

## **501. APPLIED GEOCHEMISTRY**

### **UNIT I**

Structure and composition of the Earth- Internal structure of the earth; composition of the crust; composition of the earth; primary differentiation of the elements; geochemical classification of elements.

Isomorphism, atomic substitution, polymorphism. Isotopes-stable isotopes; oxygen isotopes; sulfur isotopes; carbon isotopes; hydrogen isotopes.

Magmatism and igneous rocks-chemical composition of magmas and igneous rocks; mineralogical composition of igneous rocks; crystallization of magma; minor, trace & Rare earth elements in magmatic crystallization; volatile components of a magma.

Sedimentation and sedimentary rocks- sedimentation as a geochemical process; soil geochemistry; chemical composition of sedimentary rocks; mineralogical composition of sedimentary rocks; physico-chemical factors in sedimentation; ionic potential; hydrogen ion concentration; oxidation-reduction potentials; colloids and colloidal processes; products of sedimentation.

Metamorphism as a Geochemical process- chemical composition of metamorphic rocks; mineralogy of metamorphic rocks; stability of minerals; thermodynamics of metamorphism; kinetics of metamorphism; metamorphism and phase rule; Facies principle; metasomatism in metamorphism; ultrametamorphism.

### **UNIT II**

Geochemical Exploration concepts - terminology and their definitions in geochemical exploration. Background, threshold, anomaly. Primary and secondary environments and dispersion, additive, leakage and diffused halos. Zoning, mobility, migration, indicator, pathfinder elements and minerals.

Geochemical Exploration methods - conceptual models, lithogeochemical, pedogeochemical, hydrogeochemical, biogeochemical and atmogeochemical methods

Definitions of ore, gangue, tenor, grade, specifications. Geochemistry of mineral deposits: Sedimentary affiliation - banded iron deposits, manganese deposits, igneous habitat - gold, diamondiferous kimberlites. Metamorphic affiliation - asbestos formation, talc-soap stone formations.

Petroleum Geochemistry: Source rocks, Kerogen types. carbon cycle, trace element cycles, organic geochemistry of fresh-water and soils, organic geochemistry of sea water and marine sediments, coal and petroleum.

### **UNIT III**

The hydrological cycle, inter relationship of surface and ground water. Physico-chemical properties of water and its structure and bonding. Solution and solubility.

Geochemistry and water quality, measures of water quality, chemical analysis, Water quality criteria, factors influencing ground water quality.

Assessment of metal pollution in soils, sources and types of metal pollution. Bioremediation, Types of bioremediation, bioindicators. acid rain, green house effect, ozone layer, CFCs.

Principles of remote sensing – Application of remote sensing techniques for geological and geochemical studies, General application of satellite data for lithological, geomorphological and structural mapping.

### **UNIT IV**

Precision and accuracy, detection limits, contamination effects, standard solutions, classical and rapid methods of analysis; rock dissolution techniques, acid attack, rock dissolution procedures, fusion with alkali salts. Classical methods of rock analysis.

Principles of optical spectroscopy, monochromator, optical filters, photon detectors.

Geochemical Analytical Instruments: Flame photo meter, Inductively coupled plasma methods (ICP-ES) and (ICP-MS), X-ray Fluorescence analysis (XRF), X-ray diffraction methods (XRD), Atomic absorption spectrophotometer (AAS), Neutron activation analysis (NAA), Ion selective electrodes.

### **Reference Books:**

Brain Mason, Carleton B. Moore (1982): Principles of Geochemistry, 4<sup>th</sup> edition, John Wiley and Sons

Konard B. Krauskopf (1979): Introduction to Geochemistry, 2<sup>nd</sup> edition. Mc Graw Hill publication

James I. Drever (1982): The Geochemistry of natural waters, Prentice Hall Inc.

David Keith Todd, (1980): Ground water Hydrology. 2<sup>nd</sup> edition, John Wiley and sons

Arthur H. Brownlow (1979): Geochemistry. Prentice Hall Inc.

U. Ashwathanarayan, (1985): Principles of Nuclear Geology, Oxonian Press.

Potts, P.J. (1996): A handbook of silicate a rock analysis. Blackie Academic & Professional (An imprint of Chapman and Hall)

Chris Riddle (Ed) (1993): Analysis of Geological Materials. Marcel Dekker, Inc., New York

Philpotts, A.R., 1994, Principles of Igneous and Metamorphic Petrology, Prentice Hall of India Private Limited.

Best, M.G., 1986, Igneous and Metamorphic Petrology, CBS Publishers and distributors, New Delhi

Faure Gunter, (1992): Principles and applications of Inorganic Geochemistry, Macmillan Pub.

Badgley.P.C., 1998: Structure and Tectonics. Harper and Row

Drury.S.A., 2002: Image Interpretations in Geology. Allen and Unwin.

Iain Thornton, (1983): Applied Environmental Geochemistry, Academic press

Iain Thornton, (1986): Applied Geochemistry in 1980's. Graham and Trotman limited.

David K. Todd, (1980): Ground Water Hydrology, 2nd edition. John Wiley & Sons.

B.K.Sharma & H.Kaur (1997) Environmental Chemistry- Goel pub. House, Meerut