SEMESTER III

	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	**World of Minerals Rocks**		
Course Type	**Minor A**		
Course Level	**(200-299)**		
Course Code	**MG3DSCUGE221**		
Course Overview	This course will provide a structured framework for understanding minerals and rocks, ensuring students develop foundational knowledge and practical skills for further geological studies and applications.		
Semester	**3**	**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	Comprehend the definition, characteristics, and classification of minerals and mineraloids and their physical properties.	U	1

2	Classify minerals into silicate and non-silicate groups, and interpret their crystal structures and chemical composition.	An	2
3	Examine the physical, chemical, and optical properties of rock-forming minerals and relate these properties to their geological significance	Ap	1
4	Understand the formation, classification, and characteristics of igneous, metamorphic, and sedimentary rocks.	Ev	3
5	Interpret the processes responsible for sedimentary structures and their significance in geological studies.	Cr	1,2

COURSE CONTENT

		CO No.
Module 1: Physical properties of minerals	10 Hours	1,2
Minerals-Definition of Mineral and Mineraloid. Scope and aim of Mineralogy. Physical Properties of minerals. Electric, Magnetic and Radioactive properties of minerals. Types of Bonds. Polymorphism, isomorphism and pseudomorphism. Solid solution and exsolution in minerals.		
Module 2: Silicate structure and classification of minerals	15 Hours	3
Classification of Minerals- Rock forming minerals. Silicate structure and classification of silicate minerals. Physical, chemical and optical properties of the following- Olivine, Garnets, Pyroxenes, amphiboles, Micas, feldspars, quartz. Systematic study of the important non silicates minerals- Calcite, Diamond, Graphite, Gold.		
Module 3: Igneous and metamorphic rocks	20 Hours	4
Igneous Rock-definition, types. Origin of magma; primary and parental magma, melting and crystallization. Bowen's reaction series. Texture, structure and classification of igneous and metamorphic rocks.		
Module 4: Sedimentary rocks	15 Hours	5
Sedimentary rock- definition. Texture, structure and classification of sedimentary rocks. Sedimentary structures– origin, classification-primary, secondary and organic structures		

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

Learning Resources

1. Dana E. S. (1995) A text book of mineralogy. Asia publishing house Wiley.

2. William D Nesse (2008). Introduction to Mineralogy. Mc Graw Hill Book Company, New York.

3. Perkins Dexter (2006) Mineralogy. Pearson Education; Prentice Hall.

4. Tyrrell, G.W (1978). Principles of petrology. Chapman and Hall Ltd. London.

5. John D Winter (2012). An Introduction to Igneous and Metamorphic Petrology. Prentice Hall.

6. Pettijohn, F.J (1983) Sedimentary Rocks. Hraper & Bros.

	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	**History of the Universe**
Course Type	**MDC**

Course Level	**200-299**		
Course Code	**MG1DSCUGE121**		
Course Overview	This course covers an overview of the origin of the universe and solar system. It gives an understanding of the theories of formation of Earth and Moon, the members of the solar system, the geological time scale and plate tectonics.		
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 origin of the Universe	U	4
2	Explain the members of the Solar system	R	4
3	Analyze the Internal structure of the Earth	An	1,4
4	Understand the Geologic Time Scale	U	1,4
5	Understand plate tectonic theory and lithospheric plates	U	1,2

COURSE CONTENT

		CO No.
Module 1: Origin of the Universe	10 Hours	1
The origin of the Universe and the Solar system; Theories of origin of Earth. Earth - Shape, size, age and rotation. Chemical Composition of the Earth and the Moon, Condensation and Accretion of the Planets, Origin of the Moon.		
Module 2: The solar system	15 Hours	2
Members of the Solar System: Satellites and Planetary Rings; Comets and Other Icy Bodies; Asteroids; Meteorites		2
Module 3: The Earth	15 Hours	3,4

Internal structure of earth; crust, mantle, core; density and chemical composition; major seismic discontinuities. Basic Concepts of Geological Time Scale.		
Module 4: Endogenic Processes	20 Hours	5
Plate tectonics; Lithosphere, Movement of plates; mantle convection, major plates and hot spots, plate boundaries; continental drift and seafloor spreading.		

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

Learning Resources

1. Holmes, A. Principles of Physical Geology, Ronald, New York, 1965.
2. Plummer Carlson, Mc Geary (2003).Physical Geology. McGraw–Hill.
3. Earth as an Evolving Planetary System Kent C. Condie, Elsevier Academic Press, London

SEMESTER IV

	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	**Historical Geology**		
Course Type	**Minor**		
Course Level	**200-299**		
Course Code	**MG4DSCUGE221**		
Course Overview	This course comprehensively explains Earth's history through key geological principles and methods. It covers the Geologic Time Scale, the principles of stratigraphy, and dating techniques, including both relative and absolute methods, to analyze and interpret Earth's dynamic processes. Learners will gain essential skills in correlating geological events, reconstructing past environments, and evaluating human impact on Earth's systems.		
Semester	**4**	**Credit**	**4**
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work// fieldwork**	
	60	15	
Pre-requisite	Basic knowledge of geology and geological time scale		

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 fundamental principles of Stratigraphy.	R	1
2	Understand the basics of stratigraphy.	U	2
3	Analyze evolutionary milestones of life on earth.	An	1
4	Describe the hierarchical organization of the Geologic Time Scale, including Eons, Eras, Periods, Epochs, and Ages.	Cr	1,6
5	Understand Earth’s formation, and describe geological and tectonic processes that led to the formation and evolution of the Indian Ocean.	Ap	4

COURSE CONTENT

		CO No.
Fundamentals of Stratigraphy: Principles and Applications	15 Hours	1, 2
Definition, and scope of stratigraphy. Historical development of stratigraphy. Importance of stratigraphy in geology. Fundamental Principles of Stratigraphy. Law of Superposition. Principle of Original Horizontality. Principle of Lateral Continuity.		

