

# **DETAILS OF UNDERGRADUATE SYLLABUS (Yearly)**

## **(Subject: Geology)**

### **B.Sc. I year Geology**

#### **Paper- I**

**Theory:**

**Max marks 50**

#### **Physical Geology and Structural Geology**

##### **Physical Geology**

Geology and its branches Earth in the Universe. Origin and age of the Earth. Interior and internal energy of the Earth, Endogenic and exogenic processes of the earth. Concept of sea floor spreading and plate tectonics. Mountain building and Isostasy, Causes, magnitude, intensity and distribution of earthquakes. Causes, types and distribution of volcanoes. Landslides and their types, The rock cycle. Basic characters of igneous, sedimentary and metamorphic rocks. Weathering and soil formation. Erosion and its types, Geological works and associated landforms of wind, glacier, river, oceans and underground water.

##### **Structural Geology**

Elements of Structural Geology- out crop, bedding, strike and dip of beds, contours and their important patterns, Determination of Top and Bottom of beds, Folds and faults- their morphology and classification, effects of folds and faults on outcrops, Joints and their classification. Unconformity- types and significance, Rock cleavage, schistosity, foliations, and lineations; their types, and geological significance.

#### **Paper- II**

**Theory:**

**Max marks 50**

#### **Crystallography and Mineralogy**

##### **Crystallography**

Definition of crystal, Crystalline and amorphous, Crystals forms, faces, edges, solid angles, interfacial angles and their measurement, Crystallographic axes and elements of symmetry. Parameters, Weiss and Miller system of notation, Morphological study of common forms of the normal class of cubic, tetragonal, hexagonal, orthorhombic, monoclinic, and triclinic system, Types of Twinning.

##### **Mineralogy:**

Physical properties of minerals concept of silicon oxygen tetrahedral and classification of silicates, Study of minerals of silica, feldspar, mica, amphibolites, pyroxene, garnet, and olivine families, Plane polarized light. Isotropism and Anisotropism. Nicol prism and polarizing

microscope, Behaviour of light in isotropic and anisotropic minerals (Uniaxial), Basic knowledge of birefringence, pleochroism and extinction.

**Suggested Readings:**

1. Rutley's Elements of Mineralogy, by H. H. Read
2. Essentials of Crystallography, V. Snigireskava
3. Morphologic Crystallography and Optical Mineralogy, by S. Ray

**Practical:**

**Max. marks 35**

**Structural Geology:** Reading of topographic maps, graphical solution of simple problems of dip, strike and width of outcrops. Three points problem. Completion of outcrops from partial data on contoured topographic maps. Study of geological maps, interpretation of outcrop patterns of different types of folds, faults, unconformities and igneous bodies and preparation of geological cross section and geological history thereof.

**Crystallography:** Study of the forms of normal class of Cubic system (cube, octahedron, rhomb do decahedron, tetrahexahedron, trapezohedron), Tetragonal system (Zircon, visuvinite) Hexagonal system, (Beryl), Orthorhombic system (Barytes) and Monoclinic system (Gypsum and Orthoclase)

**Mineralogy:** Study of common rock forming minerals in hand specimens. Study of common rock forming minerals in thin sections. Study of the optical characteristics of minerals such as form colour, relief, cleavage, pleochroism extinction and twinning : Quartz, Ortoclase, Microcline, Plagioclase, Augite, Hornblende, Olivine, Garnet, Biotite, Muscovite, Kyanite, Sillimanite.

**Field work (Two weeks)**

**10 Marks**

**Sessional and Viva-Voce**

**05 Marks**

## B.Sc. II year Geology

### Paper I

#### Petrology

##### Theory

Max marks 50

**Igneous Petrology:** Composition of crust in terms of major chemical elements and lithology; Elementary knowledge of magma , it's composition and mode of crystallization; Bowen's reaction series and its significance; Elementary ideas of magmatic differentiation and assimilation; Crystallization of magma in binary system; Structure and texture of igneous rocks; Classification of basic igneous rocks; Petrology of granite, rhyolite, syenite, basalt, dolerite, gabbro and dunite; Basic concepts of the origin of common igneous rocks, ultramafic and acidic rocks.

**Metamorphic Petrology:** Metamorphism ,Agents and kinds of metamorphic zones and grades of metamorphism ; Concept of metamorphic facies; Structures and textures of metamorphic rocks. Petrography and origin of important metamorphic rocks- phyllite, schists, gneisses, charnockite, marble, quartzite, hornfels and amphibolites.

