B. Sc. (HONS.) GEOLOGY

DISTRIBUTION OF DIFFERENT COURSES AND CREDITS IN VARIOUS SEMESTERS

Offered By:
Department of Geology
Faculty of Science
Banaras Hindu University
### Semester-wise Distribution of Courses and Credits

<table>
<thead>
<tr>
<th>Semester – I</th>
<th>Course Code</th>
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The B.Sc. (Hons.) Geology shall be imparted to students for three academic sessions consisting of six semesters as given below. Candidates will be examined and evaluated on grade basis at the end of each semester in the different courses of theory and practical as per credits given against each course. The B.Sc. (Hons.) Geology will consist of (a) Core Courses and (b) Geological Field Training.
a) The Core courses will be compulsory for all the admitted students. There will be eleven core courses, each of 6 credits (4 credits for theory and 2 credits for practical) covering major branches of Geology.

b) The compulsory geological field training includes a few days field work. The field training will be conducted by faculty members. Geological field training for semesters I to IV is included in the respective practicals. Geological field training course GLB608 may be undertaken any time during the combined duration of semester (V &VI) inclusive of semester break.

SEMESTER – I

Course No. GLB101: ELEMENTARY PHYSICAL AND STRUCTURAL GEOLOGY
Credit: 4

Section – A: Physical Geology

Unit-1
Introduction to geology, scope, subdisciplines and relationship with other branches of science; Earth in the solar system, origin, size, shape, mass, density, rotational and evolutilonal parameters.

Internal constitution of the earth, core, mantle and crust; Convections in the earth’s core and production of magnetic field; Composition of earth in comparison to other bodies in the solar system; Origin of hydrosphere and atmosphere, biosphere; Origin of oceans, continents and mountains; Age of the earth; Radioactivity and its application in determining the age of the earth; Rocks, minerals and fossils.

Unit-2
Earthquakes - causes, geological effects and their measurement, distribution of earthquake belts; Volcanoes - types, causes and geological effects, distribution of volcanic belts; Relationship of earthquakes with volcanic belts; Weathering and erosion; Soil, soil formation, soil profile and soil type; Geological time scale; Major events in the earth’s history.
Section – B: Structural Geology

Unit-3
Topography and its representation; Dip and strike; Outcrop, effects of topography on outcrop; Forms of igneous rocks; Clinometer compass and its use; Folds, parts of fold, nomenclature and description of folds and causes of folding.

Unit-4
Faults - parts of faults, types of faults and causes of faulting; Joints- their geometric classification; Unconformity, its kinds and significance; Overlap; Outlier and inlier.

Books Recommended:

**Physical Geology and Structural Geology**


Course No.GLB102: Practicals (connected with GLB101) (inclusive of Geological Field Training)
Credit: 2

Physical Geology:
Study of important geomorphological models; Reading topographical maps of the Survey of India; Elementary study of aerial photographs.

Structural Geology:
Study of clinometer compass; Exercises on structural problems; Completion of outcrops; Drawing and interpretation of sections across elementary representative geological structures.

**SEMESTER – II**

Course No. GLB201: ELEMENTS OF MINERALOGY AND CRYSTALLOGRAPHY
Credit: 4
Section – A: Introductory Mineralogy

Unit-1
Minerals, definition and classification; Processes of mineral formation (magmatic, post-magmatic, pegmatic, weathering, sedimentary and metamorphic); Common physical properties of minerals (form and shape, colour, streak, luster, cleavage, fracture, hardness, tenacity, transparency, specific gravity, magnetic nature).

Unit-2
Chemical composition and diagnostic physical properties of rock forming minerals mentioned below: quartz, orthoclase, microcline, albite, labradorite, nepheline, muscovite, biotite, augite, hypersthene, tremolite, hornblende, olivine, serpentine, talc, chlorite, apatite, calcite, dolomite, garnet, kyanite, sillimanite, andalusite, staurolite, topaz, tourmaline, corundum, gypsum, graphite and kaolinite.

