

# **Syllabus for B.Sc. with Geology**

**Six Semester course  
(Effective from session 2018-21)**

## B.Sc. Geology Course (6-Semester)-2018-2021

### Semester-1

Course No.	Title of the Courses	Theory	Sessional
GEOL/C-001	Physical Geology	80	20
GEOL/C-002	Structural Geology	80	20
GEOL/C-003	Practical	40	10
	Total		250

### Semester-2

Course No.	Title of the Courses	Theory	Sessional
GEOL/C-004	Crystallography and Mineralogy	80	20
GEOL/C-005	Igneous Petrology	80	20
GEOL/C-006	Practical	40	10
	Total		250

### Semester-3

Course No.	Title of the Courses	Theory	Sessional
GEOL/C-007	Sedimentary and Metamorphic Petrology	80	20
GEOL/C-008	Paleontology	80	20
GEOL/C-009	Practical	40	10
	Total		250

### Semester-4

Course No.	Title of the Courses	Theory	Sessional
GEOL/C-010	Stratigraphy	80	20
GEOL/C-011	Ore genesis	80	20
GEOL/C-012	Practical	40	10
	Total		250

### Semester-5

Course No.	Title of the Courses	Theory	Sessional
GEOL/C-013	Mineral distribution	80	20
GEOL/C-014	Elements of Applied Geology	80	20
GEOL/C-015	Practical	40	10
	Total		250

### Semester-6

Course No.	Title of the Courses	Theory	Sessional
GEOL/C-016	Geohydrology	80	20
GEOL/C-017	Geology of Uttarakhand	80	20
GEOL/C-018	Practical	40	10
	Total		250
	Grand Total		1500

**Note: At least one question to be asked from each unit of the prescribed syllabus.**

## **SEMESTER I**

### **GEOL/C-001 Physical Geology**

**Unit-I:** Introduction to geology and its scope; Earth and solar system: origin, size, shape, mass, density and its atmosphere; A brief account of various theories regarding the origin and age of the earth; Brief idea of interior of earth and its composition.

**Unit-II:** Weathering and erosion: factors, types and their effects; Geological action of wind, glacier, river, underground water and ocean.

**Unit-III:** Earthquakes: nature of seismic waves, their intensity and magnitude scale; Origin of earthquake; Volcanoes: types, products and causes of volcanism; Isostasy, Island arcs.

**Unit-IV:** Continents and Oceans, Geosynclines and Mountains.

### **GEOL/C-002 Structural Geology (Theory)**

**Unit-I:** Introduction to Structural Geology; contours, topographic and geological maps; Elementary idea of bed, dip and strike; Outcrop, effects of various structures on outcrop. Clinometer/Brunton compass and their use.

**Unit-II:** Elementary idea of types of deformation; Folds: nomenclature and classification; Recognition of fold on maps and in the field.

**Unit-III:** Faults: nomenclature, geometrical and genetic classifications, normal, thrust and slip faults; Recognition of fault on maps and in the field.

**Unit-IV:** Definition, kinds and recognition of joints and unconformity. Brief idea of secondary planar and linear structures; Salt domes.

### **GEOL/C-003 Practical**

**Physical Geology:** Study of important geomorphological models; Reading topographical maps of the Survey of India; Identification of geomorphic features. (10 marks)

**Structural Geology:** Study of clinometers/Brunton compass; Identification of different types of folds/faults from block models; Exercises on structural problems: preparation of cross section profile from a geological map. (10 marks)

**Laboratory record:** (10 marks)

**Viva Voce:** (10 marks)

### **Books Recommended:**

1. Arthur Holmes, 1992. Principles of Physical Geology. Chapman and Hall, London.
2. Miller, 1949. An Introduction to Physical Geology. East West Press Ltd.
3. Spencer, E.V., 1962. Basic concepts of Physical Geology. Oxford & IBH.
4. Mahapatra, G.B., 1994. A text book of Physical geology. CBS Publishers.
5. Billings, M.P., 1972. Structural Geology. Prentice Hall.
6. Davis, G.R., 1984. Structural Geology of Rocks and Region. John Wiley
7. Hills, E.S., 1963. Elements of Structural Geology. Farrold and Sons, London.
8. Singh, R. P., 1995. Structural Geology, A Practical Approach. Ganga Kaveri Publ., Varanasi.

