DEPARTMENT OF EARTH SCIENCES UNIVERSITY OF KASHMIR, SRINAGAR
ENTRANCE TEST SYLLABUS for TWO-YEARS PG APPLIED GEOLOGY
BASED ON NEP_UG SYLLABUS

Unit-1
FUNDAMENTALS OF GEOLOGY

Modern theories about the origin of the solar system. Origin of the Earth. Exogenous and endogenous process. Concept of catastrophism and uniformitarianism. Davis cycle of erosion. Types and agents of weathering. Types, distribution, and eruptional features of volcanoes. Types of glaciers. Geological work of glaciers. Erosional and depositional features of wind. Geological work of rivers. Drainage patterns. Karst topography, Structural landforms. Soil formation and Soil profiles. Topography of seafloor. –Continental shelves, slope, abyssal plains, ocean ridges, submarine valleys, canyons, deep-sea trenches, and guyots. Coral reefs and types. Basic concept of igneous, sedimentary and metamorphic rocks. Structure of earth. Various Geospheres.

Unit-2
IGNEOUS AND METAMORPHIC PETROLOGY

Structure of igneous rocks: large structures- blocky lava, amygdaloidal lava, and vesicular structures, pillow structures, flow structures, sheet and platy structures, prismatic and columnar structures. Textures: Crystallinity, granularity (phaneric and aphanitic), shapes of crystals, mutual relations of crystals, equigranular and unequigranular textures, porphyritic, poikilitic, opthitic, intersertal an intergranular texture, directive textures, intergrowth textures. Reaction structures – corona and kelyphitic borders. IUGS classifications of igneous rocks. Composition of magma, types of magma, physico-chemical constitution of magma. Fractionation and differentiation–Gravity settling, filter-press differentiation, flow diffusion and gaseous transfer within magma; liquid immiscibility, mixing of magmas. Concept of metamorphism. Controls of metamorphism–bulk composition and motivating forces in metamorphism- heat, pressure and chemically active fluids. Types of metamorphism– Contact, cataclastic, regional. Metasomatism, anataxis, palingenesis, migmatization. Metamorphic facies. Metamorphic textures and structures.

Unit-3
PALEONTOLOGY

Origin and evolution of life through ages. Preliminary idea about faunal succession. Fossils, their characters, conditions necessary for fossilization; types of preservation and occurrence. Application of Paleontology. Evolution of Man, Horse & Elephant. Morphological characters, geological, geographical and stratigraphic distribution of the following: (1) Brachiopoda (2) 3 Bivalvia (3) Gastropoda (4) Cephalopoda (5) Graptoloida (6) Anthozoa (7) Echinoidea (8) Trilobita. Elementary concept of vertebrate Paleontology with special reference to Siwalik. Introduction to Paleobotany with special reference to Gondwana plant fossils. Microfossils and their application.

Unit-4

STRATIGRAPHY

Nomenclature and Principles in Stratigraphy. Stratigraphic correlation. Geological Time Scale. Precambrian rocks of India; Dharwar, Aravalli, Cuddapah, Vindhyan and Himalaya with special emphasis on the classification, distribution, lithology and economic deposits. Stratigraphy of Phanerozoic rocks with reference to the lithology and fossil content. Paleozoic succession of Kashmir, Triassic of Spiti, Jurassic of Kutch, Cretaceous of Tiruchirappalli. Stratigraphy of Siwalik and Karewa of Kashmir.

Unit-5
ENGINEERING GEOLOGY

Engineering properties and classification of rocks. Factors affecting engineering properties of rocks. Importance of geological studies to Engineers and significance of geological Investigations for civil engineering projects. Types of dams, bridges, tunnels, and reservoirs. Geology for site selection and construction of roads, buildings, dams, bridges, Tunnels, and reservoirs. Rock stability tests (RQD, RMR, GSI), slope stability, slope failure, Angle of repose, retaining walls and rock bolting. Engineering properties of soils. Mass movements. Earthquakes: liquefaction, creep and seismic zones of India. Reservoir-induced seismicity.

Unit-6
MEDICAL GEOLOGY

Natural distribution and abundance of elements; anthropogenic sources of elements; element consumption by humans; biological functions and responses of elements; geological impacts on nutrition. Health hazards associated with volcanic eruptions; global dust flux and respiratory problems; impacts of fluoride, radon, arsenic, selenium, mercury, iodine, and uranium on physiological function; carcinogenic associations with coal and fibrous minerals; geological effects on animal health, and geophagy (human ingestion of soil materials as a dietary supplement). Effects of combustion of coal and other fuel materials, dust, heavy metals, volatile organic compounds, and pesticides on human and ecological health. Principles of toxicology. Disease and well-being. Environmental and behavioral diseases. Major human diseases and mortality in modern time: Top ten killers and their significance. Climate change impacts on human and ecological health and its mitigation.

