

COURSE OF STUDY

(GEOLOGY)

BABA BHAIRABANANDA (AUTONOMOUS)

MAHABIDYALAYA

CHANDIKHOLE, JAJPUR, 755044

GEOLOGY (HONOURS)

1ST YEAR

SEMESTER-I

C: 1-GEOLOGY-I

(Credit: 6, Theory: 4, Practical: 2)

Theory: 70 Marks, Practical: 30 Marks

Theory: 40 Classes (1hr duration)

CCG: 1

UNIT- I: General geology-A

Geology - its perspective, scope and subdivisions; Earth in the Solar system; Origin of the Earth, Seismology and internal structure of the earth; Radioactivity and age of the earth.

UNIT-II: General geology-B

Volcanoes: Types, products and distribution. Earthquakes - intensity, causes and distribution.

UNIT-III: Geomorphology-A

Weathering and Erosion, Mass wasting; Geological works of rivers, glaciers, and landforms produced by them.

UNIT-IV: Geomorphology-B

Geological works of wind, underground water and oceans and landforms produced by them.

UNIT-V: Quaternary Geology

Scope, climate change, eustatic movement and other geological phenomena during Quaternary; Landforms and deposits with special reference to India; Neotectonics; Glaciation and its causes; Sea-level change during Quaternary.

PRACTICAL

Study of geomorphic forms. Study of contour patterns and drawing of profiles. Laboratory records and viva voce.

C: 2-GEOLOGY-II

(Credit: 6, Theory: 4, Practical: 2)

Theory: 70 Marks, Practical: 30 Marks

Theory: 40 Classes (1 hr. duration)

CCG: 2

UNIT-I: Geotectonics-A

Tectonic movements Epeiorogeny and orogeny; Isostasy concept and theories; Geosynclines; Mountain building theories.

UNIT-II: Geotectonics-B

Plate tectonics concept and types of plate margins; Continental drift evidences and causes; Sea-floorspreading; Mid-oceanic ridge; Island arc.

UNIT-III: Photogeology

Principles of aerial photography; Scale, photo-elements and interpretation. Application of aerial photography in mineral exploration, ground water exploration and geomorphology.

UNIT-IV: Remote Sensing

Principles of remote sensing, Electromagnetic radiation, Scale, Sensors; Platforms, Photo mosaic and FCC. Application of remote sensing in mineral exploration, ground water exploration and geo- morphology.

UNIT-V: Marine Geology

Relief of ocean floor; Marine sediments and their classification; Marine resources; Submarine canyons, Sea mounts and guyots; Coral reef.

PRACTICAL

Study of aerial photographs and uses of stereoscopes. Laboratory records and viva voce.

SEMESTER-II

C: 3-GEOLOGY-III

(Credit: 6, Theory: 4, Practical: 2)

Theory: 70 Marks, Practical: 30 Marks

Theory: 40 Classes (1 hr. duration)

CCG:3

UNIT-I: Crystallography-A

Crystalline and non-crystalline substances, Crystals - definition, characteristics, intercepts, parameters, indices and forms. Symmetry elements and classification of crystals in to seven systems.

International Symbol; Holohedrism, hemihedrism hemimorphism and enantiomorphism. Study of axial relationship, symmetry elements and forms present in $4/m\ 2/m$, $3m$, $2/m$, $4/m2/m2/m$ and $2/m$ classes.

UNIT-II: Crystallography-B

Study of axial relationship, symmetry elements and forms present in $6/m2/m2/m$, 622 , $2/m$, $3m$, 32 , $2/m2/m2/m$, $2/m$ and classes. Twinning, Fundamentals of stereographic projection of crystals. Zone and zonal laws.

UNIT-III: Mineralogy-A

Scope of mineralogy; chemical bonding and compound formation. Definition and classification of minerals. Physical properties of minerals, Silicate structure and its classification.

UNIT-IV: Mineralogy-B

Study of atomic structure, chemistry, physical, optical properties and uses of minerals of Olivine, Feldspar, Pyroxene, Amphibole, Garnet, Feldspathoids and Mica groups.

