

**B.Sc. GEOLOGY SYLLABUS UNDER CBCS SCHEME  
SCHEME OF INSTRUCTION**

**(Revised and effective from academic year 2019-2020)**

<b>Semester</b>	<b>Paper [ Theory and Practical ]</b>	<b>Instructions Hrs/week</b>	<b>Marks</b>	<b>Credits</b>
<b>I</b>	<b>Paper – I : Physical Geology and Crystallography</b>	<b>4</b>	<b>100</b>	<b>4</b>
	<b>Practicals – I : Physical Geology and Crystallography</b>	<b>3</b>	<b>50</b>	<b>1</b>
<b>II</b>	<b>Paper – II: Mineralogy and Optical Mineralogy</b>	<b>4</b>	<b>100</b>	<b>4</b>
	<b>Practicals – II : Mineralogy and Optical Mineralogy</b>	<b>3</b>	<b>50</b>	<b>1</b>
<b>III</b>	<b>Paper – III : Petrology</b>	<b>4</b>	<b>100</b>	<b>4</b>
	<b>Practicals – III : Petrology</b>	<b>3</b>	<b>50</b>	<b>1</b>
<b>IV</b>	<b>Paper – IV : Structural Geology and Economic Geology</b>	<b>4</b>	<b>100</b>	<b>4</b>
	<b>Practicals – IV : Structural and Economic Geology</b>	<b>3</b>	<b>50</b>	<b>1</b>
<b>V</b>	<b>Paper –V : A. Stratigraphy, Indian Geology and Palaeontology B. Environmental Geology</b>	<b>4</b>	<b>100</b>	<b>4</b>
	<b>Practicals – V: A. Stratigraphy and Palaeontology B. Environmental Geology</b>	<b>3</b>	<b>50</b>	<b>1</b>
	<b>Paper – VI : A. Hydrogeology B. Mineral Exploration</b>	<b>4</b>	<b>100</b>	<b>4</b>

<b>VI</b>	<b>Practicals VI: A. Hydrogeology B. Mineral exploration</b>	<b>3</b>	<b>50</b>	<b>1</b>
-----------	------------------------------------------------------------------	----------	-----------	----------

**Total credits: 30**

**Skill Enhancement Courses (2 Credits)**

- 1. Mining Geology**
- 2. Engineering Geology**
- 3. Mineral Economics**
- 4. Field Geology**

**Generic Elective: (4 Credits)**

- 1. Earth Resources**

**Project work /Optional (Field work followed by visit to quarry or mine ) (4 credits)**

**B.Sc. Geology- I Year  
Semester – I**

Paper – I - Physical Geology & Crystallography

**(DSC - Compulsory)**

**Unit-1**

**Physical Geology – Earth**

Definition of Geology – Basic assumptions of Geology – Its relationship with other sciences – Branches of Geology – Aim and Applications of Geology.

**Earth:** Its shape, size and density – movement and their effects. Origin and age of earth. Interior of the earth. Geological processes – exogenic and endogenic, Definition of weathering – Types of weathering of rocks – physical and chemical; Definition of erosion and denudation, agents of erosion, cycle of erosion; erosion, transportation and deposition;

**Earth movements:** Definition of diastrophism, epirogeny and orogeny – mountains, continental drift and plate tectonics

**Wind:** Development of characteristic features by wind (arid cycle) erosion and deposition – pedestal rock-mushroom topography-Incelberg – Ventifacts – locus – sand dunes.

**Unit-2**

**Glaciers:** Definition of a glacier – types of glaciers – development of typical land forms by glacial erosion and deposition – cirque, U-shaped valley – hanging valley, monadnocks, moraines, drumlin. Eskers and Varves, Characteristic features of glaciated regions.

**Groundwater** –Storage of ground water – porosity, permeability, aquifer, water table, zone of saturation, artesian well, spring, geysers development of typical land forms by erosion and deposition by groundwater (Karst topography) - sinkhole, cavern, stalactites and stalagmites.

**Seas:** offshore profile – land forms of sea – marine deposits and coral reefs Lacustrine (Lake) deposits,

**Unit-3**

**Rivers:** Erosion, Transportation and deposition of river (fluvial) cycle in different stages – Development of typical land forms by river erosion and deposition. V-shaped valley. Waterfall, alluvial fans, natural levees, meander, ox-bow lakes, flood plains, peneplain and deltas. Types of rivers.

