SYLLABUS FOR THE POST OF LECTURER (10+2) GEOLOGY

SUBJECT: GEOLOGY

Physical Geology:Earth and solar system: origin, size, shape, mass, density and its atmosphere.A brief account of various theories regarding the origin and age of the Earth. Brief idea of interior of earth and its composition. Concept of Catastrophism and uniformitarianism. Weathering and erosion: factors, types and their effects; agents and products of weathering; Mass wasting and factors affecting mass wasting. Epeirogenesis and orogenesis. Oceans, Topography of sea floor (Continental shelves, slope, abyssal plains, Ocean ridges and, submarine valleys, canyons, deep-sea trenches and guyots). Oceanic erosion and deposition. Coral reefs, types fringing, barrier and atolls. Volcanoes- Causes, types, distribution and eruptional features.

Basic principles of Geomorphology, geomorphological cycles,Geological work of wind, river, underground water and ocean and their erosional and depositional features. Glaciers, Definition and types, snowline, geological work of glaciers and its erosional and depositional features.Drainage patterns Karst topography. Climate and landforms, humid, sub-humid, arid, semi-arid.

Structural Geology and Global Tectonics: Concept of stress and strain and their geological significance, Mechanics of foldingand buckling. Faults and dynamics of faulting, Planer and linear fabrics in deformedrocks,Joints, classification of joints and unconformity and its types.

Concept of petrofabrics and symmetry, Interpretation of fabric data on microscopicand mesoscopic scale. Geometrical analysis of simple and complex structures onmacroscopic scale. Internal structure of the Earth, Plate tectonics and mountainbuilding. Models of mountain building, Collision tectonics.

Paleobiology and Stratigraphy:-Modern concepts of origin of life, Precambrian fossil record and origin of Metazoa.Taphonomy and Fossil communities. Principles of biostratigraphy. Methods andtechniques in Paleontology. Morphology and evolutionary trends in Ammonoids,Brachiopods, Graptolites and Trilobites. Morphology, classification, andevolutionary trends of Foraminifera, Ostracodes and Conodonts, their ecological andgeological significance. Sequence of plant life through geological time. An account ofGondwana plant fossils of India with respect to paleoclimatic conditions.Morphology and applications of spores and pollens. Landmarks in the evolution ofvertebrates, Extinction of Dinosaurs, Siwalik vertebrates, Phylogeny of Equidae andproboscidae. Faunal change with respect to tectonic and climate changes. Humanevolution, Principals of stratigraphy, Stratigraphic classification, International Codeof stratigraphic nomenclature, Concept of stratigraphic facies, Stratigrasphiccorrelation, Graphic representation of stratigraphic data, seismic stratigraphy, ,Magnetostratigraphy. Precambrian- Cambrian, Premian-Triassic,Cretaceous-Tertiary, and Pliocene Pleistocene boundary problems, in

stratigraphy;Paleogeography, paleoclimate, igneous and mountain building activities in theIndian subcontinent from Late Cretaceous.

Sedimentology:-Sedimentary processes, Sedimentary structures and Textures, Use of textures andstructures in sediment dispersal and basin studies. Classification of sediments,heavy minerals. Classification, Environment of deposition, provenanceand diagenesis of sandstones, carbonates and mudstones. Sedimentaryenvironments:- Classification, lithologies, structures andvertical sequences formed in alluvial, deltaic, coastal, and deep sea, glacial andaeolian environments. Concept of sedimentary facies, Walters law of facies andapplication, Sedimentary cycles and cyclothems, Facies models and environmentalreconstruction. Scalar properties and paleocurrents, Paleogeographicreconstruction, and basin analysis, Sedimentation and tectonics, Basin evolution inrelation to plate tectonics.

Mineralogy and Geochemistry:-Internal symmetry in crystals; Twinning and twin laws; Pauling's rule, ionicsubstitution and crystalline solutions, Polymorphism and pseudomorphism,Exsolution, Non-crystalline minerals (mineraloids). Concept and application ofoptical indicatrix and interference phenomenon. Orthoscopic and conoscopic studyof minerals. Optic figure, optic sign, dispersion, pleochroism and absorption.Determinative methods of Refractive index. Pleochroic scheme and 2V microscopicmethods. Axiality and optic sign, Systematic mineralogy of silicates, sulphides,oxides, hydroxides and carbonates. Geochemical classification of elements, TraceElement Geochemistry and concepts of partitioning and distribution coefficients oftrace elements vis-à-vis partial melting and magmageneration. Distribution of REE in earth's mantle and crust. Isotope geochemistry,decay mechanism and growth of isotopes; Geochronological applications of Rb-Sr,K-Ar, U-Th-Pb and Sm-Nd systematics Stable isotope geochemistry of oxygen andhydrogen.