UNIT-V: Mineralogy-C

Isomorphism, polymorphism and pseudomorphism; Chemical composition, physical and optical properties of important rock forming minerals.

PRACTICAL

Study and identification of crystal models as mentioned in theory. Megascopic identification of rock forming minerals, Laboratory records and viva voce.

C: 4-GEOLOGY-IV

(Credit: 6, Theory: 4, Practical: 2)

Theory: 70 Marks, Practical: 30 Marks

Theory: 40 Classes (1 hr. duration)

CCG: 4

UNIT-I: Mineral Optics-A

Nature of light rays and their propagation, internal reflection, double refraction, interference and polarization. Nicol Prism and polaroids.

Petrological microscope - parts and their functions.

UNIT-II: Mineral Optics-B

Preparation of thin section of minerals and rocks. Behaviour of light in thin section and production of interference colours. Order of interference colour and Twinkling. Optic axis, Uniaxial and biaxial minerals.

UNIT-III: Mineral Optics-C

Isotropism and anisotropism,. Extinction and extinction angle. Pleochroism, pleochroic scheme, Birefringence; Outline of study of optical characters of minerals in thin sections.

UNIT-IV: Geochemistry-A

Cosmic abundance of elements; composition of planets and meteorites.

Structure and composition of earth.

UNIT-V: Geochemistry-B

Geochemical classification of elements, Primary geochemical differentiation; Atomic substitution and solid solution.

PRACTICAL

Microscopic identification of rock forming minerals; Measurement of extinction angle; sign of elongation and order of interference colour.

Laboratory records and viva voce.

2ND YEAR

SEMESTER-III

C: 5-GEOLOGY-V

(Credit: 6, Theory: 4, Practical: 2)

Theory: 70 Marks, Practical: 30 Marks

Theory: 40 Classes (1 hr. duration)

CCG: 5

UNIT-I: Igneous Petrology-A

Magma and its characteristics; Crystallization behaviour of unicomponent magma; bicomponent magma showing solid solution and eutectic relationships, Introduction to Di-Ab-An ternary system.

UNIT-II: Igneous Petrology-B

Introduction, Forms, Texture, Mega- and micro-structures of igneous rocks.

UNIT-III: Igneous Petrology-C

Bowens reaction series and its implications. Differentiation of magma and diversity of igneous rocks.

UNIT-IV: Igneous Petrology-D

Classification of igneous rocks. Preliminary idea on assimilation processes.

UNIT-V: Igneous Petrology-E

Petrographic notes on Basalt, Dolerite, Gabbro, Granite, Pegmatite, Syenite, Dunite, Diorite, Peridotite, Carbonatite, Anorthosite and Kimberlite and their occurrences in India.

PRACTICAL

Megascope and microscopic identification of igneous rocks. Laboratory records and viva voce.

C: 6-GEOLOGY-VI

(Credit: 6, Theory: 4, Practical: 2)

Theory: 70 Marks, Practical: 30 Marks

Theory: 40 Classes (1 hr. duration)

CCG: 6

UNIT-I: Sedimentary Petrology-A

Introduction, formation of sediments and sedimentary rocks. Elementary idea on sedimentary environments.

UNIT-II: Sedimentary Petrology-B

Texture, structure and diagenesis of sedimentary rocks. Elementary idea on sedimentary facies.

UNIT-III: Sedimentary Petrology-C

Classification of sedimentary rocks. Sedimentary basins of India.

UNIT-IV: Sedimentary Petrology-D

Palaeocurrent; Heavy minerals and Provenance.

UNIT-V: Sedimentary Petrology-E

Petrographic notes on sandstones, conglomerate, shale, limestone and breccia and their occurrences in India.

PRACTICAL

Megascope and microscopic identification of sedimentary rocks. Laboratory records and viva voce.

C: 7-GEOLOGY-VII

(Credit: 6, Theory: 4, Practical: 2)

Theory: 70 Marks, Practical: 30 Marks

Theory: 40 Classes (1hr duration)

CCG: 7

UNIT-I: Metamorphic Petrology-A

Introduction, agents and types of metamorphism; ACF and AKF diagrams.