Atmospheric circulation, weather and climatic changes, land air, interaction. Earth's heat budget and global climatic changes.

Earth movements – definition of diastrophism, epirogenic and orogenic movements – Mountains. Geosynclines. Basic concepts of isostasy, continental drift and plate tectonics.

**Earthquakes:** Causes and kinds of earthquake waves and mode of propagation, intensity of earthquakes, Richters scale – seismograph and seismogram. Effects of earthquakes.

**Volcanoes:** Origin, products of Volcanoes.

#### **Unit-4**

**Crystallography :** Definition of a crystal – amorphous and crystalline states. Morphology of Crystals – face, edge, solid angle, interfacial angle.

Forms: Simple, combination, closed, and open forms.

Symmetry: Plane, axis, centre, crystallographic axes, Parameters, indices; crystallographic notation – parameter system of Weiss, index system of Miller

Classification of Crystals into 7 Systems.

Morphological study of the following classes of symmetry.

- I **Cubic system** – Normal Class – Galena type.
- II Tetragonal system – Normal Class - Zircon type
- III Hexagonal system - Normal Class – Beryl type
- IV Trigonal system - Normal Class - Calcite type
- V Orthorhombic system - Normal Class – Barytes type
- VI Monoclinic system - Normal Class – Gypsum type
- VII Triclinic system – Normal Class - Axinite type

### **B.Sc. Geology – I year**

#### **Semester - I**

Paper – I - Physical Geology & Crystallography Practicals

#### **(DSC - Compulsory)**

1. Study of Symmetry Elements of Seven Crystal Systems – Orientation and description of crystals from different crystal systems
2. Study of important geomorphological models and charts..

#### **SUGGESTED BOOKS**

1. Holmes Principles of Physical Geology by D.L.Holmes (1978).
2. Physical Geology by A.N.Strahler (1981).
3. Basic Physical Geology by E.S.Rkobinsion (1982).
4. Rutleys elements of mineralogy - H.H.Reed.
- 5.Elements of mineralogy - Mason and Berry.

**B.Sc. Geology I - Year**  
**Semester - II**  
Paper – II – Mineralogy and Optical Mineralogy  
**(DSC - Compulsory)**

**Unit-1**

**Mineralogy**

Definition of a mineral – classification of minerals into rock forming and ore minerals. Physical properties of minerals-colour, streak, play of colours, opalescence, asterism, transparency, luster, luminescence, specific gravity, magnetic properties, electrical properties, pyro and piezo electricity.

**Chemical properties of minerals-** Isomorphism, solid solution, polymorphism, allotropy, pseudomorphism, radioactivity; silicate structures.

**Modes of Formation of Minerals:** Occurrence and association of minerals.

**Unit-2**

**Descriptive Mineralogy**

Study of physical properties, chemical properties and mode of occurrence of the following mineral groups.

**Nesosilicate** Olivine, Garnet, Aluminum silicates

**Sorosilicate** Epidote

**Cyclosilicate** Beryl

**Unit-3**

**Descriptive Mineralogy**

Study of physical properties, chemical properties and mode of occurrence of the following mineral groups

**Inosilicate:** Pyroxene; Amphibole

**Phyllosilicate:** Mica, Hydrous magnesium silicate

**Tectosilicate:** Feldspars, Feldspathoids and Silica group

**Miscellaneous:** Staturolite, Tourmaline, zircon, Calcite, Corundum, Apatite.

**Unit-4**

**Optical Mineralogy:** Petrological microscope (polarizing) its mechanical and optical parts. Double refraction, Refractive Index, Construction of Nicol Prism.

Behavior of isotropic and anisotropic minerals between crossed nicols – extinction, pleochroism, interference colours. Definition of Uniaxial and Biaxial minerals.

**B.Sc. Geology I - Year**  
**Semester - II**

Paper – II – Mineralogy and Optical Mineralogy Practicals  
**(DSC - Compulsory)**

1. Study of physical properties and diagnostic features of the following minerals.  
Quartz, Jasper, Agate, Chalcedony, Amethyst, Flint, Chert, Orthoclase, Microcline, Plagioclase, Labradorite, Augite, Hornblende, Tremolite, Asbestos, Muscovite, Biotite, Zircon, Apatite, Corundum, Talc, Gypsum, Calcite, Serpentine.
2. Study of optical properties of following minerals.  
Quartz, Orthoclase, Microcline, Plagioclase, Hypersthene, Augite, , Hornblende, Muscovite, Biotite, Garnet, Olivine, Kyanite, Silliminite, Leucite, Calcite.

