

# M. Sc. Geology - Course structure

## Under Choice Based Credit System (CBCS)

**Department of Geology**  
**Faculty of Earth Sciences, M.L. Sukhadia University**

### M. Sc. Second Year (Semester III) : 2019-20

#### GEOLOGY

Course S.No.	Course Code	Title of Course	L-T-P	No. of Credit	Max. Marks		Total
					Univ. Exam	Inter. Exam	
1	M3GEO01-CT09	Core Course –IX <b>Economic Geology</b>	3-1-0	4	80	20	100
2	M3GEO02-CT10	Core Course – VI <b>Igneous Petrology</b>	3-1-0	4	80	20	100
3	M3GEO03-ET01	Discipline Specific Elective Course – I <b>Ground Water Geology</b>	3-1-0	4	80	20	100
4	M3GEO04-ET02	Discipline Specific Elective Course – II <b>Photo-geology and Remote Sensing</b>	3-1-0	4	80	20	100
5	M3GEO05-CP05	Core Course PR–V <b>(Economic Geology &amp; Igneous Petrology)</b>	0-0-8	4	80	20	100
6	M3GEO06-EP01	Elective PR– I <b>(Ground Water Geology &amp; Photo-geology and Remote Sensing)</b>	0-0-8	4	80	20	100
TOTAL				24	480	120	600

### M. Sc. Second Year (Semester III)

#### GEOLOGY

**M3GEO01-CT09      Core Course – IX : Economic Geology      No. of Credits : 4**

#### Unit – I

Study of ore forming processes: Magmatic concentration, Hydrothermal, Contact metasomatism, Mechanical and Residual concentration, Volcanogenic, Bacteriogenic.

#### Unit –II

Study of ore forming processes: Oxidation and Supergene Sulphide enrichment, Metamorphism, Evaporation and Sedimentation, MVT type deposits, Skarn deposits. Plate tectonics in relation to ore genesis.

### Unit –III

Metallogenic epochs and provinces, Structures and Textures of ores, Wall rock alteration, Control of Mineralization, Classification of ore deposits, Important World Deposits : Porphyry Iron and Copper deposits, Broken Hill deposit of Australiya, Ni-Pt deposit of Ontario, Stassfurt deposit of Germany, Witwaters Sand deposit of South Africa, Kuroko type deposit.

### Unit – IV

Study of the following metallic deposits in India with reference to their geographic and geologic distribution mode of occurrence and origin: iron, manganese, aluminum, chromium, gold, copper, lead, zinc and atomic minerals.

### Unit – V

Study of the following minerals in India with reference to their geographic and geologic distribution mode of occurrence origin and uses: fertilizer minerals, refractory minerals, glass and ceramic minerals, abrasives, gemstones, cement, building stones, energy & fuel minerals: Coal and petroleum deposits: their distribution, classification, origin and potentialities; Important coal and petroleum fields of India.

#### **Recommended Books:**

*Craig, J.M. & Vaughan, D.J., 1981: ore Petrography and Mineralogy. John Wiley*

*Dahlkamp, F.J., 1993: Uranium Ore Deposits. Springer Verlag*

*Evans, A.M., 1993: Ore Geology and Industrial Mineral. Blackwell*

*Guilbert, J.M. and Park, Jr. C.F., 1986: The Geology of Deposits. Freeman*

*Holson, G.D. and Tiratsoo, E.N., 1985: Introduction to Petroleum Geology. Gulf Publ. Houston, Texas*

*Jansen M.L. & Bateman A.M.: 1981, Economic Mineral Deposits, John Wiley & Sons, Singapore*

*Klemm, D.D. and Schneider, H.J., 1977: Time and Strata Bound Ore Deposits. Springer Verlag*

