

B.Sc., Revised Geology CBCS Syllabus 2020-21

Structure of the Programme

| Year | Semester | Paper | Subject | IA | EA | Total |
|------|----------|-------|--|----|----|-------|
| 1 | I | I | Physical Geology, Crystallography & Mineralogy | 25 | 75 | 100 |
| | II | II | Petrology & Structural Geology | 25 | 75 | 100 |
| 2 | III | III | Indian Geology & Palaeontology | 25 | 75 | 100 |
| | IV | IV | Economic Geology & Mineral Exploration | 25 | 75 | 100 |
| | | V | Mining Geology & Ore Dressing | 25 | 75 | 100 |

Course Objectives

The aims and objectives of UG educational programs in science in general and Geology in particular should be structured to:

- Create the facilities and environment in all the educational institutions to introduce and consolidate the knowledge acquired at +2 level and to motivate and inspire the students to create deep interest in Geology, to develop broad and balanced knowledge and understanding of geological concepts, principles and theories of stratigraphy, geological mapping, exploration of natural resources and understand Earth evolution.
- Learn, design and perform experiments in the labs to demonstrate the concepts, principles and theories learned in the classrooms.
- Develop the ability to apply the knowledge acquired in the classroom and laboratories to specific problems in theoretical and applied Geology.
- Expose the student to the vast scope of Geosciences as a theoretical and experimental science with applications in solving most of the geogenic problems in nature spanning from disaster management, watershed management, water pollution, oil exploration and mining, etc.
- Emphasize the need for integrating Geosciences as one of the most important branch of science for pursuing the interdisciplinary and multidisciplinary higher education and/or research in interdisciplinary and multidisciplinary areas.
- To emphasize the importance of Geology as the most important discipline for sustaining the existing industries and establishing new ones to create job opportunities at all levels of employment.

SEMESTER-I
Paper- I - Physical Geology, Crystallography & Mineralogy

Unit –I (12 hrs)

Definition of geology - Branches of geology - Origin and age of the earth. Geological process of weathering- types of weathering of rocks- Physical and chemical; erosion, transportation and deposition.

Rivers: Erosion, transportation and deposition of rivers-Development of typical land forms by river erosion and deposition. Definition of a glacier - types of glaciers - development of typical land forms by glacial erosion and deposition.

Unit-II (12hrs)

Wind: Development of characteristic features by wind. Geological action of winds-Wind erosion, transportation, and deposition. Landforms caused by wind.

Earthquakes: earthquake waves, causes of earthquakes, Richter's scale - seismograph and seismogram. Effects of earthquakes – Interior of the earth based on seismic theory.

Volcanoes: origin, types and products of Volcanoes.

Continental Drift & Plate tectonic Theory.

Unit-III(12 hrs)

Definition of a crystal - amorphous and crystalline states. Morphology of Crystals - interfacial angle. Types of Crystal Forms: Elements of Symmetry. Crystal Parameters, parameter system of Weiss, index system of Miller. Classification of crystals into systems.

Morphological study of the following classes of symmetry

- I. Cubic system – Galenatype
- II. Tetragonal system - Zircontype
- III. Hexagonal system - Beryltype
- IV. Trigonal system - Calcitetype.
- V. Orthorhombic system - Baritetype
- VI. Monoclinic system - Gypsum type-
- VII. Triclinic system - Axinitetype

Unit-IV (12 hrs)

Definition of a mineral - Physical properties of minerals - Colour, streak, lustre, hardness, cleavage and fracture. Silicate structures- Study of physical properties, chemical composition and mode of occurrence of the following mineral groups: Quartz, Feldspar, Pyroxenes, Amphiboles and Mica.

Unit-V (12 hrs)

General Principles of optics, Isotropic and anisotropic minerals. Polarised light, refractive index, double refraction, uniaxial and biaxial minerals – Nicol prism and its construction. Petrological microscope (Polarising) - its mechanical and optical parts – optical properties of Minerals - extinction, pleochroism and interference colors.

Practical –I: Physical Geology, Crystallography & Mineralogy (50 Marks)

Physical Geology

Study of important geomorphological models.

Crystallography

Study of symmetry and form of the Normal classes of seven crystal systems of the following:

1. Cubic system – Galena type
Tetragonal system – Zircon type
2. Hexagonal system – Beryltype
3. Trigonal system – Calcitetype
4. Orthorhombic system – Baritestype
5. Monoclinic system – Gypsumtype
6. Triclinic system – Axinitetype

Mineralogy & Optical Mineralogy

Study of physical properties and diagnostic features of the following mineral: Quartz Jasper, Agate, Chalcedony, Amethyst, Orthoclase, Microcline, Plagioclase, Hypersthene, Augite, Hornblende, Actinolite, Tremolite, Asbestos, Muscovite, Biotite, Phlogopite, Olivine, Epidote, Garnet, Kyanite, Sillimanite, Andalusite, Beryl, Apatite, Corundum, Talc, Gypsum, Calcite, Fluorspar and Serpentine.