**SUGGESTED BOOKS**

1. A text book of mineralogy Rutleys Elements of mineralogy - H.H.Reed
2. Manual of optical mineralogy – C.S. Hurlburt and C.Klein.
3. Mineralogy for students- M.H. Baitey.
4. A text book of Mineralogy-E.S.Dana and W.E.Ford.
- 5.

**REFERENCE BOOKS**

1. An introduction to rock forming Minerals - Deer, Howie, and Zussman.
2. Elements of Mineralogy- Manson and Berry
3. Optical Crystallography - Wohlstorm.
4. Elements of optical mineralogy; an introduction to microscope petrography by Winchel, N.H. and - F.A. and A.N. Wichell (New ton Horace), Part-1
5. Manual of opaticalmineraology-Shelly

**B.Sc. Geology- II Year  
Semester – III**

**Paper – III:: Petrology**

**(DSC - Compulsory)**

**Unit-1**

Nature and scope of petrology – definition of rock, classification of rocks into igneous, sedimentary and metamorphic. Distinguishing features of three types of rocks.

**Igneous Rocks:** Classification into plutonic, hypabyssal and volcanic rocks; Forms – Lava flows, Intrusions, sills, laccolith, bysmalith, lopolith, dykes, ring dykes, cone sheets, volcanic necks, phacoliths and batholiths.

Structures – vesicular, amygdaloidal, block lava, ropy lava, pillow, flow, jointing and sheet structures. Plates, columnar and prismatic structures. Textures – Definition of texture, micro-structure, devitrification – allotrimorphic, Hypidiomorphic, panidiomorphic, porphyritic, poikilitic, ophitic, intergranular, intersertal trachytic graphic and micrographic textures.

Reaction structures – corona, myrmekitic, orbicular, spherulitic, pelitic.

**Unit-2**

Classification of Igneous rocks - CIPW and Tyrrell tabular classification.

**Descriptive Study of following rock types:** Granite, Granodiorite, Syenite, Nepheline syenite, Diorite porphyry, Pegmatite, Aplite, Gabbro, Anorthosite, Peridotite, Pyroxenite, Dunite, Dolerite, Rhyolite, Obsidian, Trachyte, Andesite and Basalt.

Composition and constitution of magma – Crystallization of Magma, Uni-component binary system, eutectic and solid solutions.

Origin of igneous rocks – Bowen's reaction principle, differentiation and assimilation.

**Unit-3**

**Sedimentary Rocks:** Sources of sediments – mechanical and chemical weathering, modes of transportation, stratification. Sedimentary structures, types of bedding, surface marks, deformed bedding solution structures.

**Classification of Sedimentary Rocks:** Clastic – rudaceous, arenaceous, argillaceous and non-clastic - calcareous, carbonaceous, ferruginous, phosphatic, evaporites. Descriptive Study of the following sedimentary rocks – Conglomerate, Breccia, Sandstone, Grit, Arkose, Greywacke, Shale, limestone, Shelly limestone.

**Unit-4**

**Metamorphic Rocks:** Definition of metamorphism, agents of metamorphism, types of metamorphism, grades and zones of metamorphism. Metamorphic minerals, stress and anti-stress minerals. Structures of metamorphic rocks – Cataclastic, maculose, schistose, granulose and gneissose. Textures of metamorphic rocks - crystalloblastic, palimpsest, xenoblastic, idioblastic.

Definition of anatexis and palingenesis. Descriptive study of the following metamorphic rocks. Gneiss, schist, slate, phyllite, quartzite, marble, eclogite, amphibolites, migmatite, charnockite and khondalite.

**B.Sc. Geology - II Year  
Semester – III**

**Paper – III:: Petrology Practicals**

**(DSC - Compulsory)**

1. Megascopic identification of Igneous rocks - Granite, Syenite, Diorite, Gabbro, Dolerite, Rhyolite, Basalt, Pegmatite, Schist,
2. Megascopic identification of Sedimentary rocks - conglomerate, Breccia, Sandstone, Grit, Arkose, Greywacke, Shale, limestone, Shelly limestone,
3. Megascopic identification of Metamorphic rocks - Gneiss, Schist, Quartzite, Marble, Charnockite and Khondalite.
  
