70%)**

Learning Resources

1. Walker, CH., Hopkin, S.P., Sibly RM., Peakall DB. Principles of Ecotoxicology, Taylor and Francis, New York
2. Lippmann, M. (Ed.). (2000). Environmental toxicants: human exposures and their health effects.
3. Prabhakar VK. Toxic and Hazardous chemicals, Anmol, New Delhi
4. Sarkar, B. (2002). *Heavy metals in the environment*. CRC press.
5. Letcher, T., & Vallero, D. A. (Eds.). (2019). *Waste: A handbook for management*. Academic Press.
6. Singh, J., & Ramanathan, A. L. (Eds.). (2010). *Solid waste management: present and future challenges*. IK International Pvt Ltd.
7. Sinha, B. D., & Menon, P. S. K. (2000). *Environmental sanitation health and panchayati raj*. Concept Publishing Company.
8. Rajaram, V., Siddiqui, F. Z., Agrawal, S., & Khan, M. E. (2016). *Solid and liquid waste management waste to wealth: Solid and liquid waste management waste to wealth*. PHI Learning Pvt. Ltd..