Section – B: Optical Mineralogy

Unit-3
Polarizing microscope, its parts and functioning; Prism and its construction; Optically isotropic and anisotropic substances; Ordinary and polarized lights; Common optical properties observed under ordinary and polarized lights and crossed nicols; Optical properties of some common rock forming minerals (quartz, orthoclase, microcline, plagioclase, garnet, biotite, muscovite, augite, hypersthene, hornblende, olivine and calcite).

Section – C: Introductory Crystallography

Unit-4
Crystal, elementary idea of crystal structure; Parts of crystal - face, edge, apex, solid angle and interfacial angle; Crystallographic axes and angles; Parameters and indices; Common crystal forms - dome, prism, pyramid and pinacoid; Elements of crystal symmetry; Introduction to different crystals systems.

Books Recommended:

Elements of Mineralogy and Crystallography


Course No.GLB202: Practicals (connected with GLB201) (inclusive of Geological Field Training)

Credit: 2
Mineralogy and Crystallography
Study of physical properties of minerals mentioned in theory course; Study of elements of symmetry of representative crystals from each system; Use of polarizing microscope; Study of optical properties of important rock forming minerals.

SEMESTER – III

Course No. GLB301: PETROLOGY AND ECONOMIC GEOLOGY
Credit: 4

Section – A: Petrology

Unit-1: Igneous Petrology
Magma and its composition; Phase rule application to H₂O system; Common textures; Magmatic differentiation and assimilation; Introduction to mineralogical classification; Brief petrographic description of common igneous rocks (granite, diorite, syenite, gabbro, dolerite, basalt, rhyolite, trachyte, pyroxenite and peridotite)

Unit-2: Sedimentary Petrology
Weathering and denudation of supra-crustal rocks; Origin of clastic and nonclastic sediments and genesis of sedimentary rocks; Primary sedimentary structures; Elementary idea about texture and mineral composition of clastic and nonclastic sedimentary rocks; General classification of sedimentary rocks; Descriptive petrography of fundamental rock types such as - conglomerate, breccia, sandstone, limestone and shale.

Unit-3: Metamorphic Petrology
Definition, types and agents of metamorphism; Classification of metamorphic rocks; Metamorphic textures and structures; Metamorphic zones and isogrades; Progressive, regional and thermal metamorphism of pelitic, calcareous and basic igneous rocks; Common metamorphic rocks and their protoliths as given below:
slate, phyllite, schist, gneiss, hornfels, marble, quartzite.

Section – B: Economic Geology

Unit-4
Definition of ore, ore mineral and gangue; Classification of ore deposits; Chemical composition, diagnostic characters, uses and distribution in India of the following minerals:
magnetite, hematite, chromite, psilomelane, pyrolusite, chalcopyrite, galena, sphalerite, native gold, magnesite, bauxite, pyrite, diamond, muscovite, beryl, fluorite, gypsum, barite, halite, phosphorite, talc, kyanite, graphite, asbestos, monazite and corundum; Elementary idea regarding origin, uses and distribution of coal and petroleum in India.

Books Recommended:
Petrology and Economic Geology


Course No. GLB302: Practicals connected with GLB301 (inclusive of Geological Field Training)
Credit: 2

Petrology
Megascopic and microscopic study of the following rock types:
granite, syenite, nepheline syenite, diorite, gabbro, peridotite, rhyolite, trachyte, dolerite, basalt,
sandstone, limestone, conglomerate, breccia, gneiss, schist, quartzite, marble.

Economic Geology
Study of ore and economic minerals in hand specimens as detailed in the theory syllabus; Preparation
of maps showing distribution of important metallic and non-metallic deposits and important coal and
oil fields of India.

