

U.G. 2nd Semester

Paper: GLY201C (Core) Mineralogy

Credits: 5 = 4+0+1 (64 Lectures)

Total Number of Theory classes (*Lectures*) : 64 (64 hours)

Total Number of Practical classes (*Practicals*) : 16 (32 hours)

THEORY

Mineralogy : *Number of Lectures: 64*

Scope of Mineralogy: Definition of mineral; Physical properties of mineral; Relationship of physical properties with atomic structure; Mineral Classification; Structure of silicate minerals.

Study of physical & optical properties, atomic structure and chemistry of the following groups of mineral – Olivine, Garnet, Epidote, Pyroxene, Amphibole, Mica, Clay minerals, Silica, Feldspar and Feldspathoid.

Study of the following individual minerals – Sillimanite, Kyanite, Andalusite, Staurolite, Apatite, Chlorite, Zircon, Beryl, Calcite, Tourmaline, Magnetite, Ilmenite, Hematite, Sphene, and Rutile.

PRACTICAL *Number of Practical: 16*

Study of the distinguishing characters and physical properties of the important silicate minerals and carbonate minerals (Calcite & Dolomite) in hand specimen.

Recommended Books:

1. Mineral Science – Cornelis Klein, *John Wiley and Sons*.
2. Mineralogy – Dexter Perkins, *Pearson*.
3. Manual of Mineralogy – C. Klein and C. S. Hurlbut, *Wiley*.

Paper: GLY202C (Core) Geochemistry and Optical Mineralogy

Credits: 5=4+0+1 (64 Lectures)

Total Number of Theory classes (*Lectures*) : 64 (64 hours)

Total Number of Practical classes (*Practicals*) : 16 (32 hours)

THEORY

Geochemistry : *Number of Lectures: 20*

Cosmic abundance of elements; Chemical differentiation of the earth; Composition of crust, mantle and core of the earth; Composition of seawater; Composition and evolution of atmosphere; Composition of meteorites and lunar rocks; Geochemical classification of elements; Geochemical cycle.

Concept of partition coefficient, camouflage, capture and admittance; Preliminary idea on major, trace and rare earth elements.

Radiogenic and non-radiogenic isotopes & their applications in earth science.

Optical Mineralogy : Number of Lectures: 44

Scope & utility of optical mineralogy; Reflection and refraction of rays; Refractive index; Dispersion of light; Polarization of light (*plane or linear polarization, circular polarization & elliptical polarization*); Polarizer; Linear or plane polarization by doubly refracting crystals (*Nicol prism*), by differential absorption (*Polaroid*) and by reflection (*Brewster's Law*); Isotropic and anisotropic media.

Isotropic and Anisotropic (Uniaxial positive & negative and Biaxial positive & negative) minerals; Optic axis; Optical Indicatrix : Isotropic, Uniaxial & Biaxial indicatrices, their configuration and different sections within these indicatrices.

Opaque and non-opaque minerals; Petrological (refraction or transmitted-light) and Ore (reflection-light) microscope and their configuration; Orthoscopic and conoscopic arrangement of Petrological microscope; Accessory plates (*Mica Plate, Gypsum Plate & Quartz Wedge*) & their uses.

Properties of minerals in thin section : Colour; Pleochroism; Determination of pleochroic scheme; Relief; Shape or Form; Cleavage; Fracture; Double refraction; Birefringence;

Determination of refractive index of minerals [*Liquid immersion method, Central illumination method (Becke Test) & Oblique illumination method*]; Extinction positions; Extinction angle (*straight or parallel, oblique & symmetrical extinction*); Interference colour & its determination; Determination of vibration direction.

Different types of Uniaxial and Biaxial Interference figures; Determination of optic sign; Measurement of optic axial angle.

Distinguishing Optical Characters of Some Important Non-opaque minerals: Garnet group (*Garnet*); Olivine group (*Olivine*); Aluminosilicate group (*Sillimanite, Kyanite, Andalusite*); *Serpentine; Staurolite*; Pyroxene group (*Enstatite, Hypersthene, Augite, Diopside*); Amphibole group (*Actinolite, Hornblende*); Mica group (*Biotite, Muscovite*); Feldspar group [*Orthoclase, Microcline, Plagioclase (Albite to Anorthite)*]; Feldspathoid group (*Nephelene, Leucite*) and Silica group (*Quartz*); Carbonate minerals (*Calcite, Dolomite*).

PRACTICAL Number of Practicals: 16

Optical Mineralogy :

Study & Identification of the following minerals in thin section under Petrological Microscope :

Minerals with high to moderate relief: Garnet group (***Garnet***); Olivine group (***Olivine***); Alumino-silicate group (***Sillimanite, Kyanite, Andalusite***); ***Serpentine; Staurolite***; Pyroxene group (***Enstatite, Hypersthene, Augite, Diopside***); Amphibole group (***Actinolite, Hornblende***); Mica group (***Biotite, Muscovite***).

