Subject Code : P8AG10

IGNEOUS PETROLOGY

UNIT-1:

Igneous activity at the present day – Magma types and their evolution at: The Ocean Floor, Island Arcs, Orogenic Continental Margins, Intracontinental Orogenic Belts, and other Continental provinces. Nature and Physical properties of Magmas. Forms and structures of intrusive and extrusive igneous rocks. Textures of Igneous Rocks - their evolution and petrogenetic significance.

UNIT-2:

Classification of Igneous Rocks: CIPW Norm, Niggli Values and Basis, IUGS – Streckeisen's Plutonic and Volcanic rocks classifications. Peacock's Alkali Lime Index and Classification based on Irvine and Baragar. Petrography and Petrogenesis of: Granite – Rhyolite Clan, Syenite – Trachyte Clan, Gabbro – Basalt Clan, Alkaline rocks, Anorthosites, Lamprophyres, Kimberlites, Komatiites, Carbonatites and Charnockite.

UNIT-3:

Introduction to principles and laws of thermodynamics. Gibb's Phase rule and its application to igneous petrogenesis. Derivation and application of Lever Rule. Crystallization of Unicomponent magma. Simple Eutectic (Albite-Silica), Solid Solution (Forsterite-Fayalite) and incongruent melting (Forsterite-Silica) behavior of Bicomponent melts. Ternary melt-systems of Diopside – Forsterite – Silica, Diopside- Albite – Anorthite and Anorthite – Forsterite – Silica. Effects of pressure, fluids and vapors (H_2O and CO_2) on melting and cooling behavior of silicate systems. Crystallisation of Basaltic magma.

UNIT-4:

Magmatic Differentiation - Liquid immiscibility, Soret effect, Role of volatile components, Fractional Crystallization, Assimilation and Magma mixing - and their roles in magmatic differentiation. Field and laboratory evidences in favor and against the 'Reaction Principles' of Bowen and Osborn. Petrographic provinces of magmatic rocks. The diversity of magmatic rocks, their abundance and distribution on the earth's Crust.

UNIT-5:

Chemical petrology: Brief outline of Analytical methods of igneous rocks using Flame photometers, AAS, XRF, ICP and Wet chemical methods. Distribution and behavior of major-oxide elements in rocks. Application of Bivariate (Harker Diagram) and Triangular (AFM Diagram) variation diagrams. REE and Trace elemental distribution in rocks and their application to igneous systems. Isotopes, and their geochemical criteria for discriminating between tectonic environments magmatic systems..

Text Books:

1. Tyrrell. G.W.(1963)- Principles of Petrology – Asia Publishing House.
2. Turner.F.J and Verhoogen.J –1960.- Igneous and Metamorphic petrology – McGraw Hill.
3. MacKenzie.W.S. et.al.,-(1982); Atlas of Igneous rocks and their textures – Longman.
4. Bowen.N.L.(1928)- The evolution of the Igneous Rocks. Dover Publications.
5. Middlemost. A.K.(1985) – Magmas and Magmatic Rocks.- LONGMAN.
6. McBirney.A.R.(1994) – Igneous Petrology – CBS Publishers and Distributors.
7. Raymond.L.A.-2002- Petrology – McGraw Hill.
8. Hall- A (1992) – Igneous Petrology – ELBS.
9. Barth, F.W. – 1962 – Theoretical Petrology, Wiley.

References:

1. Shand –S.H.(1949)- Eruptive Rocks.
2. Morse.S.A – (1980)- Basalts and Phase diagrams –Springer – Verlag.
3. Winter. J.D.- (2001) – Igneous and Metamorphic Petrology –Prentice Hall.