4. Microscopic identification of Igneous rocks - Granite, Syenite, Diorite, Gabbro, Dolerite, Rhyolite, Basalt, Pegmatite,
5. Microscopic identification of Sedimentary rocks - Sandstone, Limestone, Grit, Shale,
6. Microscopic identification of Metamorphic rocks - Schist, Gneiss, Quartzite, Marble, Charnockite and Khondalite.

**SUGGESTED BOOKS**

1. The Principles of Petrology, G.W. Tyrrell.
2. Petrology - W.T.Huang.
3. Petrology for students - S.R.Nockolds Knox, Chinnar.
4. A Text book of Sedimentary Petrology - Verma& Prasad.



## **B.Sc. Geology - II Year**

### **Semester – IV**

#### **Paper – IV::Structural Geology and Economic Geology**

#### **(DSC - Compulsory)**

##### **Unit-1**

Definition of Structural geology. Aim and Objectives of the Structural Geology; Importance of study of structures, primary and secondary structures; outcrop, attitude of beds; strike, dip and apparent dip, use of clinometer.

##### **Unit-2**

Primary structures, Folds – description, nomenclature of folds, recognition of folds in the field. Joints – Geometrical and genetic classification of Joints.

Faults – Geometrical and genetic classification of faults, recognition of faults in the field, effects of faults on the outcrops. Unconformities – definition of unconformity – types of unconformities, recognition of unconformities in the field and distinguishing the faults from the unconformities. Definitions of overlap, of flap, outlier, cleavage, schistosity, foliation and lineation.

##### **Unit-3**

Definition of Economic Geology. Mineral resources and mineral deposits. Importance of economic minerals and rocks. Ore minerals, gangue minerals (gangue), industrial minerals. Tenor and grade; syngenetic deposits, epigenetic deposits. Classification of mineral deposits – Bateman's classification modified by Jensen. Processes of formation of mineral deposits; endogenetic and exogenetic processes.

##### **Unit-4**

Study of Ore deposits of gold, copper, lead, zinc, aluminum, iron, manganese, chromium, uranium and thorium, with respect to their mineralogy, mode of occurrence, origin, distribution in India and uses.

Distribution of Industrial Minerals in India for the following industries; Abrasives, cement, Ceramic, Glass, Fertilizers & Chemicals, Insulators)

**Fossil fuels:** Coal- origin and types of coal – coal deposits of India.

**Oil and Natural Gas:** Origin, migration and entrapment – and distribution in India, use of micropaleontology in oil exploration. **Atomic Minerals:** Uranite, Pitchblende. Beach sands: Monazite, Ilmenite, Rutile and Zircon. Mineral resources of Telangana

## **B.Sc. Geology - II Year**

### **Semester – IV**

#### **Paper – IV::Structural Geology and Economic Geology Practicals**

#### **(DSC - Compulsory)**

1. Study of Topographical maps.
2. Interpretation of simple geological maps with horizontal and inclined beds, unconformity, folds and faults with reference to the topography and structure, geological succession and history. **Section drawing (at least 8 maps)**
3. Problems dealing with true dip and apparent dip.
4. Bore-hole data thickness and width of the outcrop and dip of the beds (At least 8 problems).
5. Megascopic study, mode of occurrence, distribution in India and uses of the following economic minerals, haematite, magnetite, pyrite, pyrolusite, psilomelane, chalcopyrite, malachite, Azurite, Bauxite, chromite, galena, sphalerite, magnesite, gypsum, asbestos, graphite, zircon, fluorite, barytes, corundum, , calcite, kyanite, sillimanite, garnet and mica.

#### **SUGGESTED BOOKS**

1. Structural Geology - Marland. F.Billings.
2. An outline of structural Geology - E.S..Hills.
3. The Geology of Ore deposits. 1. Guilbert, J.M. and Park Jr., C.F. (1986) Freeman & Co.
4. Economic Mineral Deposits Bateman, A.M. and Jensen, M.L. (1990). John Wiley.
5. Ore Geology and Industrial minerals . Evans, A.M. (1993). John Wiley
6. Ore deposits of India their distribution and processing Gokhale, K.V.G.K. and Rao, T.C. (1978), Tata-McGraw Hill, New Delhi.
7. Industrial minerals and rocks of India. Deb, S. (1980). Allied Publishers.

