

DISCIPLINE SPECIFIC CORE COURSE– (DSC-9): Metamorphic Geology (L3, P1)

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
(DSC-9) Metamorphic Geology (L3, P1)	4	3	0	1	12th pass with science	Studied Earth System Science, Structural Geology, and Mineralogy or Equivalent

Learning Objectives

Focuses of the course on metamorphic geology is to provide students scientific knowledge and understanding about mineralogical and textural transformations in solid state. The main aim of the course is to motivate them to appreciate and learn about the natural state variables at the time of transformation as well as inferring the geodynamic settings of such changes.

Learning outcomes

After completing the course students will acquire knowledge about changes that occur within the minerals and in the rocks in response to changing physical and chemical conditions in the Earth. Using hand-specimen and microscopic studies, they will be able to identify different structures and textures that develop in the rock due to changing geological processes. Students will learn about the basic concepts of phase equilibrium and how they can be correlated with the fundamental concepts of thermodynamics. Students will be able to apply the concepts of the chemical equilibrium to retrieve the physical conditions of the formation of the rocks. After completing the course students will be able to correlate the textural and phase equilibrium concepts to comprehend the different mountain-building processes that shaped the Earth.

SYLLABUS OF DSC-9

Credit-4

Theory (45 hours),

UNIT – I (9 hours)

Detailed contents

Metamorphism: Definition of metamorphism. Factors controlling metamorphism, Types of metamorphism. Structure and textures of metamorphic rocks, Relationship between metamorphism and deformation

UNIT – II (12 hours)

Detailed contents

Phase rule: Phase rule and Goldschmidt mineralogical phase rule. Chemographic projections, concept of compatible and incompatible assemblages, bulk composition influence on metamorphic assemblages.

UNIT – III (12 hours)

Detailed contents

Metamorphic reaction and minerals: Metamorphic zones, index minerals and isograds. Continuous and discontinuous reactions, basics of geothermobarometry.

UNIT – IV (12 hours)

Detailed contents

Metamorphism and tectonic settings: Metamorphism of various protoliths, metamorphic rock associations-schists, gneisses, charnockites and eclogites. Melting and migmatites.

Tectonic setting of metamorphic rocks, paired metamorphic belts, concept of P-T-t path.

Practical Component- (30 Hours)

Hand specimen study of metamorphic rocks.

Textural and mineralogical study of metamorphic rocks in thin sections.

Inferring mineral growth versus deformation in metamorphic rocks

Graphical plots of metamorphic mineral assemblages using chemographic projections.

Application of mineral formula calculations in metamorphic rocks

Essential/recommended readings

Winter, J. D. (2014). Principles of igneous and metamorphic petrology, Pearson.

Yardley, Bruce, and Clare Warren. (2021). An introduction to metamorphic petrology. Cambridge University Press.

Suggestive readings

Winter, J. D. (2014). Principles of igneous and metamorphic petrology, Pearson.

Yardley, Bruce, and Clare Warren. (2021). An introduction to metamorphic petrology. Cambridge University Press.

Philpotts, A. R., and Ague, J. J. (2022). Principles of igneous and metamorphic petrology. Cambridge University Press.

Metamorphic Phase Equilibria And Pressure-Temperature-Time-Paths

Frank S. Spear (reprinted 1995)