## Semester II

### GEOL/C-004 Crystallography and Mineralogy

**Unit-I:** Crystals and their characters: Crystal form, face, edge, solid angle; Interfacial angle; Crystal parameters, Weiss and Miller system of notations;

**Unit-II:** Symmetry elements and description of normal class of Isometric, Tetragonal, Hexagonal, Trigonal, Orthorhombic, Monoclinic and Triclinic systems; Twinning.

**Unit-III:** Minerals and silicate structures; Common physical properties of Garnet, Chlorite, Epidote, Calcite, Fluorite, Gypsum, Baryte, Beryl, Tourmaline, Kyanite, Corundum, Orthoclase, Muscovite, Biotite, Quartz, Plagioclase, Hornblende, Pyroxene, Olivine.

**Unit-IV:** Polarizing microscope and its functioning; Ordinary and polarized lights; Optical properties of some common rock forming minerals (Quartz, Orthoclase, Microcline, Olivine, Augite, Hornblende, Muscovite, Biotite, Garnet, Calcite, Sillimanite).

### GEOL/C-005 Igneous Petrology

**Unit-I:** Magma: definition, composition, types and origin; Forms of igneous rocks; textures and structure of igneous rocks.

**Unit-II:** Reaction principle; Differentiation and Assimilation; Crystallization of unicomponent and bicomponent (mix-crystals); Bowen's reaction series.

**Unit-III:** Mineralogical and chemical classification of igneous rocks.

**Unit-IV:** Detailed petrographic description of Granite, Granodiorite, Rhyolite, Syenite, Phonolite, Diorite, Gabbro, Peridotite, Charnockite, Basalt, Pichstone, Obsidian.

### GEOL/C-006 Practical

**Crystallography and Mineralogy:** Study of symmetry elements of normal class of Isometric, Tetragonal, Hexagonal, Trigonal, Orthorhombic, Monoclinic and Triclinic systems. Study of physical properties of minerals mentioned in theory course. Use of polarizing microscope; Study of optical properties of common rock forming minerals mentioned in theory course. (10 marks)

**Igneous Petrology:** Identification of rocks (given in theory course): On the basis of their physical properties in hand specimen; and optical properties in thin sections. (10 marks)

**Laboratory record:** (05 marks)

**Geological Field Training:** Students will be required to carry out 03 days field work in a suitable geological area to study the elementary aspects of field geology and submit a report thereon. (10 marks)

**Viva voce:** (05 marks)

### **Books Recommended:**

1. Dana, E.S. and Ford, W.E., 2002. A textbook of Mineralogy (Reprints).
2. Flint, Y., 1975. Essential of crystallography, Mir Publishers.
3. Phillips, F.C., 1963. An introduction to crystallography. Wiley, New York.
4. Berry, L.G., Mason, B. and Dietrich, R.V., 1982. Mineralogy. CBS Publ.
5. Nesse, D.W., 1986. Optical Mineralogy. McGraw Hill.
6. Read, H.H., 1968. Rutley's Element of Mineralogy (Rev. Ed.). Thomas Murby and Co.
7. Berry and Mason, 1961. Mineralogy. W.H. Freeman & Co.
8. Kerr, B.F., 1995. Optical Mineralogy 5th Ed. Mc Graw Hill, New York.
9. Turner, F.J. & Verhoogen, J., 1960, Igneous & Metamorphic petrology. McGraw Hill Co.
10. Bose, M.K., 1997. Igneous petrology. World press

11. Tyrell, G. W., 1989. Principles of Petrology. Methuren and Co (Students ed.).
12. Ehlers, WG, and Blatt, H., 1987. Petrology, Igneous, Sedimentary and Metamorphic rocks, CBS Publishers
13. Moorhouse, WW., 1969. The study of rocks in thin sections. Harper and sons.

