BACHLOR OF SCIENCE (GEOLOGY)
4th SEMESTER
DISCIPLINE SPECIFIC COURSE -4 (CORE-4)
GL421C: GEOLOGY: GEOCHEMISTRY, GEOPHYSICS AND HYDROGEOLOGY

CREDITS: THEORY-4, PRACTICAL-2
MAXIMUM MARKS: THEORY: 60, PRACTICAL: 30
MINIMUM MARKS: THEORY: 24, PRACTICAL: 12

THEORY (4 CREDITS: 60 HOURS)

Objective/Expected learning outcomes:
This course deals with extracting geological information out of geochemical and geophysical datasets. The student will acquire skills to use various geochemical and geophysical methods for exploration and their significance. The geophysical techniques include seismic, gravity, magnetic and electrical resistivity methods and their various applications. The students will gain an understanding of the seismic involved in bringing the earthquakes and their impact on society. Besides, the student will understand the hydrological processes acting on and below the surface of earth.

CREDIT -1 (15 HOURS)

Introduction to geochemistry: Crystal chemistry-chemical bonds, coordination number, radius ratio, ionization potential, electro-negativity, atomic substitution, phase rule. Cosmic abundance of elements. Major element, trace elements and Rare earth elements; Large-ion lithophile elements and High field strength elements. Gold Schmidt's geochemical classification of elements. Geochemical characteristics of crust, mantle and core. Geochronology and age of Earth. Relative and absolute dating techniques for age determination. Radioactivity and concept of half-life, decay constant, natural radioactive isotopes.

CREDIT -2 (15 HOURS)

Introduction and scope of geophysics, Spheroidal shape of earth and Geoid, magnetic field of the earth, palaeomagnetism, 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. Thermal gradient of the earth. Convection currents-evidence and models. 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.

CREDIT -3 (15 HOURS)

Seismology: Earthquake and Seismic waves, effects of seismic waves and damage to structures and natural objects. Basic features of seismographs; Magnitude and intensity of an earthquake. Types of earthquakes: tectonic and volcanic. Induced seismicity, Neotectonics. Elastic rebound theory - statement and geodetic evidence. Earthquake location: Focus, epicenter and hypocenter; Earthquake belts; Focal depth of earthquakes. Earthquake focal mechanisms - how these are obtained. Seismic wave reflection and refraction. Structure of the Earth: Crust, mantle; Outer core, inner core; wave speed and density distribution. Earthquake Prediction: Need, definition, possibility, results; Seismic gap theory.

CREDIT -4 (15 HOURS)

Hydrosphere: Distribution of water: Saline water and fresh water. Forms and origin of water. Surface water (hydrology) and subsurface water (soil water and ground water). Porosity: Primary and secondary: specific yield and specific retention. Aquifer, aquitard, aquiclude, aquifuge. Types of aquifers: unconfined, confined and perched aquifers. Hydraulic conductivity and storativity. Darcy's Law, Understanding the transport and purification of water through Hydrological cycle. Physico-chemical quality of water (pH, EC, Ca, Mg, Na, K, Cl, HCo_3, So_4, No_3).

PRACTICAL (2 CREDITS: 60 HOURS; MAXIMUM MARKS: 30, MINIMUM MARKS: 12)

Seismology: Earthquake location: Focus, epicenter and hypocenter; Earthquake belts on earth.
Hydrogeology: Delineations of hydrological boundaries on water table contour maps and estimation of aquifer properties as hydraulic conductivity. Storage coefficient and Transmissivity.

BOOKS RECOMMENDED:

Albarede, F., 2003: Geochemistry - An Introduction, Cambridge.

Bhimasarikaram V.L.S., (1990) Exploration Geophysics - An Outline by Association of Exploration Geophysicists, Osmania University, Hyderabad.

Dobrin, M B and Savit C H. (1988) Introduction to Geophysical Prospecting, McGraw Hill Inc.

Gunter, F., 1991: Principles and Applications of Inorganic Geochemistry, Prentice Hall.

Karanth, K. R., 1987: Groundwater assessment, Development and Management, MG. Hill.

Lowrie, W., (2007) Fundamentals of Geophysics. Cambridge University Press.

Marshal, C. P. & Fairbridge, R. W., 1999: Encyclopaedia of Geochemistry, Kluwer Acadmic.

Moore M. (1982) Principles of Geochemistry, Wiley.

McCalpin, J. C., 1996. Field techniques in palaeoseismology. Palaeoseismology, Academic Press, London, p. 588. McCalpin, J., 2009. Paleoseismology. Second Edition: San Diego, Academic Press, p. 613.

Parasnis D. S. (1986): Well Logging in Oil Fields, In: Principles of Applied Geophysics, Springer.

Raghunath H.M. (2003) Groundwater, New age education.

Ramachandra Rao and Prasaranga, M B. (1975) Outlines of Geophysical Prospecting - A Manual for Geologists by University of Mysore, Mysore.

Telford, W. M., Geldart, L. P., and Sheriff, R. E., (1990) Applied geophysics (vol. 1). Cambridge University Press. Todd, D. K., 1980: Groundwater Hydrology, John Wiley.

William, L., 1998: Introduction to Geophysics, Cambridge.