Study of optical properties of the following minerals:

Quartz, Orthoclase, Microcline, Plagioclase, Hypersthene, Augite, Tremolite, Hornblende, Muscovite, Biotite, Olivine, Epidote, Garnet, Kyanite, Beryl, Calcite.

Course learning outcome:

- The study of this paper strengthens student's knowledge with respect to understanding the essentials of the structural dynamics of the earth.
- Studying the basics of mineralogy and crystallography helps in understanding and building the overall knowledge in Geology.

Text Books

1. Holmes Principles of Physical Geology- D.L.Holmes
2. An Introduction to Crystallography - R.C.Phillips
A textbook of mineralogy - E.S. Dana and W.E. Ford.
3. Rutleys elements of mineralogy - H.H.Reed
4. Elements of Crystallography - F.A.Wade and R.B.Matrix

Reference Books:

1. Manual of mineralogy - C.S. Hurlbut and C.Klein
2. Mineralogy for students - M.H.Batey.
3. An introduction to rock forming minerals - Deer, Howie, and Zussman.
4. Elements of mineralogy - Mason and Bern.
5. Essential of Crystallography- E.Flint.
6. Basic Physical Geology- E.S.Robinson
7. Physical Geology- B.F. Mallory and D.N.Gargo
8. A textbook of mineralogy-E.S. Dana and W.E.Ford
9. A book of Physical Geology -A K Datta
10. Physical Geology - A.N.Strahler
11. Principles of Physical Geology, Chapman and Hall, London. Arthur Holmes (1992)
12. A Text Book of Physical Geology, CBS Publishers, Mahapatra G.B. (1994)
13. Miller, (1949) An Introduction to Physical Geology. East West Press Ltd

II-SEMESTER
Paper-II-Petrology and Structural Geology

Unit-I (12 hrs)

Nature and scope of petrology - Forms of Igneous Rocks - Sills, laccolith, lopolith, dykes, ring dykes, Batholiths – Structures of Igneous Rocks.

Textures of Igneous Rocks- Definition of texture,-, porphyritic, poikilitic, ophitic, intergranular, trachytic and graphic textures. Classification of igneous rocks - CIPW and Tyrrell tabular classification. Origin of igneous rocks-Bowen's reaction principle, differentiation of magma.

Unit-II (12 hrs)

Sedimentary Processes, Sedimentary structures - Types of bedding, surface marks, Textures of Sedimentary Rocks.

Classification of sedimentary rocks; clastic - rudaceous, arenaceous, argillaceous, non-clastic-calcareous, carbonaceous, evaporites.

Unit-III (12 hrs)

Metamorphism - agents of metamorphism, types of metamorphism. Structures of metamorphic rocks - Cataclastic, maculose, schistose, granulose and gneissose. Textures of metamorphic rocks- crystalloblastic, xenoblastic.

Classification of metamorphic rocks. Cataclastic, thermal, dynamo-thermal metamorphism of argillaceous and arenaceous rocks.

Unit-IV (12 hrs)

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 and dip. Use of clinometers, Folds -description, nomenclature of folds-Geometrical and genetic classification.

Unit-V (12 hrs)

Geometrical and genetic classification of Joints and Faults. Recognition of faults in the field.

Unconformities- types of unconformities. Recognition of unconformities in the field.

Practical- II-Petrology and Structural Geology (50 Marks)

Petrology

Megascopic and microscopic study of the following igneous rocks: Dunite, Peridotite, Granite, Syenite, Diorite, Gabbro. Dolerite, Basalt and Pegmatite.

Megascopic and microscopic study of the following sedimentary rocks:

Conglomerate, Breccia, Sandstone, Shale, Limestone and its varieties.

Megascopic and microscopic study of the following rocks: Schist, Gneiss, Quartzite, Marble, slate, phyllite, charnockite and khonodolite.

Structural Geology

Study of topographical maps: 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. Geological Section drawing (at least 8 maps) Problems dealing with true dip and apparent dip. Bore-hole data thickness and width of the outcrop and dip of the beds (At least 8 problems for each method).

Course learning outcome

- On completion of the course the students will have gained an understanding of the processes involved in the formation of igneous, sedimentary and metamorphic rocks, their textures, structures, classifications and their importance.
- The course deals with geological structures like faults, folds, joints and unconformities resulting from the action of these forces on rocks. The student will gain knowledge of the geometry of the rock structures, understand the mechanism of the evolution of rock structures and its application in the field.