**B.Sc. Geology- III Year  
Semester – V**

**Paper – V :: (A) Stratigraphy, Indian Geology and Palaeontology**

**(DSE – Elective I)**

**Unit-1**

Definition of stratigraphy, principles of stratigraphy, lithostratigraphy, standard geological time scale. Physiographic divisions of India with their stratigraphic and structural characteristics.

Brief study of type area, distribution in India, lithology, age, fossil content and economic importance of the systems Dharwar system, Cuddapah system, Vindhyan system, Kurnool system and Gondwana system.

**Unit-2**

Brief study of type area, distribution in India, lithology, age, fossil content and economic importance of the systems Triassic of Spiti, Jurassic of Kutch, Cretaceous of Tiruchirapalli, Deccan Traps and their Age, Siwaliks with vertebrate fossils. Geology of Telangana. Stratigraphic contact boundaries between Archaean and Proterozoic and Cretaceous and tertiary.

**Unit-3**

Definition of Palaeontology, conditions of fossilization, modes of preservation and uses of fossils. Phylum Protozoa, Phylum Coelenterata, Phylum Echinodermata, Phylum Brachiopod, Phylum Mollusca and Phylum Arthropoda..

**Unit-4**

Study of the following fossils with respects to their classification, morphology and geological distribution. Cidaris, Micraster, Holaster, Hemiaster, Terebratula, Spirifer, Rhynchonella, Productus, Turritella, Murex, Natica, Voluta, Pecten. Gryphaea, Arca, Cardita, Exogyra, Nautilus, Ammonoids, Bellemnites, Calymene, Paradoxide, Corals and Graptolites.

Plant fossils - glossopteris, gangamopteris, ptylophyllum.

**Note:** Phyla given in Units-3, are studied with respect to their classification morphology, and geological distribution.

**B.Sc. Geology- III Year  
Semester – V**

**Paper – V :: (A) Stratigraphy, Indian Geology and Palaeontology Practicals**

**(DSE – Elective I)**

1. Preparation of stratigraphic columns
2. Drawing and description of invertebrate fossils - Cidaris, Micraster, Holaster, Hemiaster, Terebratula, Spirifer, Rhynchonella, Productus, Turritella, Murex, Cypraea, Natica, Voluta, Pecten. Gryphaea, Arca, Cardita, Exogyra, Nautilus, Ammonoids, Bellemnites, Calymene, Paradoxide, Corals and Graptolites.
3. Drawing and description of plant fossils - Glossopteris, gangamopteris, ptylophyllum.

**SUGGESTED BOOKS**

1. Krishnan, M. S. (1982) Geology of India and Burma, CBS Publishers, Delhi
2. Doyle, P. & Bennett, M. R. (1996) Unlocking the Stratigraphic Record. John Wiley
3. Ramakrishnan, M. & Vaidyanadhan, R. (2008) Geology of India Volumes 1 & 2, Geological society of India, Bangalore.
4. Valdiya, K. S. (2010) The making of India, Macmillan India Pvt. Ltd.
5. Raup, D. M., Stanley, S. M., Freeman, W. H. (1971) Principles of Paleontology
6. Clarkson, E. N. K. (2012) Invertebrate paleontology and evolution 4th Edition by Blackwell Publishing

**B.Sc. Geology- III Year  
Semester – V**

**Paper – V :: B Environmental Geology**

**(DSE – Elective II)**

**Unit-1**

Fundamental concepts of Environmental Geology-Environmental geoscience–it's scope, objectives, and aims. Environmental Awareness - Role of Geologist in Environmental Protection and Planning. Earth's thermal environment and Climates. Global warming. Green house effect. Ozone depletion–Ice sheets and fluctuation in sea levels. Concepts of ecosystem. Earth's major ecosystems terrestrial and aquatic.

**Unit-2**

Earth resources – Air, water and soil. Pollution of natural resources. National and International standards. Constructions and urbanization. Waste disposal – Environmental effects – Waste recycling – recycling of resources. Land Cover-Application of remote sensing, mapping soil cover, forest cover, degraded land, surface water reservoirs.

**Unit-3**

Mining: opencast, underground, solid waste generation, dumping stacking, rehandling, management, mineral processing, tailing ponds, acid mine drainage, siltation, case studies. Noise levels - national standards. Fundamental concepts of geological hazards and crisis management. Mining impact on the environment – Health Hazards – Minerals resource depletion. Environmental considerations in location and construction of dams, reservoirs and tunnels.

