

Group A: (Igneous Petrology)

Unit I: Introduction:

Pressure and temperature domains of igneous processes. Physical properties of magma- temperature, volatile content, viscosity and density. Role of volatile in magmatic crystallization. Processes of magma formation and sources of magma. Salient features controlling ascent of magma. Preliminary ideas on distribution of igneous rocks in continental crust and oceanic crust. Concept of equilibrium and phase rule, Bi-variant field, univariant curve and invariant point. Studies on crystallization of melts in the following systems with particular reference to phase rule: Diopside-Anorthite, Albite-Anorthite, Nepheline-Quartz, Diopside-Albite-Anorthite, and petrogenetic application of these systems.

Unit II: Mineralogy and petrogenesis:

Origin of some common textures: Porphyritic, ophitic, perthite, spinifex.

Mineralogical and textural features of the following rocks: Lamprophyre, kimberlite, nepheline-syenite, tonalite, basalt, pyroxenite and peridotite. Petrogenesis of the following rocks with their distribution in India: Granite, basalt, anorthosite, peridotite, alkaline rocks.

Group B: (Sedimentary and Metamorphic Petrology)

Unit III: Sedimentary Petrology

Elementary ideas on hydraulics of open channel flows. Scalar and vector properties of sediments.

Sedimentary facies: Definition, litho- and bio- facies, Walther's law. Salient features of environments of deposition.

Statistical analysis of grain size data: Mean, median, mode, standard deviation, skewness and kurtosis.. Heavy minerals and provenance.

General petrography of evaporites and volcanoclastics.

Unit IV: Metamorphic Petrology:

Types of metamorphic changes: Mineralogical, textural and chemical. Pressure – temperature limits of metamorphism.

Elementary ideas on processes of solid-state transformation: Recrystallization and neo-crystallization.

Mineralogical assemblage and textures of the following rocks: Mylonite, migmatite, calc-silicate rocks, eclogite.

Metamorphic grade and zones, isograd and iso-reaction grad.

Metamorphic facies: Facies classification, P-T fields of different metamorphic facies.

Criteria for equilibrium and disequilibrium, phase rule and its application.

Regional metamorphism of pelitic rocks, mafic rocks and contact metamorphism of impure limestone.

Brief idea of retrograde metamorphism and metamorphic differentiation.

Reading Lists:

1. Best, M.G.(1986) *Igneous and Metamorphic Petrology*, CBS
2. Carmichael, I.; Turner, F. and Verhoogen, J.(1977) *Igneous Petrology*, McGraw Hill
3. Collinson, J.D. and Thompson, D. B. (1989). *Sedimentary Structures*, Unwin Hyman
4. Ehlers, E.G. and Blatt, H.(1987) *Petrology*, CBS Publication New Delhi
5. Hall, A(1987) *Igneous Petrology*, ELBS
6. Hatch, F. Wells, A.K. and Wells, M.K.(1984) *Petrology of Igneous Rocks*, CBS
7. Mason, R.(1978) *Petrology of Metamorphic Rocks*, CBS
8. Pettijohn, F.J.(1984) *Sedimentary Rocks*, CBS
9. Sengupta, S.(1994) *Introduction to Sedimentology*, Oxford and IBH
10. Tucker, M.(1981) *Sedimentary Petrology*, ELBS
11. Turner, F. and Verhoogen, J.(1977) *Igneous and Metamorphic Petrology*, CBS
12. Tyrell, G.H. (1976) *Principles of Petrology*, Asia Publishing House
13. Winkler, H.G.F. (1976) *Petrogenesis of Metamorphic Rocks*, Springer Verlag
14. Yardley, B. (1989) *An Introduction to Metamorphic Petrology*, ELBS
15. Raymond L.A.(2002) *The study of Igneous, Sedimentary and Metamorphic Rocks* McGraw Hill
16. Winter J.D.(1998) *An introduction to Igneous and Metamorphic Petrology*, Prentice Hall

Paper: GELH 502(PRACTICAL): Igneous, Sedimentary and Metamorphic petrology
Max. Marks: 25

(Contact hours: 48)
Time: 4 hours

1. *Igneous petrology:*

Identification of the following rocks in *hand specimens*:

Nepheline syenite, norite, granodiorite, andesite, peridotite, pyroxenite, dunite, anorthosite, aplite.

Marks: $1\frac{1}{2} \times 2 + 5 = 8$

Petrography and petrogenesis of the following rocks in thin sections:

Nepheline syenite, norite, granodiorite, trachyte, peridotite, pyroxenite, dunite, anorthosite.

2. *Sedimentary petrology:*

Identification of the following rocks in *hand specimens*: breccia, conglomerate, greywacke, limestone, shale, sandstone.

