Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NGLD502	Nanotechnology in Mineral and Hydrocarbon Exploration	3	0	0	3

Course Objective
The primary objective of the course is to introduce fundamental aspects of Nanotechnology in Mineral and Hydrocarbon Exploration to the students.
Learning Outcomes
Upon completion of the course, students will be able to • Basic concept of nano geosciences. • Application of nano-studies in CBM, petroleum exploration, CO2 sequestration.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Nano- ores: High resolution techniques for studying ore samples at the nanoscale; Nanomaterials in Earth Science	4	Basic concept of nanogeosciences.
2.	Trace elements systematics: Understanding nanoscale incorporation of trace metals in ore samples	4	Learn trace element systematics of ore samples.
3.	Ore mobility: Colloidal transport, precipitation and isotopic fractionation in supergene settings	4	Ore mobility and its role in the formation of ore deposits
4.	Ore depositional mechanism: The effects of atomic and nanoscale processes on ore stability	3	Understand the effects of atomic and nanoscale processes on ore depositional mechanism.
5.	Introduction: Introduction, New forms of matter, Nanopowders and nanomaterials, nanopores and their properties, Structure of nanomaterials, Fullerene structures, New forms of carbon, carbon nanotubes (CNT)	8	Nanomaterials and carbon nanotubes
6.	Analytical methods: Analytical methods for studying nanomaterial: Scanning Tunneling Microscope, Atomic Force Microscope (AFM), Raman Spectroscopy	5	Methods for studying nanomaterials
7.	Processes: Processes for CNT production; Utilization of coal for production of CNT; Application of CNT- vacuum microelectronics, energy storage,	4	Various methods of producing CNT
8.	Applications: Dynamics of natural gas adsorption; Application of Nanotechnology: gas separation and storage; Removal of SO_x and NO_x, Coal Bed Methane, Petroleum exploration; CO_2 sequestration and CO_2 adsorption dynamics of nanopores; Molecular sieves; Nanoprobes and sensors.	10	Application of nano-studies in CBM, petroleum exploration, CO_2 sequestration.
	Total	**42**	

Recommended Books:

1. Carbon Nanotubes Synthesis, Structure, Properties and Applications : Mildred S. Dresslhaus, Gene Dresslhaus and PhaedonAvouris (Eds), 2001 (Springer)