### Semester III

#### **GEOL/C-007 Sedimentary and Metamorphic Petrology**

**Unit-I:** Processes of formation of sedimentary rocks; Classification, textures and structures of sedimentary rocks;

**Unit-II:** Petrographic details of important siliciclastic and carbonate rocks such as - conglomerate, breccia, sandstone, greywacke, shale, limestones.

**Unit-III:** Process and products of. metamorphism; Type of metamorphism. Factors, zones and grade of metamorphism; Textures, structures and classification of metamorphic rocks.

**Unit-IV:** Petrographic details of some important metamorphic rocks such as - slate, schists, gneiss, quartzite, marble, granulite, migmatite.

#### **GEOL/C-008 Palaeontology**

**Unit-I:** Introduction of Palaeontology; Fossils: definition, characters, binomial nomenclature in taxonomy, mode of preservation, condition of fossilization and significance of fossils.

**Unit-II:** Brief idea of various Ecosystem; Origin and evolution of life; extinction.

**Unit-III:** Morphology and geological distribution of brachiopods, pelecypods, cephalopods, gastropods, trilobites, echinoids.

**Unit VIII:** Elementary ideas about foraminifera and corals. Evolutionary history of dinosaurs, horse, elephants and Man.

#### **GEOL/C-009 Practical**

**Sedimentary and metamorphic Petrology:** Identification of sedimentary and metamorphic rocks (given in theory course) both in hand specimen and thin sections. (10 marks)

**Paleontology:** Morphological characters, systematic position and age of fossil genera pertaining to brachiopods, pelecypods, cephalopods, trilobite and Echinacea. (10 marks)

**Laboratory record:** (10 marks)

**Viva Voce:** (10 marks)

#### **Books Recommended:**

1. Friedman & Sanders, 1978. Principles of Sedimentology. John Wiley and sons.
2. Pettijohn, F.J., 1975. Sedimentary rocks, Harper & Bros. 3rd Ed.
3. Prasad, C., 1980. A text book of sedimentology.
4. Sengupta, S., 1997. Introduction to sedimentology. Oxford-IBH.
5. Turner, F.J., 1980. Metamorphic petrology. McGraw Hill.
6. Mason, R., 1978. Petrology of Metamorphic Rocks. CBS Publ.
7. Winkler, H.G.C., 1967. Petrogenesis of Metamorphic Rocks. Narosa Publ.
8. Moorhouse, WW., 1969. The study of rocks in thin sections. Harper and sons.
9. Shrock, R.R. & Twenhoffel, W.H., 1952. Principles of Invertebrate Paleontology. CBS Publ.
10. Swinerton, HH., 1961. Outlines of Paleontology. Edward Arnold Publishers
11. Jain, P.C. & Anantharaman, M.S., 1983. Paleontology: Evolution & Animal Distribution. Vishal Publ.
12. Lehmann, U., 1983. Fossil Invertebrate. Cambridge Univ. Press.
13. Rastogi, 1988. Organic evolution. Kedrath and Ramnath Publ.

## Semester IV

### GEOL/C-010 Straigraphy

**Unit I:** Definition, Principle of stratigraphy; Geological Time Scale and stratigraphic classification; Physiographic division of India- Himalaya, Ganga plain and peninsular India.

**Unit II:** Study of following Precambrian succession: Dharwar, Cuddapha, Vindhyan and Delhi Supergroups; Brief idea of Palaeozoic succession of northwestern Himalaya; Triassic of Spiti; Mesozoic type seccession of Kutch and Rajasthan; Cretaceous of Tiruchirapalli;

**Unit III:** Study of following type localities: Gondwana and Deccan Trap.

**Unit IV:** Palaeogene-Neogene sequences of northwest Himalaya and Assam.

### GEOL/C-011 Ore genesis

**Unit-I :** Definition and scope of ore genesis; Concept of ore and ore deposits; ore minerals and gangue minerals.

**Unit-II:** Processes of ore genesis- Magmatic, Metasomatism, Contact metasomatism, Hydrothermal, Residual and mechanical concentration, Supergene sulphide enrichment, metamorphism.

