INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/ CENTRE/SCHOOL: Department of Earth Sciences

Subject Code: ESC-501 **Course Title:** Mineralogy

L-T-P: 3-0-2 **Credits:** 4 **Subject Area:** PCC

Course Outlines: Chemical bonds, crystal stability and growth; Crystal systems, symmetry Operations; Mineral classification, physical and optical properties of rock forming minerals; Silicate structure, Phase equilibria; Introduction to economic/strategic/critical minerals; Analytical mineralogy.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/ CENTRE/SCHOOL: Department of Earth Sciences

Subject Code: ESC-503 **Course Title:** Geochemistry

L-T-P: 3-0-2 **Credits:** 4 **Subject Area:** PCC

Course outlines: Chemical principles and processes shaping geological materials; Geochemical quantitative techniques; mass balance, equilibrium partitioning, element transport; Geochronology, stable isotopes; Cosmochemistry; Analyses and interpretation of geochemical data.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/ CENTRE/SCHOOL: Department of Earth Sciences

Subject Code: ESC-505 **Course Title:** Igneous Petrology

L-T-P: 3-0-2 **Credits:** 4 **Subject Area:** PCC

Course Outlines: Classification, textures and structures of igneous rocks; Thermodynamic rules and phase diagrams; Generation and evolution of primary magmas; Fractional crystallization and crustal contamination; Plate tectonics and igneous petrogenesis.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/ CENTRE/SCHOOL: Department of Earth Sciences

Subject Code: ESC-507 **Course Title:** Structural Geology

L-T-P: 3-0-2 **Credits:** 4 **Subject Area:** PCC

Course Outlines: Concepts of deformation, behavior of rocks under stress; Rheology, brittle and ductile deformation; Strain estimation techniques; Geometry and mechanisms of fold genesis; Interference Patterns; Fault-Related Folding; Geometry and analysis of shear zones; Structures related to various tectonics regimes; Joints, lineation and foliation.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Earth Sciences

Subject Code: ESC-504 **Course Title:** Applied Palaeontology

L-T-P: 2-0-2 **Credits:** 3 **Subject Area:** PCC

Course Outline: Scope and principles of Paleontology; techniques in the recovery of fossils; major fossil groups including microfossils, vertebrates, invertebrates, and plants; applications of fossils in studies on stratigraphy, evolution, paleobiogeography, paleoclimates, paleoecology, and petroleum exploration; paleoceanography, vertebrate evolution, palynology, and fossil biomolecules including ancient DNA.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Earth Sciences

Subject Code: ESC-506 **Course Title:** Metamorphic Petrology

L-T-P: 2-0-2 **Credits:** 3 **Subject Area:** PCC

Course Outline: Formation processes of metamorphic rocks; Identification, genesis, classification of metamorphic rocks; Mineralogy, texture and structure; Metamorphic grades and Facies; Forward and reverse thermodynamic modeling; Implications for plate tectonics, mineral exploration, and crustal evolution.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Earth Sciences

Subject Code: ESC-508 **Course Title:** Geomorphology

L-T-P: 2-1-0 **Credits:** 3 **Subject Area:** PCC

Course Outline: Timescale and processes of landform development, energy flow in geomorphic systems, Weathering-erosion and soil development, mass wasting, and hill slope development, Fluvial processes, Glacial landforms, Marine and coastal geomorphic system, eolian environment and landforms, Tectonic and seismic geomorphology, exploration geomorphology, Geomorphological mapping.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Earth Sciences

Subject Code: ESC-510 **Course Title:** Economic and Ore Geology

L-T-P: 2-0-2 **Credits:** 3 **Subject Area:** PCC

Course Outline: Principles and application of ore microscopy, identification of ore minerals, textures and chemical analyses of ores**;** Fluid inclusions, thermodynamics and stable isotope techniques to understand economic mineral deposits; Metallogeny and mineralogy of base, precious and ferrous metal deposits; Critical minerals.

Practical: Preparation of thin and thick polished rock sections for microscopic study; Microscopic identification of ore, industrial and critical minerals; Identification of various ore textures; Developing mineral paragenesis; Introduction to heating-freezing experiments on fluid inclusions.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Earth Sciences

Subject Code: ESC-511 **Course Title:** Sedimentology and Stratigraphy

L-T-P: 3-0-2 **Credits:** 4 **Subject Area:** PCC

Course Outline: Facies analysis and facies modelling; Classification and characteristics of marine and non-marine sedimentary environments; Eustasy, relative sea level and shoreline trajectory; Cyclicity in sedimentary successions; Advanced stratigraphic principles and correlations; Concepts and methods of Sequence Stratigraphy; Sequence stratigraphy of common sedimentary environments.

Practical: Petrographic study of sedimentary rocks under the microscope, Mesoscopic study of primary sedimentary structures of sedimentary rocks, Palaeocurrent analysis, Grain size analysis, Preparation and correlation of sedimentary logs, Applications of stratigraphic principles.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Earth Sciences

Subject Code: ESC-513 **Course Title:** Geophysical Prospecting

L-T-P: 2-0-2 **Credits:** 3 **Subject Area:** PCC

Course Outline: Physical properties of Earth materials relevant to geophysics; Gravity, Magnetic, Electrical, Seismic, and Electromagnetic methods; Geophysical data acquisition, processing, and interpretation; Geophysical techniques for mineral, groundwater, hydrocarbon, geothermal, and engineering investigations; Surface geophysical methods and borehole geophysics; Multi-method approach for geological investigations; Factors affecting geophysical measurements.

Practical: Familiarization with basic instruments: magnetometer, resistivity meter, seismograph; Basic land surveying to prepare base maps for geophysical surveys: GPS Reading; Basic land surveying to prepare base maps for geophysical surveys: Mark traverse lines and grid layouts; Field data acquisition: Vertical Electrical Sounding (VES) using Schlumberger Configuration; Field data acquisition: Electrical Resistivity Profiling using Wenner Configuration; Identify a geophysical and geological anomaly; Gravity Survey: Demonstration and Data Interpretation; Magnetic Survey: Demonstration and Data Interpretation; Seismic Refraction Method: Field Setup and Data Collection; Seismic Refraction: Field Setup and Data Collection; Seismic Reflection data interpretation to determine depth to bedrock.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Earth Sciences

Subject Code: ESL-521 **Course Title:** Paleoclimatology

L-T-P: 2-1-0 **Credits:** 3 **Subject Area:** PEC

Course Outline: Components of the earth's climate system; introduction to paleoclimatology; terrestrial and marine archives of past climate change; overview of Earth's long-term climate history; orbital Changes & Ice Age climates; Milankovitch mysteries; the Indian monsoon; monsoon and global teleconnections; human civilizations and abrupt climate change; projections for future climate change.