SEMMESTER – IV

Course No. GLB401: PALEONTOLOGY AND STRATIGRAPHY
Credit: 4
Section – A: Paleontology
Unit-1
Paleontology, definition, subdivisions and scope, its relationship with other sub-disciplines of
geology; History of development in paleontology; Fossils, definition, characters, kinds (body and
trace fossils); Conditions of fossilization; Incompleteness of fossils record; Elementary ideas about
origin of life; their adaptation to various kinds of environments; Bathymetric distribution of
organisms.

Unit-2
Systematic classification of organisms; Elementary knowledge about the chief characteristics of the
following phyla - Arthropoda, Hemichordata, Brachiopoda, Mollusca, Echinodermata, Cnidaria and
Bryozoa; A detailed study of the morphology and geological distribution of the following classes/orders - Trilobita, Graptoloidea, Anthozoa and Echinoidea.

**Section – B: Stratigraphy**

**Unit-3**
Stratigraphy: Definition, its scope and relationships with other subdisciplines of geology; History of advancement in stratigraphy; Principles of stratigraphy; Geological time scale; Elements of stratigraphic classification; Rock units, time units and time rock units; Physical and structural subdivisions of India and their characteristics; Brief elementary account of important Indian Paleozoic, Mesozoic and Tertiary stratigraphic horizons.

**Unit-4**
Study of the following supergroups of Indian Precambrian rocks with special reference to classification, lithology and economic significance - Dharwar of Karnataka, Mahakoshal (Bijawars) of Central India, Cuddapah of Andhra Pradesh and Vindhyan of Son valley.

**Books Recommended:**
Kumar, R. (1985): Historical Geology and Stratigraphy of India, Wiley Eastern Ltd.

**Course No.GLB402: Practicals connected with GLB401 (inclusive of Geological Field Training)**
**Credit:** 2

**Paleontology**
Study of modes of preservation of fossils; Study of morphological characters of about 30 genera pertaining to Trilobita, Graptoloidea, Echinoidea and Anthozoa.

**Stratigraphy**
Preparation of lithostratigraphic maps of India showing distribution of the following - Dharwar Supergroup, Mahakoshal (Bijawars) Supergroup, Cuddapah Supergroup and Vindhyan Supergroup.
Study of important rock types of the above mentioned stratigraphic units; Preparation of physiographic map of India showing important features.

SEMESTER – V

Course No.501: PHYSICAL AND STRUCTURAL GEOLOGY
Credit:4

Section –A: Physical Geology

Unit-1
Exogenic and endogenic geomorphic processes; Evolution of landscape; A detailed account of the geological work of natural agencies - groundwater and springs, rivers, glaciers, lakes, ocean and wind.

Unit-2
Origin and classification of mountains; Concept and theories of isostasy; Origin and significance of mid oceanic ridges and trenches; Sea floor spreading & continental drift; Brief idea about plate tectonics and distribution of plates; Mitigation of environmental hazards - earthquakes, landslides, floods, basic concepts of remote sensing; Indian space mission; elements of photogeology.

Section –B: Structural Geology

Unit-3
Geological significance and recognition of unconformities; Fold morphology, geometric and genetic classifications, mechanics and causes of folding; Geometric and genetic classification of faults.

Unit-4
Effects of faulting on the outcrops; Geometric and genetic classification of joints; Foliation, descriptive terminology, origin and relation to major structures; Stereographic projection and its use in structural analysis.

Books Recommended:
Course No. GLB502: IGNEOUS PETROLOGY, MINERALOGY AND CRYSTALLOGRAPHY
Credit: 4

Section - A: Igneous Petrology

Unit-1
Physical properties, genesis, evolution and types of magma; Concepts of rock series and rock association; Phase equilibrium in one (SiO$_2$), two (Di-An, Fo-Si$\alpha$, Ab-An) and three (Di-Ab-An and Di-Fo-An) component silicate systems.