UNIT-II: Metamorphic Petrology-B

Texture and structure of metamorphic rocks.

UNIT-III: Metamorphic Petrology-C

Classification of metamorphic rocks; Metamorphic differentiation.

UNIT-IV: Metamorphic Petrology-D

Zone and grade and facies of metamorphism. Metasomatism.

UNIT-V: Metamorphic Petrology-E

Petrographic notes on important rock types like schists, gneisses, marble, quartzite, slate, phyllites, khondalite and charnockite and their occurrences in India.

PRACTICAL

Megascope and microscopic identification of metamorphic rocks. Laboratory records and viva voce.

SEMESTER-IV

C: 8-GEOLOGY-VIII

(Credit: 6, Theory: 4, Practical: 2)

Theory: 70 Marks, Practical: 30 Marks

Theory: 40 Classes (1hr duration)

CCG: 8

UNIT-I: Palaeontology-A

Fossil-definition and conditions of fossilization; Mode of preservation and geological significance of fossils.

UNIT-II: Palaeontology-B

Morphology, evolution and geological history of Trilobite, Brachiopoda, Pelecypoda, Cephalopoda and Gastropoda.

UNIT-III: Palaeontology-C

Morphology, evolution and geological history of Echinoidea, Coral and graptolite. Index and Zonal guide fossils. Brief ideas on evolution of horse and man.

UNIT-V: Palaeobotany

Scope of paleobotany, taxonomy of plants, Gondwana flora and their significance.

UNIT-V: Palynology

Introduction; Separation of spores and pollens and mounting for study. Utility of palynological studies in different fields.

PRACTICAL

Identification of important invertebrate and plant fossils; Drawing and labeling of fossils; Arrangement of fossils in chronological order; Laboratory records and viva voce.

C: 9-GEOLOGY-IX

(Credit: 6, Theory: 4, Practical: 2)

Theory: 70 Marks, Practical: 30 Marks

Theory: 40 Classes (1hr duration)

CCG: 9

UNIT-I: Stratigraphy-A

Principle of Stratigraphy, Stratigraphic units; Stratigraphic correlation, Standard stratigraphic timescale and Indian equivalences; Geomorphic and tectonic divisions of India.

UNIT-II: Stratigraphy-B

Precambrian stratigraphy of Karnataka, Odisha, Jharkhand, Rajasthan, Madhya Pradesh and Maharashtra. Stratigraphy of Cuddapah and Vindyan basins.

UNIT-III: Stratigraphy-C

Gondwana rocks with special emphasis on fossils, climate and economic importance. Deccan traps and Tertiary of Assam.

UNIT-IV: Stratigraphy-D

Triassic of Spiti, Jurassic of Kutch and Cretaceous of Trichinopoly. Siwalik rocks.

UNIT-5: Paleogeography

Elements of paleogeography; Paleogeography of Indian subcontinent during Permo-Carboniferous, Triassic, Jurassic and Cretaceous periods.

PRACTICAL

Drawing of stratigraphic units in outline map of India and Odisha; Identification and interpretation of stratigraphic assemblages; Drawing of paleogeographic maps as mentioned in theory; Laboratory records and viva voce.

C: 10-GEOLOGY-X

(Credit: 6, Theory: 4, Practical: 2)

Theory: 70 Marks, Practical: 30 Marks

Theory: 40 Classes (1hr duration)

CCG: 10

UNIT-I: Structural geology-A

Introduction, Attitude of beds; Vs rule; Deformation, concept of stress and strain; Outlier, Inlier, Nappe, Klippe and Window.

UNIT-II: Structural geology-B

Fold - geometry, classification, recognition in field and map, causes of folding. Top and bottom criteria of deformed strata.

UNIT-III: Structural geology-C

Fault- classification, mechanism, significance, recognition in the field and map, general effects of faulting. Joints - geometry, classification and significance.

UNIT-IV: Structural geology-D

Unconformity - types, significance, recognition in the field and map, difference between fault and unconformity.