Principle of Cross-Cutting Relationships. Principle of Faunal Succession. Principle of Inclusions and Unconformities.		
Module 2: The Geologic Time Scale: Structure and Evolution	15 Hours	3,4
Geologic Time scale. Hierarchical structure: Eons, Eras, Periods, Epochs, and Ages. Eons: Hadean, Archean, Proterozoic, Phanerozoic. Eras in Phanerozoic: Paleozoic, Mesozoic, Cenozoic.		
Module 3: Dating Geological Events: Relative and Absolute Techniques	15 Hours	5
Relative dating techniques: Superposition, cross-cutting relationships, and faunal succession. Absolute dating methods: Radiometric dating (e.g., Carbon-14, Uranium-Lead). Biostratigraphy and index fossils in time correlation.		
Module 4: Evolution of Earth and Anthropogenic Influence	15 Hours	3, 4, 5
Formation of the Earth (~4.6 billion years ago). Evolution of life: Origin, Cambrian Explosion, mass extinctions, and the rise of mammals. Evolution of Indian Ocean. Major climatic shifts: Ice ages and warming periods. Current Epoch and Anthropogenic Influence. Overview of the Holocene epoch. Introduction to the Anthropocene concept: Human impact on geological processes.		

Mode of Transaction	**Classroom activities** **Field activities** 1. Geological Fieldwork 2. Identification of fossils 3. Study sedimentary structures **Lab-based activities**
Mode of Assessment	Continuous Evaluation **Assignment/Quiz/Discussion/Seminar** **Internal Exam (40%)** **Final exam (70%)**

Learning Resources

1. John P. Grotzinger Thomas H. Jordan. Understanding Earth.
2. Michael E. Brookfield. Principles of Stratigraphy
3. Sedimentology and Stratigraphy

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

Course Title	**Identification of Minerals and Rocks**		
Course Type	**SEC**		
Course Level	**200-299**		
Course Code	**MG4SECUGE201**		
Course Overview	This course covers an overview of the identification of common minerals and rocks. The course aimed to cater to different criteria for the identification of minerals in hand specimens as well as the microscopic identification. It also gives a basic idea of the petrographic analysis of various common rock types.		
Semester	**2**	**Credit**	**3**
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work// fieldwork**	
	15	30	
Pre-requisite	Basic knowledge of minerals and rocks		

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PSO No.
	Upon completion of this course, students will be able to;		
1	Identify and describe the physical properties of minerals through hand specimen analysis.	R	1
2	Analyse the optical properties of minerals using a polarising microscope	U	2
3	Classify and differentiate rocks based on their megascopic physical properties.	U	1
4	Interpret and evaluate rock petrography through optical mineral identification.	An	3
5	Apply integrated megascopic and microscopic techniques for mineral and rock identification to improve geological interpretation skills for academic and professional use.	Ev	1,2

COURSE CONTENT

		CO No.
Module 1: Hand Specimen Analysis	10 Hours	1

Physical Properties of Minerals: Colour, Streak, Lustre, Hardness - using the Mohs scale, Cleavage, Fracture, Specific Gravity, Transparency, and other properties such as Magnetism, reaction to acid, taste, or smell.		
Module 2: Optical Analysis	15 Hours	2
Optical properties of Minerals: Refractive Index, Relief, Transparency, Colour, Pleochroism, Interference Colour, Extinction, Birefringence, Twinning, Cleavage, and Optic Sign.		
Module 3: Megascopic identification	15 Hours	3,5
Physical Properties of Rocks: Texture - Composition, Grain size, shape, and their arrangements; Structure - Large-scale features like layering, banding, or foliation; Colour - General appearance.		
Module 4: Petrographic Analysis of Rocks	20 Hours	4, 5
Optical Properties of Rocks: Mineral Identification - Determining minerals present in the rock based on their optical properties, Texture Analysis - Grain boundaries, Grain size and shape, and Relationship between minerals - intergrowth, zoning, or replacement, Modal Composition - Percentage of each mineral phase.		

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

Learning Resources

1 Ford, W. H. (1955) A textbook of Mineralogy- Asia publishing House – Wiley.
2 Phillips, (1956) An Introduction to Crystallography – Longmans Green
3 Cornelis Klein and Hurlbut (1985) Manual of Mineralogy, John Wiley
4. Deer, W. A., Howie, R.A and Zussman, J. (1992) An introduction to the rock-forming minerals, ELBS –Longman, England.
5 Hans- Rudolf Wenk & Andrei Bulakh (2004) Minerals – their constitution and origin, Cambridge University Press.
6 Nesse, W. D. (1999) Introduction to Mineralogy, Oxford University Press, New Delhi.
7 Perkins D. (2002) Mineralogy, Prentice-Hall of India Pvt Ltd, New Delhi.