**Unit-III:** Brief idea of the origin, mode of occurrence of coal and hydrocarbons and their distribution in India.

**Unit-VII:** Mineral resources of Uttarakhand

### GEOL/C-012 Practical

**Stratigraphy:** Preparation of lithostratigraphic maps of India showing distribution of important geological formations; Identification of stratigraphic rocks in hand specimen. (10 marks)

**Economic Geology:** Study of ore minerals in hand specimen; Preparation of maps showing distribution of important coal and oil fields of India. (10 marks)

**Laboratory record:** (05 marks)

**Geological Field Training:** Students will be required to carry out 03 days field work in a suitable geological area to study the elementary aspects of field geology and submit a report thereon. (10 marks)

**Viva voce:** (05 marks)

### **Books Recommended:**

1. Wadia, D., 1973. Geology of India. Mc Graw Hill Book co.
2. Krishnan, M.S., 1982. Geology of India and Burma, 6th Edition. CBS Publ.
3. Ravindra Kumar, 1985. Fundamentals of Historical Geology & Stratigraphy of India. Wiley Eastern.
4. Brown, C. and Dey, A.K. 1955. Indian Mineral Wealth. Oxford Univ.
5. Gokhale, K.V.G.K. and Rao, T.C., 1983. Ore Deposits of India. East West Press Pvt. Ltd.
6. Jense, M.L. and Bateman A.M., 1981. Economic Mineral Deposits. John Wiley and Sons.
7. Evans, A.M. 1993. Ore Geology and Industrial Minerals. Blackwell ScLPubl.
8. Guilbert, J.M. and Park Jr., C.F. 1986. The Geology of Ore deposits. Freeman & Co.

## Semester V

### GEOL/C-013 Mineral Distribution

**Unit-I :** Economic geology- Definition and scope; ore minerals and gangue minerals. Forms, structures and textures of mineral deposits.

**Unit-II:** Occurrence, distribution and uses of metalliferous deposits in India i.e.- Copper, lead, zinc, iron, manganese, aluminium, chromium, nickel, gold, silver, molybdenum.

**Unit-III:** Indian occurrence and uses of non-metals i.e.- mica, asbestos, barites, gypsum, graphite, apatite and beryl; Indian occurrence of gemstones, refractory minerals, abrasives and minerals used in glass, fertilizer, paint, ceramic and cement industries.

**Unit-VI:** Metallogenetic epochs and provinces; Elementary idea of National Mineral Policy.

### GEOL/C-014 Elements of Applied Geology

**Unit-I:** Engineering properties of rocks and Soils, Soil groups of India.

**Unit-II:** Dam, Types and their geological and environmental considerations; Geological investigation for dam; Geological problem of reservoirs.

**Unit-III:** Tunnels: geology, structure, seepage problem and role of water table; Landslides: classification, causes and preventative measures; Bridges-types and geological consideration.

**Unit-IV:** Elementary idea about mineral exploration and mining.

### GEOL/C-015 Practical

**Economic Geology:** Study of ore and economic minerals in hand specimen; Preparation of maps showing distribution of important metallic and non-metallic deposits. (10 marks)

**Applied Geology:** Surveying by Plane Table/Theodolite; Preparation of engineering geological maps; Engineering properties and identification of building stones. Study of soil profiles. (10 marks)