Text books

1. Principles of petrology- G.W.Tyrrell
2. Sedimentary Rocks-F.J.Peettijohn

Reference Books:

1. IgneousPetrology-Hyndman
2. A Text book of sedimentary petrology -Verma&Prasad
3. Petrology of the sedimentary rocks -J.T.Greehsmith
4. Petrology of the igneous rocks -F.KHatch, Wells andWells.
5. Ram S. Sharma (2016) Metamorphic Petrology Concepts and Methods. Text Book Series, Geological Society of India, Bangalore
6. Bose M.K. (1997) Igneous Petrology. The World Press Pvt. Ltd. 568 p.
7. Turner, F.J., (1980) Metamorphic petrology. McGraw Hill.
8. Mason, R., (1978) Petrology of Metamorphic Rocks. CBS Publishers.
9. Jain, A.K., (2014) An introduction to structural geology. Text Book series in Geological Sciences for Graduate Students. Geological Society of India, Bangalore.
10. Billings, M.P., (1972) Structural Geology. Prentice Hall.

SEMESTER-III
Paper- III- Indian Geology & Paleontology

Unit-I (12 hrs)

Principals of stratigraphy. Standard geological time scale, Physiographic divisions of India. Brief study of type area, distribution in India, lithology, fossil content and economic importance of the following systems-Dharwar system, Cuddapah system, Vindhyan system.

Unit-II (12 hrs)

Brief study of type area, distribution in India, Lithology, fossil content and economic importance of Gondwana system, Triassic of Spiti, Jurassic of Kutch, Cretaceous of Trichinopoly, Deccan Traps and their Age, Siwaliks with vertebrate fossils.

Unit-III (12 hrs)

Definition of Paleontology, Branches of Paleontology, conditions of fossilization, modes of preservation and uses of fossils. Index Fossils. Detailed study of morphology, classification and geological distribution of Corals and Brachiopoda.

Fossils: Calceola, Zaphrentis, Terebratula, Spirifer, Rhynchonella, and Productus,

Unit-IV (12 hrs)

Detailed study of morphology, classification and geological distribution of Gastropods, Cephalopoda and Lamellibranchia;

Fossils: Turritella, Natica, Physa, Pecten. Gryphaea, Arca, Cardita, Nautilus. Ammonoids, Ceratites, Bellemnites.

Unit- V (12 hrs)

Detailed study of morphology, classification and geological distribution of Trilobita, Echinodermata, Graptolites and Plant fossils. Fossils: Calymene, Paradoxide, Cidaris, Micraster, Hemiaster, Monograptus, Diplograptus, Glossopteris, Gangamopteris and Ptylophyllum.

Geology Practical III-Paleontology

Drawing and description of invertebrate and plant fossils as per the list mentioned in the theory syllabus. Classification, morphology and geological distribution.

Fossils: Cidaridites, Micraster, Hemiaster, Cererium, Terebratulites, Spirifer, Rhynchonella, Productella, Turritella, Natica, Physa, Pecten, Gryphaea, Arca, Cardita, Nautilus, Ammonites, Ceratites, Bellemnites, Calymene, Paradoxides. Corals. Plant fossils Glossopteris, Gangamopteris and Ptilophyllum.

Course learning outcome:

- The Indian sub-continent exposes a wide range of lithologies that span from 3.6 billion years to present. The geology of India is synonymous with the geology of the world and its ancient rock types from the Indian Peninsula, Cretaceous Deccan volcanism and Tethyan sediments exposed in the mighty Himalayas is noteworthy. The student will gain knowledge about the stratigraphy and geology of India with emphasis on the Stratigraphy of India with respect to Paleozoic, Mesozoic and Cenozoic Era which will help in understanding the different episodes on the earth during the geologic past.
- The study of Paleontology encompasses the aspects of the age of the earth, chronological arrangement of rocks and appearance and evolution of life through the geologic time. The knowledge of paleontology would enable the students to understand the changes that occurred in the history of the earth and relate them to their field observations.

Text books:

1. Invertebrate Paleontology - Henry Woods.
2. Geology of India & Burma- MS Krishnan
- 3.

Reference Books:

1. An introduction to Paleontology - Jain, P. C. et al.
2. Principles of stratigraphy - Dunbar & Rodgers.
3. Fundamentals of Historical Geology and Stratigraphy - Ravindra Kumar
4. Ramakrishnan M, and Vaidynadhan, R (1994) Geology of India, Geological Society of India Publication, Bangalore. Vol. I & II.
5. Valdiya K.S. (2010) The Making of India: Geodynamic Evolution, Springer
6. Valdiya K.S. (1984) Aspects of tectonics, Tata McGrath Hill.
7. Ravindra Kumar (2018) Fundamentals of Historical Geology and Stratigraphy of India, New age Publications.