*Mookherjee, A., 2000: Ore Genesis – a Holistic Approach. Allied Publisher*

*Selley, R.C., 1998: Elements of Petroleum Geology. Academic Press*

*Singh, M.P.(Ed.), 1998: Coal and Organic Petrology. Hindustan Publ., New Delhi*

## **M. Sc. Second Year (Semester III) GEOLOGY**

**M3GEO02-CT10**

**Core Course – X : Igneous Petrology**

**No. of Credits : 4**

### Unit – I

Igneous Rock: General Characteristics; Intrusive Forms and Extrusive Forms; Textures and Structures of Igneous rock; classification of igneous rocks (mineralogical, chemical, genetic, IUGS)

### Unit – II

Magma: Composition and constitution of magma; Generation and Emplacement and its relation to plate tectonics; Magmatic crystallization, differentiation and assimilation; Bowen's Reaction Principle.

#### Unit – III

Crystallization process in silicate melts in light of experimental studies especially for following systems: binary magma; Diopside – Anorthite Eutectic system; Albite – Anorthite solid – solution system; Foresteite – Silica Incongruent melting system; Crystallization of Ternary system : Albite – Anorthite – Diopside; Nepheline-Kaliophylite-Silica; Diopside-Forsterite-Silica.

#### Unit – IV

Petrographic Provinces: Definition and characteristics; major, trace, REE and Isotopic compositions of igneous rock and their role in petrogenesis; Origin of major igneous rock types viz Granites, Basalts and Alkaline rocks; Ophiolites and Carbonatites.

#### Unit – V

Petrography, mode of occurrence and origin of following rock groups: Granite – Granodiorite – Diorite; Rhyolite – Rhyodacite – Dacite; Gabbro – Dolerite – Basalt; Syenite – Nepheline syenite and related rock; Ultrabasic rock; Pegmatites.

#### **Recommended Books:**

*Best, M.G., 1986: Igneous Petrology, CBS Publ.*

*Hall Bose, M.K., 1997: Igneous Petrology. World Press*

*McBriney, A.R., 1993: Igneous Petrology. Jones & Bartelt Publ.*

*Perchuk, L.L. and Kushiro, I. (eds), 1991: Physical Chemistry of Magmas. Springer Verlag*

*Philippotts, A., 1992: Igneous and Metamorphic Petrology. Prentice Hall*

## **M. Sc. Second Year (Semester III) GEOLOGY**

**M3GEO03-ET01**

**Discipline Specific Elective Course – I  
(Ground Water Geology)**

**No. of Credits : 4**

#### Unit – I

Ground Water Geology: Introduction, history of the ground water development, importance of ground water. Elements of ground water hydrology. Sources of ground water and origin, hydrological cycle, occurrence and distribution of ground water, hydrological properties of rocks.

## Unit –II

Exploration and Evaluation of ground water, hydrologic investigation; surface geophysical methods, seismic methods, electric resistivity methods. Introduction to sub- surface Geophysical methods. Ground water quality: factors affecting quality of ground water, analyses of ground water, identification in terms for suitability of ground water for domestic, irrigation and industrial purposes. Saline and fresh water interface. Artificial recharge: need and benefits, method of artificial recharge.

## Unit – III

Concept of drainage basin and ground water basin, hydraulic conductivity, transitivity, storage coefficient, water table fluctuation, causative factors, concept of barometric and fidal efficiency, water table contour map. Hydrogeology of India. wet lands with special reference to Rajasthan.

## Unit- IV

Theory of groundwater flow, Darcy's law and its application, determination of permeability in laboratory and in field, Types of wells, ground water modeling; Numerical and electrical methods.

## Unit – V

Ground water problems related to foundation work, mining, canals and tunnels, problem of overexploitation and groundwater mining, groundwater development in urban areas, rain water harvesting, groundwater potentials of Rajasthan.