Unit-2
IUGS mineralogical (QAPF) and chemical (total alkali-silica diagram) classification schemes; Common igneous textures; Detailed petrographic description of granite, granodiorite, diorite, syenite, phonolilte, gabbro, norite, dolerite, basalt, andesiste, dunite, pyroxenite, peridotite, komatite, trachyte, rhyolite and dacite.

Section – B: Mineralogy and Crystallography

Unit-3
Classification of minerals; Introduction to crystal chemistry - Ionic size, packing, radius ratio and coordination number, solid solution; Isomorphism, polymorphism, diadochy, pseudomorphism, chemical bonds, Pauling’s rules; Structural classification of silicates; Study of the following group of minerals with reference to chemical and structural formulae; Classification and occurrences - olivine, garnet, alumino-silciates, pyroxene, amphibole, mica, silica and feldspar.

Unit- 4
Introduction to 32 crystals classes of crystallography and description of the holosymmetric class; Contact goniometer; Angular measurement of crystal faces; Different types of crystal projections – spherical and stereographic and their uses; Electromagnetic spectrum, light, optics of light (reflection, refraction, Snell’s law), dispersion, double refraction, sample preparation techniques for optical microscopy, refractive index liquids, Becke effect, relief, birefringence, retardation, pleochroism, extinction and interference colours; Classification of minerals into uniaxial and biaxial minerals.

Books Recommended:

Course No.GLB503: SEDIMENTARY AND METAMORPHIC PETROLOGY
Credit:4
Section – A: Sedimentary Petrology

Unit-1
Processes of formation of sedimentary rocks; Classification of rudaceous, arenaceous, argillaceous and calcareous rocks; Structures of sedimentary rocks; Mineralogical characteristics, textures, and diagenesis of sedimentary rocks; Heavy minerals and provenance interpretations.

Unit-2
Petrographic details of important siliciclastic and carbonate rocks such as - conglomerate, breccia, quartz-arenite, arkose, lithic arenite, quartzwake, felspathicwacke, lithicwacke, mudrocks / shale, limestones: crystalline, micritic and sparitic.

Section – B: Metamorphic Petrology

Unit-3
Phase rule and Goldschmidt’s mineralogical phase rule; Principles of metamorphic reactions, metamorphic facies and metamorphic facies series; Graphical representation of mineral assemblages in ACF, AKF, AFM diagrams; Prograde, retrograde and polymetamorphism.

Unit-4
Progressive metamorphism of (a) Pelitic rocks in K₂O – FeO-MgO-Al₂O₃-SiO₂ system, (b) Basic rocks in CaO – FeO – MgO – Al₂O₃ – SiO₂ system, (c) Calcareous rocks in CaO – MgO – SiO₂ – CO₂ – H₂O system; (d) Ultramafic rocks in MgO – Al₂O₃ – SiO₂ – H₂O system.

Books Recommended:

Course No. GLB504: Practicals (connected with GLB501)
Credit: 2

Physical Geology
Slope analysis from Topographical Maps. Interpretation of aerial photographs.

Structural Geology
Exercises on structural geology problems; Stereographic projection of structural data; Geometrical problems on folds and faults; Drawing and interpretation of profile sections across the geological maps.

Course No. GLB505: Practicals (connected with GLB502)
Credit: 2

Igneous Petrology
Megascopic and microscopic study of the igneous rocks as per list given in the theory paper.

Mineralogy
Study of the following silicate minerals with regards to their diagnostic physical properties - Olivine Group, Garnet Group, Aluminosilicate Group, Staurolite, Topaz, Zircon, Epidote Group, Tourmaline, Beryl, Pyroxene Group, Amphibole Group, Mica Group, Talc, Serpentine, Chlorite, Kaolinite, Silica Group, Feldspar Group, Feldspathoid Group, Zeolite Group; A study of few models of silicate and non-silicate structures.

Optical Mineralogy
Optical study of few rock-forming minerals; Determination of length fast and length slow characters of minerals; Scheme of pleochroism, extinction.