Unit-7
GEOCHEMISTRY

Crystal chemistry-chemical bonds, coordination number, radius ratio, ionization potential, electro-negativity, atomic substitution, phase rule. Chemical differentiation and composition of the Earth. Major elements, Trace elements and Rare earth elements, Large ion lithophile elements and High field strength elements. Goldschmidt’s geochemical classification of elements. Geochemical characteristics of crust, mantle and core. Radioactivity and concept of half-life, decay constant, natural radioactive isotopes. Dating of minerals and rocks with potassium-argon and uranium-lead isotopes. Petrogenetic implications of samarium-neodymium and rubidium-strontium systems. Stable isotopes of carbon, oxygen and Sulphur.

Unit-8

GEOPHYSICS

Introduction and scope of geophysics, Spheroidal shape of the earth and Geoid, the magnetic field of the earth, paleomagnetism, Exploring Earth's interior. Applications of geophysics in mineral and energy resources exploration. Earth's thermal history: Heat conduction and heat flow. The thermal gradient of the earth. Convection currents-evidence. Gravity measuring instruments: Pendulum gravimeters, Shipborne measurements. Units of gravity, gravity anomaly types (Free- air, Bouguer), local and regional concepts.

Unit-9
REMOTE SENSING AND GEOLOGICAL HAZARDS

Concept and foundation of RS (Electromagnetic spectrum, radiation laws). Overview of RS technology. Landsat, IRS, SPOT, MODIS. Interaction of Electromagnetic waves with Earth's surface features (water, soil, rocks, and vegetation). Spectral behavior of different land surface features. Geomorphological mapping, land use/land cover mapping. Digital terrain analysis using DEM data: Path analysis, network applications and morphometry. Geological Hazards: Landslides: Types, causes of landslides: natural and anthropogenic, preventive and remedial measures. Volcanoes, types, and associated hazards. GLOF, Avalanches. Mining hazards and prevention. Application of Remote Sensing in Hazard Zonation. Seismic hazard zonation. Urbanization and flooding, nature and extent of flood hazard. Tropical cyclones, tsunamis and coastal erosion.

Unit-10
ENVIRONMENTAL GEOLOGY

Climate change and environment: Change in temperature and precipitation due to global warming. Greenhouse gases. Climate change and food security. Glacier recession with special emphasis on the Third Pole. Response of cryosphere to climate change. Vulnerability of mountain ecosystem to climate change. Redistribution and availability of water resources for various uses. Milankovitch cycles and Quaternary climatic change. Air, water and soil pollution, causes and remedial measures. Geogenic and anthropogenic sources of pollution. Point and diffuse sources vis-à-vis industries, agriculture, and domestic sources. Pollution treatment. Quality criteria of water for domestic, agriculture and industry. BIS and WHO standards.

Unit-11
HYDROGEOLOGY

Introduction to Hydrogeology. Precipitation, Evaporation, Transpiration, Evapotranspiration, Condensation, runoff, infiltration, and water balance. Hydrological Cycle. Water table. Zone of Aeration and Saturation. Aquifer and its types (confined, unconfined and perched).Storage coefficient of aquifers. Hydrological properties of Aquifer: porosity, permeability, specific yield, hydraulic conductivity. Principles of Groundwater flow: Hydraulic head, hydraulic gradient, Darcy’s Law its validation and application. Radial flow, steady and transient flow. Geological controls of groundwater. Hydrochemistry, Artificial recharge. Groundwater exploration-geological and geophysical methods.

Unit-12
CRYSTALLOGRAPHY AND MINERALOGY

Morphology of crystals: Face, edge and solid angle, interfacial angle and Law of constancy of interfacial angles. Bravias Lattices, symmetry operations, Crystal Systems, Normal class of crystal systems. Parameter system of Weiss, Miller indices. Law of Rationality of indices. Types, causes and laws of twinning. Crystal forms: Crystallized, crystalline, cryptocrystalline and amorphous. Crystal habit: elongated, tabular, flattened and equant. Dimorphism, polymorphism, pseudomorphism, isomorphism and solid solution. Classification of silicate minerals and ore-forming minerals. Moho's scale of hardness. Physical properties and mode of occurrence of: Quartz, Feldspar, Mica, Amphibole, Pyroxene, Olivine, Garnet, Chlorite, and Carbonate. Elements of optics: interference of light and types of accessory plates. Refractive index. Snell's law of critical angle. Optical indicatrix of isotropic, uniaxial, and biaxial minerals. Pleochroism and Birefringence. Optical properties of minerals under plane-polarized and cross-polarized light: Forms, cleavage, fractures and parting, refractive index and relief. Becke line method.