Proposed syllabus and Scheme of Examination

for

B.Sc. with Geology

Submitted
to

University Grants Commission
New Delhi

Under

Choice Based Credit System
B.Sc. with Geology CBCS Syllabi

CORE COURSES (CC)
1. Physical and Structural Geology (Theory: 04 Credits + Practicals: 02 credits = 06 credits)
2. Crystallography and Mineralogy (Theory: 04 Credits + Practicals: 02 credits = 06 credits)
3. Petrology (Theory: 04 Credits + Practicals: 02 credits = 06 credits)
4. Stratigraphy and Palaeontology (Theory: 04 Credits + Practicals: 02 credits = 06 credits)

DISCIPLINE SPECIFIC ELECTIVE (DSE)
1. Economic Geology and Hydrology (Theory: 04 Credits + Practicals: 02 credits = 06 credits)
2. Elements of Applied Geology (Theory: 04 Credits + Practicals: 02 credits = 06 credits)

SKILL ENHANCEMENT COURSE (SEC)
1. Geomorphology and Geotectonics (02 credits)
2. Environmental Geology (02 credits)
3. Geochemistry (02 credits)
4. Photo Geology and Remote Sensing (02 credits)

ABILITY ENHANCEMENT COMPULSORY COURSES (AECC)
1. Environment Science (02 Credits)
2. English or Modern Indian Language communication (02 credits)
CC-1
Physical and Structural Geology (Theory) (4 Credits)

Unit-I: Introduction to geology and its scope, Earth and solar system: origin, size, shape, mass, density and its atmosphere.

Unit-II: A brief account of various theories regarding the origin and age of the earth; Brief idea of interior of earth and its composition.

Unit-III: Weathering and erosion: factors, types and their effects;

Unit-IV: Earthquakes: nature of seismic waves, their intensity and magnitude scale; Origin of earthquake; Volcanoes: types, products and causes of volcanism;

Unit-V: 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 its use.

Unit-VI: Elementary idea of types of deformation; Folds: nomenclature and types of folds;

Unit-VII: Faults: nomenclature, geometrical and genetic classifications, normal, thrust and slip faults;

Unit-VIII: definition, kinds and significance of joints and unconformity.

Practicals (02 Credits)
- Physical Geology:
  Study of important geomorphological models; Reading topographical maps of the Survey of India; Identification of geomorphic features.
- 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.
- Laboratory record:
- Viva Voce:

Books Recommended:
**CC-2**  
**Crystallography and Mineralogy (04 credits)**

**Unit-I**: Crystals and their characters:  
**Unit-II**: Crystal form, face, edge, solid angle; Interfacial angle and their measurements; Crystallographic axes and angles.  
**Unit-III**: Crystal parameters, Weiss and Miller system of notations;  
**Unit-IV**: Symmetry elements and description of normal class of Isometric, Tetragonal, Hexagonal, Trigonal, Orthorhombic, Monoclinic and Triclinic systems.  
**Unit-V**: Introduction to Mineralogy, Definition and characters of mineral;  
**Unit-VI**: Common physical properties of minerals; Chemical composition and diagnostic physical properties of minerals such as: Quartz, Orthoclase, Microcline, Hypersthene, Hornblende, Garnet, Muscovite, Biotite, Chlorite, Olivine, Epidote, Calcite.  
**Unit-VII**: Polarizing microscope, its parts and functioning; Ordinary and polarized lights; Common optical properties observed under ordinary, polarized lights and crossed nicols.  
**Unit-VIII**: Optical properties of some common rock forming minerals (Quartz, Orthoclase, Microcline, Olivine, Augite, Hornblende, Muscovite, Biotite, Garnet, Calcite).

**Practicals (02 Credits)**

• **Crystallography**:  
Study of symmetry elements of normal class of Isometric, Tetragonal, Hexagonal, Trigonal, Orthorhombic, Monoclinic and Triclinic systems.

• **Mineralogy**:  
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.

• **Laboratory record**:  

• **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.

• **Viva voce**:  

**Books Recommended**

CC-3
Petrology (04 Credits)

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

Sedimentary Petrology
Unit-V: Processes of formation of sedimentary rocks; Classification, textures and structures of sedimentary rocks;
Unit-VI: Petrographic details of important siliciclastic and carbonate rocks such as - conglomerate, breccia, sandstone, greywacke, shale, limestones.

Metamorphic Petrology
Unit-VII: Process and products of metamorphism; Type of metamorphism. Factors, zones and grade of metamorphism; Textures, structures and classification of metamorphic rocks.
Unit-VIII: Petrographic details of some important metamorphic rocks such as - slate, schists, gneiss, quartzite, marble.

Practicals (02 Credits)
• Igneous Petrology:
Identification of rocks: On the basis of their physical properties in hand specimen; and optical properties in thin sections.
• Sedimentary and metamorphic Petrology:
Identification of sedimentary and metamorphic rocks both in hand specimen and thin sections.
• Laboratory record:
• Viva Voce

Books Recommended:
CC-4
*Straigraphy and Palaeontology (04 Credits)*

**Unit I:** Definition, Principle of stratigraphy; Geological Time Scale and stratigraphic classification; Physiographic division of 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 succession 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.