**Sedimentary Petrology:** Sedimentary processes, sedimentation and diagenesis; Important structures in sedimentary rocks; Textural parameters; Classification of sedimentary rocks; Petrography of sandstones, conglomerates, mudstones and carbonates. Environment of sedimentation; Facies concept.

### Paper II

#### Paleontology and Stratigraphy

##### Theory

Max marks 50

##### Paleontology

Introduction- Modes of preservation, Contributions of fossil in the diverse fields - palaeoecology, biostratigraphy, biogeography, taphonomy, evolution and taxonomy. Fossil record of life, Brief morphology and geological distribution of fossils in the world and in India Brachiopoda, Mollusca (Pelecypoda, Cephalopoda and Gastropoda); Trilobita, Echinoids, Authozoa and Graptolites, Brief description about different microfossil groups- siliceous (diatoms), calcareous (Foraminifera), phosphatic and organic-walled, Brief description of plant fossils and various genera of Upper and Gondwana and Siwalik of Indian Subcontinent, Origin and diversity of vertebrates. Evolution and Classification of Horse, Man and Elephant.

##### Suggested Readings:

1. Invertebrate Palaeontology and Evolution by E.N.K. Clarkson
2. Understanding Fossils: An introduction to Invertebrate Palaeontology by Peter Doyle
3. Ancient Invertebrate and their living relatives by Lehmann and Hillmer
4. Vertebrate Palaeontology by M.J. Benton

## **Stratigraphy**

Principles, correlation, nomenclature and Geological time scale, Broad idea about lithostratigraphic. Biostratigraphic and Chronostratigraphic classification, Precambrian formations of the Indian subcontinent; their distribution, lithology and subdivisions, fossil content, correlation and magmatic activities, Phanerozoic formations of the Indian subcontinent; their distribution, lithology and subdivisions, fossil content, correlation and magmatic activities, Brief account of Geology of Uttarakhand. Suggested Readings:

1. Fundamentals of Historical Geology and Stratigraphy of India by Ravindra Kumar
2. Geology of India and Burma by M.S. Krishnan
3. Making of India: Geodynamic Evolution by K.S. Valdiya
4. Geology by Mahapatra

## **Practical**

**Max marks 35**

Petrology-Study of common igneous, sedimentary and metamorphic rocks in hand specimens and thin sections; Study of common structures in igneous, sedimentary and metamorphic rocks, Paleontology-Study of representative genera of Foraminifera, Brachiopods, Gastropods, Cephalopods, Echinoidea, Anthozoa, Trilobites, Graptolites and Plant fossils, Stratigraphy-Delineation of some important lithological and structural elements on the physiographic map of India. Study of Geological maps and stratigraphic columns.

**Field work (Two weeks)**

**10 Marks**

**Sessional and Viva-Voce**

**05 Marks**

## **B.Sc. III year Geology**

### **Paper I**

#### **Economic Geology**

##### **Theory**

**Max marks 50**

Definition and scope of ore deposits, ore minerals and gangue minerals, Occurrence, distribution and uses of metalliferous deposits in India i.e.- Copper, lead, zinc, iron, manganese; aluminium, chromium, nickel, gold, silver, molybdenum, 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. Building stones, phosphorite deposits. Placer deposits, rare earth minerals, Brief idea of the origin, mode of occurrence of coal and hydrocarbons and their distribution in India, Mineral resources of Uttarakhand, Elementary knowledge of mineral exploration and mining

##### **Suggested Readings:**

1. Economic Geology by Umeshwar Prasad
2. Economic Geology by Bates and Jenson
3. Economic Geology by Evans

### **Paper II**

#### **Photogeology**

##### **Theory**

**Max marks 50**

Definition and scope of photogeology. EM radiation and EM spectrum. EM energy interactions with atmosphere and earth surface features, Film and digital aerial photography. Types of aerial photographs. Annotations on aerial photographs, Scale of aerial photographs. Relief distortions and vertical exaggeration in aerial photographs. Orthophotographs, Aerial photography mission. Tilt in aerial photographs. Stereoscopic vision in aerial photographs. Stereoscopes and their types, Phototechnical and geotechnical elements of photo-interpretation. Aerial photo mosaics, their types and utility, Application potential of aerial photographs in land cover, landform, rock type and structure recognition.

##### **PRACTICAL**

**Max Marks 35**

Study of important metallic and non-metallic ores and minerals in hand Specimens. Identifying the phototechnical and geotechnical elements of different landforms, land use/ land cover classes and structures.

##### **Field work (Two weeks)**

**10 Marks**

##### **Sessional and Viva-Voce**

**05 Marks**