**Unit-4**

Study of surface geological processes, earthquakes, volcanism, floods and landslides with reference to their impact on environment. Soils, erosion and conservation. Beach erosion – sedimentation – coastal zone protection & Management – coastal engineering constructions – their effects remedial measures.. Geological solutions to environmental problems. Role of geology in waste disposal, Global warming, Climate change and Mitigation. Environmental planning, management and economics (EMP and EIA).

**B.Sc. Geology- III Year  
Semester – V**

**Paper – V :: B Environmental Geology Practicals**

**(DSE – Elective II)**

Soil testing- Grain size analysis - Mineralogy

Beach cycles - Measurement of beach profiles - Estimation of erosion and sedimentation. Chemical analysis of water & sediments.

**SUGESTED BOOKS**

1. K.S. Valdiya - Text book of Environmental Geology
2. Strahler - Environmental Geology
3. Lindgren - Environmental Geology
4. Keller - Environmental Geology

**B.Sc. Geology III Year  
Semester – VI**

**Paper – VI :: A. Hydrogeology**

**(DSE- Elective I)**

**Unit-1**

**Introduction:** Definition of Hydrology and Hydrogeology. Scope and application of Hydrogeology. **Hydrological Cycle:** Concept of Hydrological cycle, Evaporation, Condensation, Precipitation, Infiltration, Transpiration, Evapo-transpiration and Runoff. Connate water and Juvenile water. **Ground Water:** Origin, Occurrence, and age of groundwater. Vertical distribution of sub-surface water, zone of aeration - soil water, vadose water, capillary fringe. Zone of saturation – water table. Perched water table. Recharge and discharge areas. Drainage basins and their physical characteristics.

**Unit-2**

**Aquifers :** Definition of aquifer, Aquitard, Aquiclude, Aquifuge. Properties of Aquifer– Porosity, retention of water in rocks, yield of water from rocks (specific yield and specific retention), Darcy's law, permeability, hydraulic conductivity, velocity of groundwater flow. Transmissivity, Storage Co-efficient and Storativity. Types of aquifers - confined, semi-confined, unconfined, semi-unconfined, homogeneous, heterogeneous, isotropic and anisotropic aquifers. Igneous, sedimentary and metamorphic rocks as aquifers.

**Unit-3**

**Quality of Groundwater:** Physical, Chemical and Bacteriological characteristics of groundwater. Suitability of groundwater for drinking, Irrigation and Industrial purposes. **Pollution of Groundwater:** Pollution in relation to water use. Urban, industrial and agricultural sources and causes of pollution. Brief account of saline water intrusion.

**Unit-4**

**Groundwater Investigations:** Scope of investigations, Methods of groundwater exploration, Brief account of Geologic, hydrogeologic, Geo-botanical investigations, Introduction to Remote Sensing techniques.

**Geophysical Exploration:** Basic principles of Geophysical exploration methods, Electrical methods–Schlumberger & Wenner configuration, Resistivity profiling and Vertical Electrical Sounding.

**Management of Groundwater:** Groundwater balance, recharge, (natural and artificial) and discharge, static and dynamic reserves, Safe substantial and mining yields and over draft. Groundwater provinces of India.

**B.Sc. Geology III Year  
Semester – VI**

**Paper – VI :: A. Hydrogeology Practicals**

**(DSE- Elective I)**

1. Calculation of porosity and permeability.
2. Grain size analysis - uniformity co-efficient.
3. Ph Electrical conductivity and total dissolved solids.
4. Well inventory data collection.
5. Preparation of water table contour map and depth to water level map;.
6. Electrical Resistivity - Schlumberger method and VES.
7. Observation Satellite imagery for Geological Information

**Field work:** 3 periods per week ( Batch strength 12 ) field training.

**Camp:** - One week during vacation

**SUGGESTED BOOKS:**

1. Todd, D. K. 2006. Groundwater hydrology, 2nd Ed., John Wiley & Sons, N.Y.
2. Davis, S. N. and De Weist, R.J.M. 1966. Hydrogeology, John Wiley & Sons Inc., N.Y.
3. Karanth K.R., 1987, Groundwater: Assessment, Development and management, Tata McGrawHill Pub. Co. Ltd.