**Laboratory record:** (10 marks)

**Viva Voce:** (10 marks)

### **Books Recommended:**

1. Brown, C. and Dey, A.K. 1955. Indian Mineral Wealth. Oxford Univ.
2. Krishnaswamy, S., 1979. India's Minerals Resources. Oxford and IBH Publ.
3. Deb, S., 1980. Industrial minerals and Rocks of India. Allied Publishers Pvt. Ltd.
4. Umeshwar Prasad, 2003. Economic Geology. CBS Publishers and distributors.
5. Sharma, N.L. and Ram, K.V.S., 1972. Introduction to India's Economic Minerals, Dhanbad.
6. Evans, A.M. 1993. Ore Geology and Industrial Minerals. Blackwell ScLPubl.
7. Valdiya, K.S., 1987. Environmental Geology – Indian Context. Tata McGraw Hill.
8. Parasins, D.S., 1997. Principles of applied geophysics. Chapman Hall.
9. Krynine D.P. and Judd W.R., 1957. Principles of Engineering Geology & Geotechnics. McGraw-Hill Book
10. Kesavulu, N.C., 2009. A text book of engineering geology. Macmillan P publishing India Ltd.
11. Crozier. M.J., 1989. Landslides: causes, consequences and environment. Academic Press.
12. Bell, F.G., 1983. Fundamentals of Engineering Geology. Butterworth and Co.
13. Clark, G.B. 1967. Elements of Mining. 3rd Ed. John Wiley & Sons.
14. Arogyaswami, R.P.N. 1996 Courses in Mining Geology. 4th Ed. Oxford-IBH.
15. Moon, C.J., Whateley, M.K.G., Evans, A.M., 2006, Introduction to Mineral Exploration, Blackwell Publishing

## Semester VI

### GEOL/C-016 Geohydrology

**Unit-V:** Definition of Geohydrology, Hydrological cycle; Springs and Hot springs

**Unit-VI:** Hydrological parameters - Precipitation, evaporation, transpiration and infiltration.

**Unit-VII:** Origin of groundwater; Vertical distribution of groundwater; Types of aquifers; Water bearing properties of rocks - Porosity and Permeability; specific yield, specific retention.

**Unit-VIII:** Surface and subsurface geophysical and geological methods of ground water exploration; Groundwater provinces of India; Ground water quality.

### GEOL/C-17 Geology of Uttarakhand

**Unit-I:** Broad setup of Himalaya. Different roles of Himalaya. Geographic set up of Himalaya. Geological and tectonic divisions of the Himalaya. Himalaya as an orogenic belt. Characteristics of tectonic mountain. Uttarakhand- boundaries, geography and environment

**Unit-II:** Geomorphology and stratigraphy of the Uttarakhand.

**Unit-III:** Structure and tectonics of Uttarakhand and origin of the Himalaya

**Unit-IV:** Environmental geological problems of Uttarakhand, natural hazard in Uttarakhand and their remedial measures, geological resources of Uttarakhand, big dams vs. run off the rivers projects in Uttarakhand. Impact of climate change in Uttarakhand.

### GEOL/C-018 Practical

**Geohydrology:** Study of hydro-geological models, Estimation of porosity and permeability from the given data; Preparation and interpretation of water table maps. (10 marks)

**Geology of Uttarakhand:** Plotting of important geological formations/ structural features in the map of Uttarakhand; Identification of important stratigraphic rocks of Uttarakhand in hand specimen (10 marks)

**Laboratory record:** (05 marks)

**Geological Field Training:** Students will be required to carry out 03 days field work in a suitable geological area to study the elementary aspects of field geology and submit a report thereon. (10 marks)

**Viva voce:** (05 marks)

### **Books Recommended:**

1. Todd. Ground water hydrology
2. Karanth, K. R., 1989. Hydrogeology. Tata McGraw Hill Publ.
3. Raghunath, H. M., 1990. Groundwater. Wiley Eastern Ltd.
4. Subramaniam, V., 2000. Water-Kingston Publ. London.
5. Valdiya, K.S., 1980. Geology of Kumaon Lesser Himalaya.
6. Biyani A.K. 2006. Dimensions of Himalayan. SSPH, Delhi