Marks: $1\frac{1}{2} \times 1 + 4 + 1 = 6\frac{1}{2}$

Petrography and petrogenesis of the following rocks in thin sections:

Conglomerate, micrite, sparrite, fossiliferous limestone, greywacke, arkose, arenite.

Identification of important heavy minerals in thin sections.

3. *Metamorphic petrology:*

Identification of the following rocks in *hand specimens*: granulite, amphibolite, khondolite, charnockite.

Marks: $1\frac{1}{2} \times 1 + 4 = 5\frac{1}{2}$

Petrography and petrogenesis of the following rocks in thin sections:

Granulite, amphibolite, charnockite, augen-gneiss, chlorite schist.

4. *Laboratory records and viva- voce*

Marks: $2+3=5$

Reading List:

1. Collinson, J.D. and Thompson, D.B.(1989) *Sedimentary Structures*, Unwin Hyman
2. Heinrich, E.(1976) *Microscopic Petrology*, McGraw Hill
3. Moorehouse, W.W.(1985) *A Study of Rocks in Thin Section*, CBS
4. Read, H.H.(1984) *Rutley's Elements of Mineralogy*, CBS
5. Sen, A.K.(1995) *Laboratory Manual of Geology*, Modern Book agency, Calcutta
6. Williams H., Turner, F. and Gilbert, C.(1985) *Petrography*, CBS

Max. Marks: 75

Time: 3 hours

Group A: (Economic Geology)

Unit I: General

Definition of ore, gangue and tenor.

Processes of formation of economic mineral deposits: Endogenetic processes (Igneous processes: Magmatic concentration, sublimation pegmatitic, pyrometasomatic, hydrothermal, submarine exhalation; Metamorphic processes: Contact metamorphism, dynamo thermal metamorphism, metasomatism); Exogenetic processes (Sedimentary process: Processes associated with weathering and erosion- mechanical concentration, residual concentration, oxidation and supergene enrichment).

Classification of mineral deposits- Lindgren's classification, Bateman's classification, Simple genetic classification.

Metallogenetic provinces and epochs.

Unit-II: Indian economic minerals deposits:

Mineralogy, mode of occurrence, origin, uses and distribution in India of the following: Gold, copper, lead, zinc, aluminum, iron, chromium, manganese, sillimanite, mica, gypsum, limestone, diamond and barite.

Unit III: Petroleum and radioactive minerals:

Definition, mode of occurrence, composition, origin, migration, accumulation, uses of petroleum and its distribution in India with special reference to North- East India.

Mineralogy, mode of occurrence, origin, uses and distribution of Thorium and Uranium deposits of India.

Unit IV: Coal:

Definition, physical and chemical properties, macroscopic and microscopic constitution, fixed carbon, fuel ratio, coke, carbonization, mode of occurrence, origin, types, and uses of coal. Distribution of coal in India.

Reading list:

1. Bateman, A.M. and Jensen, M.L.(1981) *Economic Mineral Deposits*, John Wiley
2. Beavis, F.C.(1985) *Engineering Geology*, Blackwell
3. Bhimasankaram, V.L.S(1990) *Exploration Geophysics*, Association of Exploration Geophysicists, Hyderabad
4. Evans, A.M.(1987) *An Introduction to Ore Geology*, ELBS
5. GSI Misc. Publication no.30, *Geology and Mineral Resources of North-Eastern States*
6. Kaul, I., Bhattacharya, A.K. and Sengupta, S.(1990) *General and Applied Geophysics*, Association of Exploration Geophysicists, Hyderabad
7. Keary, P. and Brooks, M. (1988) *An Introduction to Geophysical Exploration*, ELBS
8. Kesavelu, N.C.(1993) *Engineering Geology*, Momilam India
9. Krishnasamy and Sinha(1988) *Indian Mineral Resources* Oxford and IBH

Paper: GELH 504 (PRACTICAL) Economic Geology

(Contact hours: 48)

Max. Marks: 25

Time: 4 hours

1. Economic minerals:

Marks: $1\frac{1}{2} \times 12 = 18$

Recognition of the following economic minerals in hand specimens:

Chalcopyrite, malachite, azurite, cuprite, pyrite, hematite, magnetite, siderite, limonite, ilmenite, stibnite, psilomelane, pyrolusite, braunite, chromite, galena, sphalerite, bauxite, laterite, corundum, sillimanite, kyanite, magnesite, barite, sulphur, calcite, asbestos, muscovite, biotite, fluorite, apatite.

2. Industrial Minerals:

Marks: 2

Recognition of the economic minerals used in following industries: cement, refractory, ceramic & glass, iron & steel.

3. Laboratory records and viva-voce.

Marks: $2+3=5$

Reading List:

1. Sen, A.K. (2005) *A Handbook of Economic Geology*, Modern Book Agency, Calcutta
2. Sen, A.K. (1995) *Laboratory Manual of Geology*, Modern Book agency, Calcut