**B.Sc. Geology III Year**

**Semester VI**

**(DSE- Elective-II)**

**Paper-VI:: B. Mineral Exploration**

**Unit-1**

Definition and scope of mineral prospecting and exploration. Principles of mineral exploration. Physiographic, lithological, structural and stratigraphic guides. Prospecting and exploration- conceptualization, methodology and stages, Sampling, subsurface sampling including pitting, trenching and drilling, Geochemical exploration.

**Unit-2**

Geochemical, geophysical, aerial and remote sensing techniques in mineral exploration. Geochemical prospecting – Primary and secondary dispersion, Geochemical association and pathfinders. Geophysical exploration - brief description and application of gravity, magnetic, seismic, electrical and radioactive methods.

**Unit-3**

Evaluation of data Evaluation of sampling data Mean, mode, median, standard deviation and variance.

Drilling and Logging Core and non-core drilling. Planning of bore holes and location of boreholes on ground Core-logging

**Unit-4**

Reserve estimations and Errors Principles of reserve estimation, density and bulk density Factors affecting reliability of reserve estimation Reserve estimation based on geometrical models (square, rectangular, triangular and polygon blocks) Regular and irregular grid patterns, statistics and error estimation

**B.Sc. Geology III Year**

**Semester VI**

**(DSE- Elective-II)**

**Paper-VI:: B. Mineral Exploration Practicals**

1. Identification of anomaly
2. Concept of weighted average in anomaly detection
3. Geological cross-section
4. Models of reserve estimation –

**SUGGESTED BOOKS**

1. Clark, G.B. 1967. Elements of Mining. 3rd Ed. John Wiley & Sons.
2. Arogyaswami, R.P.N. 1996 Courses in Mining Geology. 4th Ed. Oxford-IBH.
3. Moon, C.J., Whateley, M.K.G., Evans, A.M., 2006, Introduction to Mineral Exploration, Blackwell Publishing.

## **Skill Enhancement course I**

### **Mining Geology**

(Credits: 02)

30 hours

#### **Unit-1**

Introduction to mining, elements of mining, definitions and explanation of different mining terms.

Types of Mining Methods-Alluvial Mining – pan and Beta. Open Cast Mining –Bench Mining- Glory Hole Mining, Kaolin Mining, Strip Mining.

Underground Mining- Gophering, Breast, Stopping, Open overhand stopping, Underground Glory Hole Mining. Pillar and Chamber Method, Sub-Level Stopping Method. .

#### **Unit-2**

Coal Mining Method – Panel System, Board and Pillar Method, Long wall Mining, Advance and Retreat, Horizon. Mine Supports, Lighting Ventilation. Introduction to underground metal mining; Deposits amenable to underground metal mining;, modes of entry to underground mineral deposits; Mine development: drifting, raising and winzing; Classification of underground metal mining methods: general description, applicability and operations involved.

#### **SUGGESTED BOOKS**

1. Mining geology. Mckcnistry.
2. Principles of Mine Planning -Jayanth Bhattacharya. Allied Publ.
3. Mining Geology - R. N. P. ArogyaSwamy.

## **Skill Enhancement course II**

### **Engineering Geology**

(Credits: 02)

30 hours

#### Unit-1

Geology vs. Engineering, Role of Engineering geologists in planning, design and construction of major man-made structural features. Site investigation and characterization. Foundation treatment; Grouting, Rock Bolting and other support mechanisms. Intact Rock and Rock Mass properties Rock aggregates; Significance as Construction Material.

#### Unit-2

Geological, Geotechnical and Environmental considerations for Dams and Reservoirs. Tunnels and Tunneling Methods Unit 7: Landslides; Causes, Factors and corrective/Preventive measures Unit 8: Earthquakes; Causes, Factors and corrective/Preventive measures. Case histories related to Indian Civil Engineering Projects

#### SUGGESTED BOOKS:

1. Krynin, D.P. and Judd W.R. 1957. Principles of Engineering Geology and Geotechnique, McGraw Hill (CBS Publ).
2. Johnson, R.B. and De Graf, J.V. 1988. Principles of Engineering Geology, John Wiley.
3. Goodman, R.E., 1993. Engineering Geology: Rock in Engineering constructions. John Wiley & Sons, N.Y.
4. Waltham, T., 2009. Foundations of Engineering Geology (3rd Edn.) Taylor & Francis.
5. Bell: F.G-, 2006. Basic Environmental and Engineering Geology Whittles Publishing.
6. Bell, .F.G, 2007. Engineering Geology, Butterworth-Heineman

## Skill Enhancement course III

### Mineral Economics

(Credits: 02)

30 hours

#### Unit-1

The study of mineral economics, review of economic concepts and theories. Minerals and economic development, mineral abundance - curse or blessing. Specifications for important minerals for industrial use. Mineral markets, Import-Export policies and International Trade. Royalty and Taxes. India's status in mineral production. Demand analysis of minerals, changing patterns of mineral consumption and substitution.