### **Recommended Books:**

*Alley, W.M., 1993: Regional Groundwater Quality. VNR, New York*

*Black, W.& Others (ED.), 1989: Hydrogeology. Geol. Soc. of America Publ.*

*Davies, S.N. & De Wiest, R.J.M., 1966: Hydrogeology. John Wiley*

*Freeze, R. A. & Cherry, J.A., 1979: Groundwater. Prentice Hall*

*Karant, K.R., 1987: Groundwater Assessment – Development and Management. Tata McGraw Hill*

*Raghunath, N.M., 1982: Groundwater. Wiley Eastern*

*Subramaniam, V., 2000: Water. Kingston Publ. London*

*Todd, D.K., 1980: Groundwater Hydrology. John Wiley*

## **M. Sc. Second Year (Semester III) GEOLOGY**

**M3GEO04-ET02**

**Discipline Specific Elective Course – II  
Photo-geology and Remote Sensing**

**No. of Credits: 4**

## UNIT – I

Fundamental principles and technology of aerial photography; types of aerial photographs; factors affecting aerial photography; types of camera, film and filters; scale of aerial photography and factors affecting scale; mosaics and annotation; relief displacement; vertical exaggeration.

#### UNIT – II

Methods of planimetric mapping through aerial photographs; fundamental principles of radial line triangulation methods; techniques of visual interpretation of aerial photographs; application of aerial photographs in geoscience and geomorphological studies.

#### UNIT – III

Fundamentals of remote sensing; remote sensing systems; space platforms and orbit patterns; remote sensing sensors; thermal, radar and hyperspectral images; signatures of rocks, minerals and soils.

#### UNIT – IV

Digital image processing; digital data formats; fundamental steps in image processing; image rectification and restoration; elements of pattern recognition and image classification.

#### UNIT – V

Introduction to Geographic Information System (GIS); components of GIS; product generation in GIS; tools for map analysis; integration of GIS with remote sensing.

#### **Recommended Books:**

*Druvy, S.A., 1987: Image Interpretation in Geology. Allen and Unwin*

*Gupta, R.P., 1990: Remote Sensing Geology. Springer Verlag*

*Lilleasand, T.M. and Kiffer, R.W., 1987: Remote Sensing and Image Interpretation, John Wiley*

*Miller, V.C., 1961: Photogeology. McGraw Hill*

*Paine, D.P., 1981: Aerial Photography and image Interpretation for Resources Management. John Wiley*

*Pandey, S.N., 1987: Principles and Application of Photogeology. Wiley Eastern, New Delhi*

*Ray, R.G., 1969: Aerial Photographs in Geologic Interpretation. USGS Prof. Paper 373*

*Sabbins, F.F., 1985: Remote Sensing – Principles and Applications. Freeman*

*Siegal, B.S. and Gillespie, A.R., 1980: Remote Sensing in Geology. John Wiley*

## **M. Sc. Second Year (Semester III) GEOLOGY**

**M3GEO05-CP05**

**Core Course PRACTICAL – V  
(Economic Geology & Igneous Petrology)**

**No. of Credits : 4**

#### **Economic Geology:**

1. Study of economic minerals in hand specimen.

2. Important world and Indian deposits to be plotted on maps.
3. Study of important ore minerals under reflected light microscope.

**Igneous Petrology:**

1. Identification and description of important igneous rocks in hand specimen.
2. Petrographic studies of important igneous rocks.
3. Preparation and interpretation of variation diagrams in relation to petrogenesis.
4. Calculation of CIPW norms.

Viva-Voce  
Field work  
Record

**M. Sc. Second Year (Semester III)  
GEOLOGY**

**M3GEO06-EP01                  Elective PRACTICAL– I                  No. of Credits : 4**  
**(Ground Water Geology & Photo geology and Remote Sensing)**

**Groundwater :**

Calculation and exercises on groundwater quality, exploration, yield, recharge, water table fluctuation etc.

**Photogeology and Remote Sensing:**

1. Scale and height of aerial photographs.
2. Interpretation of aerial photographs.
3. Visual interpretation of satellite imageries.
4. Image analysis exercises.
5. Applications using GIS software.

Viva-Voce  
Record

**Compulsory Field Training Program :** Geological Field Training mainly based on Petrology and Economic Geology aspects. – 10 days duration  
Note: **Field Training is Compulsory, Student not taking part in the field training shall not be allowed to appear in the examination**