Crystallography:-Introduction to crystallography,Morphology of crystals, Face, edge and solid angle, interfacial angleand their measurements;Law of constancy of interfacial angles;Crystallographic axes and angles. Crystal parameters, Weiss and Miller system of notations. Law of Rationality of indices.Crystal growth and twining: Growth of crystals from solutions and from a melt under controlled conditions, crystal growth in open fractures, solution cavities and vesicles.Symmetry elements and description of normal class of Isometric, Tetragonal, Hexagonal, Trigonal, Orthorhombic, Monoclinic and Triclinic systems.Crystal chemistry: Dimorphism, polymorphism, pseudomorphism, isomorphism and solid solution.

Geophysics:- Introduction and scope of geophysics; Spheroidal shape of earth and Geoid, magnetic field of the earth, paleomagnetism. Exploring Earth's interior with geophysical techniques. Applications of geophysics in mineral and energy resources exploration. Earth's thermal history, Heat conduction and heat flow. Gravitational Field, Concept, its variability with latitude, altitude, topography, and subsurface density variations. Gravity instruments: Pendulum gravimeters, Ship borne measurements. Units of gravity, gravity anomaly - definition, types

(Free- air, Bouguer), local and regional concepts. Detection of cavities at engineering sites. Isostasy, Observation; Pratt and Airy schemes of the isostatic compensation, elastic crust on viscous mantle.
Earthquake and Seismic waves, their intensity and magnitude scale. Origin of earthquake.Basic features of seismographs; Magnitude and intensity of an earthquake; Types of earthquakes. Induced seismicity, Neotectonics. Earthquake location: Focus, epicentre and hypocentre; Earthquake belts.

Igneous and Metamorphic Petrology:-Magma nature and cooling behavior, volatiles in silicate melts. Forms of Igneous rocks; textures of igneous rocks; Classificationschemes of igneous rocks; Phase equilibria: Unary, binary and ternary systems.Genesis and tectonic setting of different Magma Types; Application of major andtrace elements (including REE) and Sr-,Pb-, and Nd-isotopes studies in decipheringMagma generation, mantle-crust interactions and tectonic environments.Detailed petrographic description of Granite, Granodiorite, Rhyolite, Syenite, Phonolite, Diorite, Gabbro.

Metamorphism and metamorphic processes, Metamorphic differentiation,Metamorphic facies and systematic description of regional and thermalmetamorphism of pelitic, basic-ultra-basic and calcareous rocks. Metamorphicreactions and their implications to geothermobarometry. Metasomatism andanataxis; Regional metamorphism and paired metamorphic belts in reference toplate tectonics. P-T-t paths.

Ore, Fuel & Exploration Geology:-Processes of the formation of ore deposits; Magmatic, metasomatic, hydrothermal, sedimentary types of depositsPrincipal mechanism of formation of the igneous, sedimentary and metamorphicmineral deposits, weathering and placer deposits. Ore deposits and plate tectonics,Mineral economics and national mineral policy in relation to strategic, critical andessential minerals; Ore Microscopy and quantitative methods in ore microscopy;Microchemical studies of ore minerals, Fluid inclusions in ore.Study of important metallic (Cu, Pb, Zn Mn, Fe, Au, Al) and non-metallic (industrial) minerals (gypsum, magnesite, mica).

Origin and occurrence of petroleum, Migration and accumulation of petroleum,Reservoir rocks and traps. Petroliferous basins of India. Rank and grade of coal;Origin of kerogen and coal. Geological and geographical distribution of coaldeposits in India with emphasis on Gondwana coal fields. Atomic minerals andmode of occurrence of atomic minerals in nature. Atomic minerals as source ofenergy and productive atomic mineral geological horizons in India.

