Syllabus of the Admission test for PhD Admission ODD SEM (2021-2022) for candidates having Geology background

Compulsory area:

Origin of the Earth – theories; Major components of Geology; The Precambrian, The Proterozoic – mobile belts and cratonic sedimentary provinces; Continental Drift Theory and Plate Tectonic theory; Scales in geomorphology; Energy flow and relative energy of surface processes; Climatogenetic geomorphology; Weathering and formation of soils; Rates and changes in surface processes; BLAG hypothesis; Quaternary Stratigraphy and dating methods; Geoarchaeology; Meghalayan age; Climate controlling factors; Global energy budget; Plate tectonics and climate change; Milankovitch cycles; Major events in earth's climatic history - Snowball earth, Cretaceous hothouse, Cenozoic climate, Pleistocene glaciations, Last Glacial Maximum and the Holocene; Pleistocene Glacial-Interglacial cycles; Structural formulae; Substitution of elements/solid solution; Unit Cells; Crystal structure; Bravais Lattice; derivation of 32 point groups; X-ray crystallography; Optical Indicatrix, Optical accessories; Mechanical properties of rocks; Mathematical treatment of stress, strain, flow; Micro-structures; Folds/Faults; Shear zones, Tectonics; Phase rule, Binary and Ternary phase diagrams; Chemical Petrology; Generation of basaltic magmas; Controls on magma segregation; Diversification of magmas; Large Igneous Provinces; Heat flow, geotherms and thermal models; Definition and scope of Micropalaeontology; Sample processing techniques; Heat flow and geothermics – calculation of equilibrium and evolving geotherms; Isotope geochemistry; Geochemistry of natural waters, and low temperature aqueous geochemistry. Chemistry of the oceans; Mass spectrometerty: principles and applications; Fission track dating; Stable isotopes of oxygen, hydrogen, carbon and sulphur; Fractionation of stable isotopes; Stable isotope geothermometry; Nuclear systematics; Geochronometry; Hydro geochemical principles and Chemical evolution of natural ground water; Quantitative Assessment of groundwater resources; Groundwater Flow transport and contamination; Coal Geology; Petroleum Geology; Coalbed methane (CBM); Ore forming processes; Application of engineering geological principles; Concept of modelling; Geological structures; Geological hazards; Engineering properties of rocks; Site investigation Analysis; Role of groundwater in engineering geology; Sedimentary basin: formation and classification; Tectonics and Sedimentation; Depositional and diagenetic signatures, Paleoclimatic and tectonic implications; Depositional system analysis: basic concept, architectural elements, Sequence stratigraphy: principles and applications; Remote Sensing: Definition, concepts and types; Electromagnetic Radiation; Radiation laws; EM Spectrum, Colour concept; Platform: Types of platforms; Basics of Aerial photographs; Kepler's law, satellite characteristics; Sensors: Types and classification of sensors, Imaging modes, characteristics of optical sensors; GIS Components and functions of GIS; Geometric and basic atmospheric correction, Digital enhancement and visualization, image transformation, Spatial filtering, Image classification and information extraction for geological applications; Fundamental concepts of Geophysics, Geophysical methods; Radioactive survey; Introduction to well logging; Global climate pattern; Modern biogeography, Calcareous microfossils including Foraminifera, Siliceous microfossils including Radiolaria, Diatoms, Silicoflagellates. Phosphatic microfossils including Conodonts. Application of Micro paleontology in Hydrocarbon Exploration.

Optional area:

Hydrogeology: Darcy's law, Flownet analysis, Well hydraulics, Hydro geochemical principles and Chemical evolution of natural ground water; Quantitative Assessment of groundwater resources; Rainwater Harvesting and Groundwater recharge; Flow in saturated and vadose zone, dating of groundwater, retardation, diffusion, dispersion, sources of Contamination, Hydrochemical behaviour of contaminants, groundwater modelling.

Metamorphic Petrology: Metamorphism: A plate tectonic overview; Variance of metamorphic paragenesis; Thermodynamics of homogeneous and heterogeneous systems; Metamorphic mineral nucleation and crystal growth; Construction of petrogenetic grids. Geothermobarometry;

Ore Geology: Metallogeny and crustal evolution - spatial-temporal distribution of ore deposits; Study of ores in all possible scales of observation; phase equilibria in common ore bearing systems.Phase equilibria in common ore bearing systems; Ores in mafic and ultramafic rocks, felsic skarns and near-surface epithermal deposits; Fluid inclusions and stable isotopes.

Geochemistry: Stellar evolution and the origin of elements; Structure and composition of earth and distribution of elements. Element fractionation in magmatic and metamorphic systems. Introduction to isotope geochemistry with implications for the crust-mantle couple. Geochemistry of natural waters, and low temperature aqueous geochemistry. Chemistry of the oceans.