

Credit distribution, Eligibility and Prerequisites of the Course

DISCIPLINE SPECIFIC CORE COURSE (DSC-2) : Mineral Science (L3, P1)

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
DSC-2 Mineral Science (L3, P1)	4	3	0	1	12th pass with science	-

Learning Objectives

The course on mineral science is to provide students fundamental knowledge and understanding about the characteristics of major mineral groups in hand specimen and thin section, phase equilibria, formation environments and associations of rock-forming minerals, crystal symmetry, crystallography, and atomic structure.

Learning outcomes

After successful completion of this course, students will develop the key understanding and knowledge to identify common rock-forming minerals in hand specimens and in thin sections using diagnostic physical, optical, and chemical properties, infer something about the formation environment of a silicate mineral using only its formula, read a phase diagram, predict the physical properties of a substance from its symmetry content, and plot crystal faces on a stereo projection.

SYLLABUS OF DSC- 2

Credits 4

Theory 45 hours

Unit 1:

(9 hours)

Detailed content

Chemical and Physical Fundamentals: Importance of minerals, the definition of a mineral, atoms, ions, periodic table, bonding in minerals, compositional variations in minerals. 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).

Unit 2:

(9 hours)

Detailed Content

Optical mineralogy: Polarized light, refractive index, uniaxial and biaxial indicatrices, interference figures.

Unit 3

(9 hours)

Detailed content

Rock-forming minerals: Igneous minerals (silicates), phase relations. Sedimentary minerals (zeolites, clays, sulfates, halides, oxides, carbonates), weathering processes.

Unit 4:

(9 hours)

Detailed Content

Metamorphic and Economic minerals: Metamorphic minerals, textures, reactions, phase equilibria. Economic minerals (magmatic, hydrothermal, and sedimentary ores; native metals, sulfides and sulfosalts, oxides and hydroxides, gemstones)

Unit 5:**(9 hours)****Detailed Content**

Symmetry, Crystallography, and Atomic Structure: Symmetry, stereo diagrams, forms and crystal morphology. 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. Ionic radii, coordination number, packing, Pauling's rules, silicate structures, substitutions, structures of non-silicates.

Practical (30 hours)

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.

Study of some key silicate minerals under an optical microscope and their characteristic properties.

Mineral stoichiometry related numerical.

Numericals related to parameters and indices of crystals faces.

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

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