INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

1. **Name of the Academic Unit: Geology and Geophysics**

2. **Subject Name: Mineralogy** **L-T-P: 3-0-0** **Credits: 3**

3. **Pre-requisites: None**

4. **Syllabus and reference books:**

Syllabus: Introduction to Mineralogy; Crystallography: Translational and Point Symmetry, 32 Point Groups and Crystal Systems, Two and Three Dimensional Space Groups, Planes and Directions in a Crystal, Miller Indices, Crystal Forms; Stereographic Projections; Optical Mineralogy: Polarised Light, Crystal Anisotropy, Uniaxial and Biaxial Minerals, Optical Indicatrix, Birefringence, Pleochroism, Extinction Angle and Sign of Elongation, Interference Figures, Optic Sign; Mineralogy: Introduction and basic concepts; Elements, Different types of Bonding, Crystal Structures and Ionic Radii, Application of Pauling's Rules, Isostructural Minerals, Polymorphism; Energetics and Mineral Stability: Solid Solutions, Exsolutions and Ordering; Crystal Growth and Defects: Point, Line and Planar Defects, Twinning; X ray Diffraction Technique (XRD), Electron beam technique, Calculation of Mineral Formulas; Classification, Structure, Chemistry and Paragenesis of selected Neso-, Cyclo-, Soro-, Ino-, Phyllo- and Tecto-silicates and a few non-silicates (Spinel Group, carbonates and phosphates).

Reference Books:

1) Crystallography and Crystal Chemistry by F.D. Bloss; 1971
2) Introduction to Mineralogy by William D Nesse; 2017; Oxford University Press
3) Optical Crystallography by E. E. Wahlstrom; 1951; 2nd Edition; John Wiley and Sons (London: Chapman and Hall); republished by Cambridge University Press in 2009
4) Minerals: Their Constitution and Origin by H-R Wenk & A. Bulakh; 2004; Cambridge University Press.
5) An Introduction to Mineral Sciences by A. Putnis; 1992; Cambridge University Press.
6) Earth Materials: Introduction to Mineralogy and Petrology by C. Klein & A. Philpotts
7) GUIDE TO THIN SECTION MICROSCOPY by MICHAEL M. RAITH, PETER RAASE & JÜRGEN REINHARDT; 2012.
8) An Introduction to the Rock-Forming Minerals by W.A. Deer, R.A. Howie, J. Zussman.
9) Mineralogy by Dexter Perkins, University of North Dakota; 2020; https://opengeology.org/Mineralogy/5-optical-mineralogy/ (Mineralogy & Optical Mineralogy)
10) The 23rd edition of the Manual of Mineral Science (4th Edition) by Klein, C., and Butrow, B., 2008, John Wiley and Sons.
11) Mineralogy and Optical Mineralogy by Dyar, M. D., Gunter, M. E., Tasa, D., 2019, Mineralogical Society of America.

5. **Lecture-wise break-up:**

Sl. No.	Topic	No. of lectures
1.	Introduction to Mineralogy; Crystallography: Translational and Point Symmetry	**2 hrs**
2.	***Crystallography:*** Symmetry elements and their geometric relationships; 32 Point Groups and Crystal Systems	**5 hrs**
3.	***Crystallography:*** Two and Three Dimensional Space Groups, Planes and Directions in a Crystal, Miller Indices, Crystal Forms; Stereographic Projections	**5 hrs**
4.	***Optical Mineralogy:*** Polarised Light, Crystal Anisotropy, Uniaxial and Biaxial Minerals, Optical Indicatrix, Birefringence	**5 hrs**
5.	***Optical Mineralogy:*** Pleochroism, Extinction Angle and Sign of Elongation, Interference Figures, Optic Sign	**5 hrs**
6.	***Mineralogy:*** Introduction and basic concepts	**3 hrs**
7.	***Mineralogy:*** *Crystal chemistry* - Different types of Bonding, Crystal structures and Ionic radii, Application of Pauling's Rules, Polymorphism, Energetics and mineral stability, Solid solution, Exsolution and Ordering, Twinning, Crystal growth and defects	**6 hrs**
8.	***Mineralogy:*** Analytical mineralogy – X-Ray Diffraction Technique (XRD), Electron beam technique, Electron Probe Micro-Analyser (EPMA), Mineral formula calculations	**4 hrs**
9.	***Mineralogy:*** Systematic description of minerals – Classification, structure, chemistry and paragenesis of Neso-, Cyclo-, Soro-, Ino-, Phyllo- and Tecto-silicates and a few non-silicates	**8 hrs**
	Total number of hours	**43 hrs**