

Course Type	Course Code	Name of Course	L	T	P	Credit
ESC	NGLE101	Introduction to Earth Sciences	3	0	0	3

Course Objective
The main objective of this course is to introduce undergraduate students to the fundamental aspects of Earth Sciences.
Learning Outcomes
<p>Upon completion of the course, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Understand the importance of the Earth as a system</li> <li>2. Learn about the formation and evolution of the Earth</li> <li>3. Learn about the dynamics of the planet along with the causes of natural hazards and their mitigation</li> </ol>

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	The Big Bang; Nucleosynthesis and formation of stars; Nebular condensation and formation of the Solar System; Planets, meteorites, comets, asteroids; Early history of terrestrial planets.	2	An overview of the Universe
2.	The continental and oceanic crust; Seismic waves; Mantle and its discontinuities; Core; Earth's internal heat; Earth's magnetic field; Earth's surface topography as a product of coupling of endogenic-exogenic processes.	4	An understanding of the Interior of the Earth
3	<p>Structural Geology: Concepts of stress, strain and deformation; Introduction to brittle and ductile deformation; Mechanisms of faults, fractures and folds.</p> <p>Volcanoes: Types of volcanoes and their products; Monitoring and predicting volcanic activity; Effect of volcanoes on the climate and environment.</p> <p>Earthquakes: Causes; Nomenclature; Richter and Mercalli scales; Seismic zones of India. Tsunamis; Landslides; Warning systems and mitigation.</p> <p>Plate Tectonics: Paleomagnetism and sea-floor spreading; Lithospheric plates; Divergent boundaries; Convergent boundaries; Transform faults and hotspots; What drives plate tectonics.</p>	12	Developing a correlation between Plate Tectonics and Natural Hazards

4.	<p>Mineralogy: Definition and physical properties of minerals; Bonding and crystal structure; Basic crystallography; Important mineral groups; Formation, exploration, and production of ore deposits; Global mineral resources.</p> <p>Petrology: The rock cycle; Origin of magma, magmatic differentiation, magmatic intrusions; Classification of igneous rocks; Bowen's reaction series; Weathering, regolith and soil formation; Sediments and the sedimentary cover; Classification of sedimentary rocks; Sedimentary structures and bedforms; Metamorphism and associated changes; Metamorphic facies; Classification of metamorphic rocks.</p>	12	An understanding of Solid Earth Materials i.e., from minerals to rocks
5.	<p>Concept of Time: Geologic time; Radiometric dating methods; Relative versus absolute age; Principles of stratigraphy; Age of the Earth.</p> <p>Life on Earth: Early life; Species, evolution, and natural selection; How fossils form; Evolution and extinctions.</p>	5	The evolution of life on Earth and the Geologic Record
6.	<p>Resources and Reserves: Energy resources, oil and natural gas, coal; Alternative fossil fuels; Energy Policy; Mineral resources; Ore deposits and plate tectonics; Finding new mineral deposits.</p> <p>Hydrological Resources: Hydrological cycle and water budgets; Aquifer properties; Groundwater flow; Groundwater-surface water interactions; Groundwater pollution and contaminant transport.</p>	7	Energy and Material Resources

#### Reference Books:

1. Hefferan, K. and O'Brien, J., 2010. Earth Materials, Wiley-Blackwell, Sussex; 670 p.
2. Jain, S., 2014. Fundamentals of Physical Geology, Springer, New Delhi; 494 p.
3. Earle, S., 2015. Physical Geology, Creative Commons Attribution 4.0; 621 p.
4. Kenneth, W. and Christiansen, E.H., 2004. Earth's Dynamic Systems, Prentice Hall; 759 p.
5. Mahapatra, G. B. 2003. A text book of Geology. CBS Publishers and distributors.