SEMESTER-IV

Paper-IV: Economic Geology and Mineral Exploration

Unit-I(12hrs)

Definition of Economic geology, mineral resources and mineral deposits, importance of economic minerals. Ore and gangue minerals. Classification of mineral deposits - Bateman's classification modified by Jensen.

Unit – II(12hrs)

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

Unit- III(12hrs)

Distribution of industrial minerals in India for the following industries – Refractories, Abrasives, cement and Ceramic. Fossil fuels: Occurrence, origin and distribution of Coal, Petroleum and Natural Gas deposits.

Atomic minerals - uranium and thorium with respect to their mineralogy. Mineral resources of Andhra Pradesh.

Unit -IV (12hrs)

Scope of mineral prospecting and exploration. Structural and lithological guides. Geochemical prospecting – primary and secondary dispersion – Geochemical association and path finders. Geophysical Exploration - brief description and application of gravity method, Magnetic Method and Seismic methods – Brief description and application of Gravity, magnetic and seismic methods.

Unit-V (12 hrs)

Brief description and application of electrical and radioactive methods.

Photogeology – Aerial photographs, Remote sensing.

Sampling Technique: Definition of sampling, Methods of sampling – Channel, chip, grab, car, groove, wagon, Pitting and trenching and drill hole sampling.

Practical IV-Economic Geology & Mineral Exploration

Economic Geology

Megascopic study of economic minerals: mode of occurrence, distribution in India and uses. Hematite, Magnetite, Pyrite, Pyrolusite, Psilomelane, Chalcopyrite, Malachite, Bauxite, Chromite, Galena, Sphalerite, Magnesite, Gypsum, Asbestos, Steatite, Graphite, Illmenite, Fluorite, Baryte, Corundum, Topaz, Calcite, Kaolinite, Kyanite, Sillimanite, Garnet and Mica.

Mineral Exploration

Estimation of ore reserves: Bedded type and vein type (Extended area and included area methods problems)

Course learning outcome:

- By the end of this course the student will have learnt about techniques of mineral exploration and exploitation, estimation of ore reserves, environmental impact of mining, and the importance conservation of mineral resources and also the exogenetic and endogenetic process of formation.

Text Books :

1. Economic Geology - A.M. Batman
2. Ore deposits of India - Ghokale and Rao

Reference Books

1. Mineral Economics - R.K. Sinha & N.L. Sarma.
2. Industrial Minerals – Deb
3. Mining Geology - McKinnstry
4. Indian mineral resources - S. Krishnaswamy
5. An Introduction to the Ore Geology - A.M. Evans
6. Geology & mineral resources of Andhra Pradesh - N.V.B.S. Dutt
7. Mineral Resources of Andhra Pradesh - Dr. P.K. Ramam
8. Courses in Mining Geology IBH Publishers Arogyaswamy RNP (2017)

SEMESTER-IV
Paper-V: Mining Geology and Ore Dressing

Unit I (12hrs)

Mining methods- Classification of mining methods; criteria for selection of mining method.

Brief description of quarrying, open cast mining methods - Stepping and Bench forms, Transport, Earth movers. Mine explosives.

Unit-II(12 hrs)

Underground mining methods- Shafts, Cross-cuts, Tunnels, Mine ventilation, Mine supports, Drainage, Pumping, Mine Haulage. Stopping methods in mining. Mining hazards and Safety measures.

Unit-III(12 hrs)

Mineral Processing- necessity and advantages of concentration. Ore dressing techniques- Crushing, Grinding, Jigging, Froth flotation method, Gravity separation, Heavy fluid separation, Magnetic separation method and Sieve analysis.

Unit-IV (12 hrs)

Drilling methods- Rotary drilling, Percussion drilling, Diamond drilling, Churn drilling, Cable tool drilling and Auger drilling.

Unit-V (12 hrs)

Mineral economics: Principles of mineral Economics. Classification of mineral deposits. National Mineral policy. Mineral concession Rules. Mineral conservation and substitution.

Practical V 50 Marks Mining Geology and Ore Dressing

Study of ore and industrial minerals collected in mines.

Field work: Submission of Field Report. Field work in the neighboring areas and also other places of geological importance.

Note: Field training camp: Ten days during vacation/ Working Days

Course learning outcome:

- By the end of this course the student will have learnt about some of the society's most important problems such as mining methods both open cast mine, quarry and underground mining methods, the environmental climate change, and proper utilization of mineral resources in day to day life.

Text Books:

1. Courses in mining geology -R.N.P.Arogyaswamy
2. Mining geology –McKinnstry

Reference Books:

1. Geological prospecting and exploration -V.M.Kneiter
2. Mineral economics -R.K.Sinha & N.L.Sarma
3. Practical Manual of Exploration and Prospecting. CBS Publishers, Babu SK & Sinha DK (1988)