DISCIPLINE SPECIFIC CORE COURSE – 2 (DSC-2) : Mineral Science

Credit distribution, Eligibility and Prerequisites of the Course

Course t itle & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite o f the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Mineral Science	**4**	**3**	**0**	**1**	**B.Sc. Hons. Geology students only**	**NIL**

Learning Objectives

Major objectives for this course are to understand:

1. the characteristics of major mineral groups in hand specimen and thin section
2. phase equilibria, formation environments and associations of rock-forming minerals
3. crystal symmetry, crystallography, and atomic structure

Learning outcomes

At the end of this course, you will be able to:

1. identify common rock-forming minerals in hand specimens and in thin sections using diagnostic physical, optical, and chemical properties.
2. infer something about the formation environment of a silicate mineral using only its formula;
3. read a phase diagram;
4. predict the physical properties of a substance from its symmetry content;
5. plot crystal faces on a stereo projection

SYLLABUS OF DSC- 2

Unit 1: Chemical and Physical Fundamentals

- Importance of minerals, the definition of a mineral, atoms, ions, periodic table, bonding in minerals, compositional variations in minerals. **(6 Hours)**
- Crystallization, crystal imperfections (defects, zoning, twinning), crystal precipitation, mineral classification schemes, and physical properties of minerals (appearance, crystal shape, strength, density, magnetism, reaction with acid). **(6 Hours)**
- Polarized light, refractive index, uniaxial and biaxial indicatrixes, interference figures. **(3 Hours)**

Unit 2: Rock-forming minerals

- Igneous minerals (silicates), phase relations **(6 Hours)**
- Sedimentary minerals (zeolites, clays, sulfates, halides, oxides, carbonates), weathering processes. **(6 Hours)**
- Metamorphic minerals, textures, reactions, phase equilibria. **(3 Hours)**

- Economic minerals (magmatic, hydrothermal, and sedimentary ores; native metals, sulfides and sulfosalts, oxides and hydroxides, gemstones) (**3 Hours)**

Unit 3: Symmetry, Crystallography, and Atomic Structure

- Symmetry, stereo diagrams, forms and crystal morphology. **(3 Hours)**

- Unit cells and lattices in two dimensions and three dimensions, Bravais lattices, unit cell symmetry and crystal symmetry, crystal structures, crystal habit and crystal faces. **(6 Hours)**
- Ionic radii, coordination number, packing, Pauling's rules, silicate structures, substitutions, structures of non-silicates. **(3 Hours)**

Practical:

1. Study of physical properties of minerals in hand specimen
   Silicates: Olivine, Garnet, Kyanite, Staurolite, Tourmaline, Serpentine, Talc, Muscovite, Biotite, Quartz, Orthoclase, Plagioclase, Microcline, Nepheline, Sodalite. Quartz varieties: Chert, Flint, Chalcedony, Agate, Jasper, Amethyst, Rosequartz, Smoky quartz, Rock crystal. Native Metals/non-metals, Sulfides, Oxides-Copper, Sulfur, Graphite, Pyrite, Corundum, Magnetite Hydroxides, Halides, Carbonates, Sulfates, Phosphates: Psilomelane, Fluorite, Calcite, Malachite, Gypsum, Apatite.
2. Study of some key silicate minerals under an optical microscope and their characteristic properties.
3. Mineral stochiometry related numerical.
4. Numericals related to parameters and indices of crystals faces.
5. Stereographic projection of crystal faces.

Essential readings

- Cornelis Klein and Barbara Dutrow, The manual of Mineral Science, Wiley Publication 2007
- Nesse W. D., Introduction to Optical mineralogy.2008, Oxford University Press.
- Deer W. A., Howie.R. A. and Zussman, J., An introduction to the rock-forming minerals 1992

Suggestive readings

1. Cornelis Klein and Barbara Dutrow, The manual of Mineral Science, Wiley Publication 2007
2. Nesse W. D., Introduction to Optical mineralogy.2008, Oxford University Press.
3. Deer W. A., Howie.R. A. and Zussman, J., An introduction to the rock-forming minerals 1992