Minerals with low relief: Feldspar group (***Orthoclase, Microcline, Plagioclase***); Feldspathoid group (***Nephelene, Leucite***) and Silica group (***Quartz***).

Minerals with variable relief : Carbonate minerals (***Calcite, Dolomite***).

Comparison of the refractive index of mineral in thin section with the help of central illumination method (Becke Test).

Determination of the composition of plagioclase by Michael-Levy method.

Study under Petrological Microscope of uniaxial and biaxial interference figures and their recognition. Determination of optic sign from centered & off-centered uniaxial interference figures and centered acute bisectrix & centered optic axis biaxial interference figures by the use of accessory plates.

Recommended Books:

1. Chemical Fundamentals of Geology and Environmental Geoscience - Robin Gill (2015); *John Wiley & Sons Ltd.*
2. Early Earth Systems: A Geochemical Approach - Hugh R. Rollinson (2007); *Blackwell Publishing Ltd.*
3. Using Geochemical Data: Evaluation, Presentation and Interpretation - Hugh R. Rollinson (1993); *Pearson Prentice Hall.*
4. Geochemistry- Introduction - Albarde Francis (2003); *Cambridge University Press.*
5. Introduction to Geochemistry: Principles and Applications - Kula C Misra (2012); *Wiley-Blackwell..*
6. Optical Mineralogy: Principles and Practice – Colin D. Gribble and Allan J. Hall, *George Allen and Unwin, 1985.*
7. Optical Mineralogy – P.F.Kerr; *McGraw-Hill Book Company, INC.*
8. Fundamentals of Optical, Spectroscopic and X-ray Mineralogy – S.Mitra; *New Age International Publishers.*
9. Optical Mineralogy: The Nonopaque Minerals – W.R.Phillips and D.T.Griffen; *CBS Publishers and Distributors.*
10. Optical Crystallography – E.E.Wahlstrom; *John Wiley and Sons, Inc.*
11. An Introduction to the Rock-Forming Minerals – W.A.Deer, R.A.Howie and J.Zussman; *ELBS Publishers with Longman.*

**Paper: GLY203G (General Elective)
General Geology and Structural Geology**

Credits: 4 = 3+0+1 (48 Lectures)

Total Number of Theory classes (*Lectures*) : 48 (48 hours)

Total Number of Practical classes (*Practicals*) : 16 (32 hours)

THEORY

General Geology : Number of Lectures: 24

Introduction to geology, its subdivisions and relation to other branches of science. Origin and age of the earth. Earth as a planet. Interior of the earth and use of seismic waves in its study. Standard stratigraphic time scale.

The three rock types – igneous, sedimentary and metamorphic rocks and their distinguishing characters. Major surface features of the earth: continents and ocean basins. Introduction to rock weathering.

Volcanism and volcanoes; types and world distribution of volcanoes. Earthquakes: causes of earthquakes, earthquake belts, earthquake zones of India, prediction of earthquakes. Geological actions of river, wind, glacier and their associated landforms.

Structural Geology : Number of Lectures: 24

Definition & scope of Structural Geology; Primary and secondary structures.

Concept of non-diastrophic and diastrophic structures; Non-diastrophic structures: stratification, current or cross bedding, graded bedding, ripple marks, unconformities, mud cracks & rain prints, flow layers, primary joints, vesicular & amygdaloidal structures and pillow structure.

Concept of Stress and Strain, Elasticity, Plasticity & Brittleness.

Diastrophic structures: Planar & linear structures; Strike direction, dip angle, dip direction.

Basic concepts of Lineation, Foliation, Fold, Fault and Joints: their geometry and classification.

PRACTICAL Number of Practicals : 16**Structural Geology :**

Study of contour line, pattern of contour line to indicate various topographical features and structure of contours on toposheets.

Maps: Interpretation of topographic maps. Drawing of profile and study of geomorphological features from contoured maps.

Determination of dip and strike from borehole data. Solution of three point problems. Interpretation of structures from geological maps with simple structures. Drawing of cross-section.

Recommended Books:

1. Physical Geology – R.F. Flint and B.J. Skinner, *John Wiley and Sons, Inc*
2. Textbook of Geology- G. B. Mahapatra, *CBS Publishers*
3. Principles of Engineering Geology- K. M. Bangar, *Standard Publishers*
4. Foundations of Structural Geology – R.G. Park; *Routledge*.
5. An outline of Structural Geology – B.E. Hobbs, W.D. Means and P.F. Williams; *John Wiley and Sons Inc.*
6. Structural Geology of Rocks and Regions – G.H. Davis, S.J. Reynolds and C.F. Cluth; *John Wiley and Sons, Inc.*
7. Structural Geology – M.P. Billings, *Pearson College*.