Principles and methodology of geological prospecting for economic minerals androcks, sampling methods, reserve estimation, grade and tonnage calculation of thedeposits. Mining methods. Concept of geochemical dispersion and pathfinderelements, geochemical sampling and geochemical field techniques. Principle,procedure, equipments used and applicability of

gravimetric, Magnetic, electrical,seismic and radiometric geophysical methods, Aeria geophysical surveys.

Tectonic Geomorphology:-Geomorphological cycle, Soils and classification of soils, Morphometric analysis ofdrainage basins, Relationship of morphometric parameters with discharge andsediment yield characters of basins, Morphometric evolution of western Himalayas,Tectonic Geomorphology, Energetics, Active Tectonics & Models of landscapedevelopment; Controversies in tectonic geomorphology. Geomorphic Markers.Landform dating techniques, Geomorphic Expression of Faults; field techniques in paleoseismology, Direct and indirect observations ofpaleoseismic displacements, Paleoseismic landforms, Use of liquefaction inducedfeatures and landslides for paleoseismic analysis. Quaternary cycles of climatechange and their effect on landforms. Geomorphic sub-divisions of Indiansubcontinent and their geomorphic features and evolution with special reference toHimalayas. Landslides, Settlement and subsidence, slope modification andreinforcement, instruments for monitoring slope movements.

Hydrogeology:-Groundwater table and Groundwater table fluctuations and controlling factors.Subsurface inflow and outflow; Periods of recharge and discharge. Averagegroundwater fluctuations, effluent and influent streams. Elementary theory ofgroundwater flow: Darcy's law and its range of validity. Steady and unsteady flow.Porosity and permeability transmissivity, storage coefficient and methods ofdetermination. Water table maps and flow net analysis; differential equation forcontrolling groundwater flow. Steady, unsteady and radial flow into a well.Confined and leaky confined and unconfined aquifers. Determination of aquifercharacterstics from pump-tests. Groundwater exploration resistivity, magnetic andseismic geophysical methods. Borehole geophysical logging-electrical, resistivityand SP; Radiation logging-gamma, gamma-gamma, and neutron logging. Clipper andtemperature logging. Preparation of strata charts, Design of tube well assembly andwater well design criteria . Water level development and yield tests. Groundwatermodeling techniques. Groundwater basin management methods: Basic ideas ofgroundwater management. Water logging and artificial recharge. Fresh andsaltwater relationship in coastal areas. Groundwater quality analysis. Qualitycriteria for drinking, irrigation and industrial purposes. Pollution of groundwater.Groundwater and hydro-chemical provinces of India.

Remote Sensing and GIS:-Concepts of remote sensing, electromagnetic radiations, matter interactions withatmosphere and terrain, reflectance, absorptance and transmittance, spectralreflectance of vegetation, soils minerals and rocks, scattering processes, basicelements of visual image interpretation, principles of image interpretation,verification and validation of RS data. Picture element and image statistics, preprocessingof satellite data: geometrical corrections of satellite data, imageenhancements, types of enchancements, filtering of images, digital imageclassification: Supervised and unsupervised classifications. Sources of errors

andmeasurement of map accuracy, kappa coefficient. Applications of remote sensingearth sciences, environmental sciences, surveying, hydrological modelling, groundwater prospecting,

Geographic Information System (GIS) Components of GIS, GIS software packages,Concept and types of information, integration of spatial and non spatial data, rasterand vector data models, geospatial analysis for disaster management with casestudies on landslides and floods, GIS for environmental applications like lakemanagement and soil mapping.

Engineering & Environmental Geology:-Engineering properties and classification of rocks. Factors affecting engineeringservices of rocks. Engineering properties of soils. Soil liquefaction and creep. Stressdistribution in soil and foundation failure. Geological consideration for evaluationof dams, reservoir and tunnel sites, Foundation evaluation techniques. Influence ofgeological conditions on foundation and design of buildings. Fundamental conceptsof environmental geosciences. General relationship between landscape, climate andbiomass. Geosciences factor in environmental planning. Earth processes andgeological hazards with reference to floods, landslides, earthquakes, volcanism, andavalanches. Cenozoic climate extremes, their impact on evolution of life especiallyon human evolution. Energy resources and environment, Environmental effectsassociated with exploitation of hydrocarbons, coal and atomic minerals. Concept ofhealth geochemistry. Natural chemical anomalies. Radon emission and health.Geological controls on radon emission levels. Radon emission survey. Use ofgeochemical maps in land use planning.