UNIT-V: Structural geology-E

Foliation - types and relation with major structures, Lineation
-Types and relation with major structures; Salt domes and diapirs.

PRACTICAL

Interpretation of structure, stratigraphy and geologic history from maps;
Drawing of sections; Completion of outcrops; Three point problems; Thickness and depth problems; Laboratory records and viva voce.

3RD YEAR

SEMESTER-V

C: 11-GEOLOGY-XI

(Credit: 6, Theory: 4, Practical: 2)

Theory: 70 Marks, Practical: 30 Marks

Theory: 40 Classes (1hr duration)

CCG: 11

UNIT-I: Ore Genesis-A

Process of formation of ore bodies: Magmatic concentration, Hydrothermal processes, Wall rock alteration and Paragenesis, Zoning.

UNIT-II: Ore Genesis-B

Process of formation of ore bodies: Residual and mechanical concentration, Oxidation and Supergene enrichment.

UNIT-III: Ore Genesis-C

Process of formation of ore bodies: Sedimentation, Evaporation, Metamorphism.

UNIT-IV: Energy Resources

Origin, occurrence, distribution and uses of coal and petroleum; Atomic minerals.

UNIT-V: Mineral Economics

Strategic, essential and critical minerals. Sustainable developments of minerals; Conservation of mineral resources.

PRACTICAL

Megascopic study of strategic, critical and essential minerals. Laboratory records and viva voce.

C: 12-GEOLOGY-XII

(Credit: 6, Theory: 4, Practical: 2)

Theory: 70 Marks, Practical: 30 Marks

Theory: 40 Classes (1hr duration)

CCG: 12

UNIT-I: Mineral Resources-A

Mineralogy, mode of occurrence, origin, Indian distribution and uses of ores of Fe and Mn. Important ore deposits of India.

UNIT-II: Mineral Resources-B

Mineralogy, mode of occurrence, origin, Indian distribution and uses of ores of Cr and Al. Important ore deposits of India.

UNIT-III: Mineral Resources-C

Mineralogy, mode of occurrence, origin, Indian distribution and uses of ores of Cu, Pb and Zn. Important ore deposits of India.

UNIT-IV: Mineral Resources-D

Mineralogy, mode of occurrence, origin, Indian distribution and uses of Mica, Asbestos, Kyanite, Sillimanite, Graphite and Magnesite.

UNIT-V: Mineral Resources-E

Controls of ore localization, Classification of mineral deposits; Metallogenic epochs and provinces; Ore districts.

PRACTICAL

Megascope identification and uses of important metallic and non-metallic minerals; Laboratory records and viva voce.

SEMESTER-VI

C: 13-GEOLOGY-XIII

(Credit: 6, Theory: 4, Practical: 2)

Theory: 70 Marks, Practical: 30 Marks

Theory: 40 Classes (1hr duration)

CCG: 13

UNIT-I: Groundwater-A

Hydrological cycle, vertical zonation of ground water, Properties of water bearing formations -porosity, permeability, specific yield, specific retention, storativity. Aquifer types- Confined and unconfined aquifers, aquitard, aquiclude, aquifuse. Darcys law.

UNIT-II: Groundwater-B

Ground Water exploration - types of wells, groundwater provinces of India and Odisha. Sea-waterintrusion, Quality of ground water and its use in domestic, agriculture and industries; Ground waterpollution.

UNIT-III: Engineering Geology-A

Introduction, engineering properties of rocks and soils, Geological considerations of Dam and reservoir site selection.

UNIT-IV: Engineering Geology-B

Geological considerations of tunnel alignment, bridge site selection. Earthquake resistant structures, Soil - classification, erosion and conservation.

UNIT-V: Exploration Geology

Geological, Geophysical and Geochemical exploration methods.

PRACTICAL

Problems related to groundwater and engineering properties of rocks.
Laboratory records and viva voce.

C: 14-GEOLOGY-XIV

(Credit: 6, Theory: 4, Practical: 2)

Theory: 70 Marks, Practical: 30 Marks

Theory: 40 Classes (1hr duration)

CCG: 14

UNIT-I: Mining

Terminology in mining, Open-cast and underground mining methods, Drilling, Surveying.

