

SEMESTER 2nd
MAJOR COURSE
GLY222J: GEOLOGY (CRYSTALLOGRAPHY AND PETROLOGY)

CREDITS: (4+2)

Objective/Expected learning outcomes:

The course will help the students to exhibit an improved understanding of crystallography and fundamental petrologic processes and common rock types. The students will gain an understanding of the processes involved in the formation of igneous and metamorphic rocks, their textures, structures, classifications and their importance. The students will also learn to identify, describe and classify rocks using hand specimens and under petrological microscope.

THEORY (4 CREDITS)

UNIT-1

Crystallography: Introduction, and Morphology of crystals: Face, edge and solid angle, interfacial angle and Law of constancy of interfacial angles. Description of Laws governing the crystallography. A brief idea of Symmetry and Lattice: Bravais Lattices, symmetry operations, Crystal Systems, crystal forms, crystal classes. Axial system and axial ratios. Parameter system of Weiss, Miller indices. Law of Rationality of indices. Translation vectors, planar and space lattices. Crystal growth and twinning: Growth of crystals from melt and solutions, and twinning in crystals: Types, causes and laws, Normal class of crystal systems. Crystal forms: Crystallized, crystalline, cryptocrystalline and amorphous. Crystal habit: elongated, tabular, flattened and equant. Description of form of crystalline and cryptocrystalline aggregates. Crystal chemistry: Dimorphism, polymorphism, pseudomorphism, isomorphism and solid solution.

UNIT-2

Nature and scope of petrology: Difference between Petrography and petrogenesis. 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, ophitic, intersertal and intergranular texture, directive textures, intergrowth textures. Reaction textures. Reaction structures – corona and kelyphitic borders.

UNIT-3

Classification of igneous rocks: Principles of classification, CIPW classifications, IUGS classification and tabular classification. Nomenclature and description of common igneous rocks Composition and constitution of magma: Definition of magma, composition of magma, types of magma, physico-chemical constitution of magma, primary magma. Processes resulting in diversity in igneous rocks: Fractionation and differentiation– Gravity settling, filter-press differentiation, flow diffusion and gaseous transfer within magma; liquid immiscibility, mixing of magmas. Assimilation.

UNIT-4

Metamorphic rocks: Definition 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.

PRACTICAL (2 CREDITS)

UNIT-5

Crystallography: Demonstration of space lattice, model-Galena, Fluorite, Sphalerite, Pyrite and Calcite. Clinographic projection of the following crystals form: Cube, Octahedron, Zircon, Beryl, Calcite and Gypsum.

UNIT-6

Igneous & Metamorphic Petrology: Study in hand specimen and under microscope of the mineral composition, textures and structures of important igneous and metamorphic rocks as included in theory paper.

SUGGESTED READINGS:

- Berry & Mason, 1988: Mineralogy. CBS Pub. Best, M. G., 1986: Igneous Petrology, CBS Pub.
Blatt H.& Tracy R.J. 1995. Petrology: Igneous, Sedimentary & Metamorphic. WHF & Co, New York.
Bose, M. K., 1997: Igneous Petrology. World Press.
Ehlers and Blatt, 1999: Petrology, (Igneous, Sedimentary and Metamorphic). CBS Pub. JAK Tareen & TRN
Kutty, 2001: Crystallography. Universities Press (India) Limited.
Kerr, P. F., 1977: Optical Mineralogy. McGraw Hill.
McBirney, A. R., 1993: Igneous Petrology. John Wiley.
Miyashiro, A., 1994: Metamorphic Petrology. UCL Press Ltd., London. Phillips, Wm, R. and Griffen, D.T.,
1986: Optical Mineralogy. CBS Edition. Philpotts, A., 1992: Igneous and Metamorphic Petrology. Prentice
Hall.
Putnis, A., 2001: Introduction to mineral Science. Cambridge University Press. Richard, V. G., 1997: Dana's
new Mineralogy. John Wiley.
Turner & Verhoogen, 1999: Igneous and Metamorphic Petrology. CBS Pub. Turner, F. J., 1980:
Metamorphic Petrology. McGraw Hill, New York. Tyrrell, G. W., 1987: Principles of Petrology. CBS Pub
Winter, J.D. 2010. Igneous and Metamorphic Petrology.
Yardley, B. W., 1989: An Introduction to Metamorphic Petrology. Longman, New York.