#### Unit-2

Exhaustible resource scarcity; scarcity and economic growth. Theory of mineral supply; optimal rate of mineral depletion; National mineral policies. Mines and Minerals (Development and Regulation) act. Mineral Concession Rules. Marine mineral resources and laws of sea. Economics of mineral exploration; cost of exploration. Role and content of mining plan. Mineral price and pricing mechanism. Feasibility study and valuation of mineral property. Conservation of mineral resources – scope and limitations. Raw materials grade control aspects in mines.

#### SUGGESTED BOOKS

1. Mineral Economics & policy by John E. Tilton.
2. Mineral Resources, Economy and the Environment, 2<sup>nd</sup> Edition: Stephen E. Kesler.
3. An introduction to Mineral Economics by Chatterjee, K. k
4. Mineral Economics. K. k. Sinha.

## **Skill Enhancement course IV**

### FIELD GEOLOGY

(Credits: 02)

30 hours

#### Unit 1:

Orientation of Topographic sheet in field, marking location in toposheet, Bearing (Front and back). Concepts of map reading, Distance, height and pace approximation

#### Unit 2:

Identification of rock types in field; structures and texture of rocks, Use of hand lense. Basic field measurement techniques: Bedding dip and strike, Litholog measurement. Reading contours and topography

#### SUGGESTED BOOKS

Field Geology by F. H. Lahee, 6<sup>Th</sup> Edition, CBS Publishers

**B.Sc. Geology- III Year  
Semester –V**

**Earth Resources(Generic Elective)** Total: 48 hrs (4 Hrs / week)

**Unit 1:**

Earth Resources Resource reserve definitions; mineral, energy and water resources in industries Historical perspective and present A brief overview of classification of mineral deposits with respect to processes of formation in relation to exploration strategies

**Unit 2:**

Definition of Energy: Primary and Secondary Energy Difference between Energy, Power and Electricity Renewable and Non-Renewable Sources of Energy The concept and significance of Renewability: Social, Economic, Political and Environmental Dimension of Energy

**Unit 3:**

Major Types and Sources of Energy Resources of Natural Oil and Gas Coal and Nuclear Minerals Potential of Hydroelectric Power, Solar Energy, Wind, Wave and Biomass Based power and Energy

**Unit 4:**

Energy Sources and Power Generation: Nuclear, Hydroelectric, Solar, Wind and Wave-General Principles. Ground water resources and its role in economic development of a country Current Scenario and Future Prospects of Solar Power, Hydrogen Power and Fuel Cells.

**Suggested Books:**

1. Energy and the Environment by Fowler, J.M 1984. McGraw-Hill
2. Global Energy Perspectives by Nebojsa Nakicenovic 1998, Cambridge University Press.
3. Energy Resources and Systems: Fundamentals and Non-Renewable Resources by Tushar K. Ghosh and M. A. Prelas. 2009, Springer
4. Introduction to Wind Energy Systems: Hermann-Josef Wagner and Jyotirmay Mathu

**Field training camp** :Ten days ( compulsory) during vacation

**Question paper pattern**

Faculty of Science

GEOLOGY

Title of the paper:

Paper:

Duration: 3Hrs]

[Max. Marks : 80

**Section-A: Short Answer Questions**

**(8 x 4 = 32)**

**Answer any EIGHT questions**

1. Unit – I
2. Unit – I
3. Unit – I
4. Unit – II
5. Unit – II
6. Unit – II
7. Unit – III
8. Unit – III
9. Unit – III
10. Unit – IV
11. Unit – IV
12. Unit – IV

**Section B: Essay Answer Questions**

**(4 x 12 = 48)**

13 (a) Unit – I

OR

(b) Unit – I

14 (a) Unit – II

OR

(b) Unit – II

15 (a) Unit – III

OR

(b) Unit – III

16 (a) Unit – IV

OR

(b) Unit – IV

\* \* \* \* \*