UNIT-II: Disaster Management

Natural disasters and their management Earthquake, Landslide, Flood, Tsunami and Cyclone.

UNIT-III: Environmental Geology-A

Renewable and non-renewable resources; Conservation of mineral resources; Impact of mining on environment; Fundamentals of environmental impact assessment.

UNIT-IV: Environmental Geology-B

Management of solid wastes including mining wastes; Fly ash, Radioactive wastes; Environmental protection- Legislative measures in India; Fluorosis problems and arsenic poisoning in India Causes and remedial measures.

UNIT-V: Resource Evaluation

Sampling; Assaying; Ore-reserve estimation

PRACTICAL

Borehole problems, ore reserve estimation. Laboratory records and viva voce.

GENERIC ELECTIVE PAPERS (GE)

(Minor-Geology) for other Departments/Disciplines

(Credits: 06 each)

SEMESTER-I

GENERAL GEOLOGY MINERALOGY

GE: 1

(Credits: 06, Theory: 04, Practical: 02)

Max. Marks: 100 (Theory: 70, Practical: 30)

UNIT-I: General geology

Scope and subdivisions of Geology; Origin, age and interior of the Earth; Earthquake and volcanoes.

UNIT-II: Geomorphology

Weathering and erosion; Geological work of river, wind, glacier and underground water.

UNIT-III: Crystallography

Crystalline and non-crystalline substances; Symmetry elements, parameters and indices; Classification of crystals into six systems. Symmetry elements and forms of normal classes of isometric, tetragonal and orthorhombic systems.

UNIT-IV: Mineralogy

Minerals: definition and classification; Study of physical and chemical characters of rock forming minerals like quartz, feldspar, hypersthene, diopside, augite, hornblende, muscovite, biotite, garnet, olivine, sillimanite, kyanite, tourmaline, topaz, epidote, calcite, apatite, uorite, talc, gypsum and corundum.

UNIT-V: Optical Mineralogy

Nature of light rays; Polarization, Double refraction, Isotropism, Anisotropism, Nicol prism, Petrological microscope; Behaviour of light in thin section; Birefringence; pleochroism, extinction angle and interference colours.

PRACTICAL

Identification of crystal models with respect to axis, symmetry and forms; Megascopic and micro-scopic identification of minerals mentioned in theory. Laboratory record and viva voce.

SEMESTER-III

PETROLOGY AND HISTORICAL GEOLOGY

GE: 3

(Credits: 06, Theory: 04, Practical: 02)

Max. Marks: 100 (Theory: 70, Practical: 30)

UNIT-I: Igneous Petrology

Forms and texture of igneous rocks; Bowens reaction series; Classification of igneous rocks; Mag-matic differentiation; Petrography of granite, syenite, peridotite, anorthosite, gabbro, dolerite and basalt.

UNIT-II: Sedimentary Petrology

Formation of sedimentary rocks; Texture, structure and classification of sedimentary rocks. Petrography of conglomerate, breccia, sandstone, shale and limestone.

UNIT-III: Metamorphic Petrology

Metamorphism: definition, agents, types. Texture, structure and classification of sedimentary rocks. Petrography of schists, gneisses, marble, charnockite and khondalite.

UNIT-IV: Palaeontology

Fossilisation and uses of fossils; Morphology and geologic history of trilobite, brachiopod, pelecypod, gastropod, cephalopod. Gondwana flora.

UNIT-V: Stratigraphy

Definition and scope of stratigraphy. Stratigraphic units and correlation. Physiographic division of Indian subcontinent. Stratigraphy of type areas of Archaeans, Cuddapah, Vindhyan, Triassic, Jurassic, Cretaceous and Gondwanas.

PRACTICAL

Megascope and microscopic identification of igneous, sedimentary and metamorphic rocks as mentioned in theory. Morphological study of invertebrate and plant fossils mentioned in theory; drawing and labelling of fossils. Laboratory record and viva voce.