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

**Unit VI:** Morphology and geological distribution of brachiopods, pelecypods, cephalopods.

**Unit VII:** Morphology and geological distribution of trilobite, echinoidea.

**Unit VIII:** Evolutionary history of horse; Morphology, distribution and significance of Gondwana flora.

**Practicals (02 Credits)**

I. Morphological characters, systematic position and age of fossil genera pertaining to brachiopods, pelecypods, cephalopods, trilobite and Echinacea.

II. Preparation of lithostratigraphic maps of India showing distribution of important geological formations.

**Books Recommended:**

DSE-1
Economic Geology and Hydrology (04 Credits)

Unit-I: Concept of ore and ore deposits, ore minerals and gangue minerals; Tenor of ores; Metallic and non-metallic ore minerals; Strategic, Critical and essential minerals.

Unit-II: Processes of formation of ore deposits; Magmatic, contact metasomatic, hydrothermal, sedimentation.

Unit-III: Study of important metallic (Cu, Pb, Zn Mn, Fe, Au, Al) and non-metallic (industrial) minerals (gypsum, magnesite, mica).

Unit-IV: Distribution of coal and petroleum in India.

Unit-V: Definition of hydrogeology, Hydrological cycle;

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.

Practicals (02 Credits)
- Economic Geology:
  Study of ore and economic minerals in hand specimen; Preparation of maps showing distribution of important metallic and non-metallic deposits and important coal and oil fields of India.
- Hydrology:
  Study of hydro-geological models, Estimation of porosity and permeability from the given data; Preparation and interpretation of water table maps.
- Laboratory record:
- Viva Voce:

Books Recommended:
DSE-2
Elements of Applied Geology (04 Credits)

Unit-I:  Engineering properties of rocks and Soils.
Unit-II: Soil and Soil groups of India.
Unit-III: Dam, Types and their geological and environmental considerations; Geological problem of reservoirs.
Unit-IV: Tunnels: geology, structure, seepage problem and role of water table;
Unit-V:  Landslides: classification, causes and preventative measures.
Unit-VI: Mineral exploration: Elementary idea of geological and geophysical prospecting.
Unit-VII: Elementary idea of mining.
Unit-VIII: Environmental considerations for mining.

Practicals
Surveying by Plane Table/Theodolite; Preparation of engineering geological maps; Engineering properties and identification of building stones. Identification of various models of landslide, tunnel and dam. Study of soil profiles.

• Laboratory record:
• Viva Voce:

Books Recommended:
**SEC-1**  
**Photo Geology and Remote Sensing**

**Unit-I:** Elementary idea about photogeology: electro-magnetic spectrum, types & geometry of aerial photographs; factors affecting aerial photography; types of camera, film and filters; factors affecting scale;

**Unit-II:** Fundamentals of remote sensing; remote sensing systems; remote sensing sensors; signatures of rocks, minerals and soils. Application of remote sensing in geoscience and geomorphological studies.

**Unit-III:** Types of Indian and Foreign Remote Sensing Satellites, Digital image processing; fundamental steps in image processing; elements of pattern recognition and image classification.

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

**Books Recommended:**

**SEC-2**  
**Geomorphology and Geotectonics**

**Unit-I:** Basic principles of Geomorphology, geomorphological cycles, weathering and erosion; Geomorphic mapping- tools and techniques.

**Unit-II:** Epigene/exogenic processes: degradation and aggradation. Hypogene/endogenic processes; Diastrophism and volcanism, Extraterrestrial processes; Geological work of wind, glacier, river, underground water and ocean.

**Unit-III:** Earth as a dynamic system. Elementary idea of continental drift, sea-floor spreading and mid-oceanic ridges. Paleomagnetism and its application.

**Unit-IV:** Plate Tectonics: the concept, plate margins, orogeny, deep sea trenches, island arcs and volcanic arcs.

**Books Recommended:**
**SEC-3**

**Environmental Geology**

**Unit-I:** Earth and its spheres: atmosphere, hydrosphere, lithosphere, biosphere and Man; Earth Material.

**Unit-II:** Energy budget: Solar radiation; Global environments: coastal, riverine, desertic, tropical, cold, polar; Concept of global warming and climate change.

**Unit-III:** Geologicacl hazards: Earthquakes, volcanism, landslides, avalanches, floods, droughts; Hazard mitigation.

**Unit IV:** Resource Management: Energy resources (Conventional and non-conventional), watershed management, landuse planning, management of water resources, land reclamation.

**Books Recommended:**

**SEC-4**

**Geochemistry**

**Unit-I:** Introduction to geochemistry: basic knowledge about crystal chemistry. Types of chemical bonds, coordination number; Colloids in geological systems, ion exchanges and geological evidence for earlier colloids; Elementary idea of Periodic Table.

**Unit-II:** Cosmic abundance of elements; Composition of the planets and meteorites; Geochemical evolution of the earth and geochemical cycles;

**Unit-III:** Gold Schmidt's geochemical classification of elements; Distribution of major, minor and trace elements in igneous, metamorphic and sedimentary rocks.

**Unit-IV:** Elements of geochemical thermodynamics; Isomorphism and polymorphism; Isotope geochemistry.

**Books Recommended:**