Crystallography
A study of about 12 crystal models belonging to the seven crystal systems; Determination of axial ratio and face symbols of orthorhombic and monoclinic crystals, Stereographic projection of olivine and hornblende.

Course No. GLB506: Practicals (connected with GLB503)
Credit: 2

Megascopic and microscopic examination of conglomerate, breccia, quartz arenite, arkose, lithic arenite, quartzwacke, feldspathicwacke, lithicwacke (grewacke), mudrocks/shale and carbonates (micrite, sparite and accretionary limestones). Examination of some common heavy minerals in grain mounts; Megascopic and microscopic study of metamorphic rocks - slate, phyllite, schist, gneiss, marble, quartzite, charnockite, hornfels, khondalite
SEMESTER – VI

Course No.GLB601: PALEONTOLOGY
Credit:3

Unit-1
Application of paleontology with special reference to problems of geological refinement, sequence stratigraphy, correlation, paleoecology and paleobiogeographic reconstructions; Organic evolution - ancient and modern concepts, evidences, theories of organic evolution: Lamarckism, Darwinism, Synthetic theory.

Unit-2
Binomial nomenclature and procedures in taxonomy; Species concept; Skeletons and their compositions; Types of fossils; Collection and preparation of macro- and micro– fossils; Identification of fossils; Describing a fossil specimen.

Unit-3
Detailed study of morphological characters and geological distribution of the following invertebrate fossil groups - Brachiopoda, Bivalvia, Gastropoda, Cephalopoda, Crinoidia and Bryozoa. Stratigraphic significance of Trilobites, Graptolites, Ammonites and Conodonts; Elementary ideas about different types of microfossils (calcareous, siliceous, phosphatic, chitinous, organic walled and agglutinated).

Unit-4
Modes of preservation of plant fossils; Classification and broad characteristics of major plant groups; elementary knowledge of Gondwana flora. Origin and general characteristic of vertebrates; Elementary ideas about vertebrate classes; Elementary knowledge of Siwalik vertebrate fauna.

Books Recommended:
Black, R.M. (1988): The Elements of Palaeontology, Cambridge Univ..
Course No. GLB602: STRATIGRAPHY
Credit: 3

Unit-1
Historical advancement in stratigraphy; Stratigraphic classification and terminology; Methods of collecting stratigraphic data; Identification of stratigraphic contact.

Unit-2
Criteria for stratigraphic refinement and correlation; Outline of sequence stratigraphy; Elements of facies concept in stratigraphy.

Unit-3
A detailed study of succession, lithology, age, economic importance and fossil content of the following –
Archaean of Southern Indian Shield, Proterozoic of Son Valley, Palaeozoic of Kashmir, Gondwana Supergroup, Triassic of Spiti, Jurassic of Kachchh, Cretaceous of Tiruchirapalli.

Unit-4
A detailed study of succession, lithology, age, economic importance and fossil content of the following:

Books Recommended:
Kumar, R. (1985): Historical Geology and Stratigraphy of India, Wiley Eastern Ltd.

Course No. GLB603: HYDROGEOLOGY, ENVIRONMENTAL GEOLOGY, EXPLORATION GEOLOGY AND COMPUTER APPLICATIONS
Credit: 3

Unit-1
Definition of hydrogeology, geohydrology and hydrology; Hydrological cycle and groundwater in the hydrological cycle; Hydrological parameters - Precipitation, evaporation, transpiration and infiltration; Origin and age of groundwater; Vertical distribution of groundwater; Types of aquifers; Water bearing properties of rocks - Porosity and Permeability; Retention of water in rocks and yield of water from rocks; Different types of springs and their formations; Darcy’s law and its validity; Dissolved constituent of groundwater; Salinization of groundwater; Groundwater provinces of India.
Unit-2
Definition and dimensions of environment; General idea about components and composition of different environmental domains such as atmosphere, hydrosphere and biosphere; Types of environmental pollution; Introduction to weather and climate; Past-climates in the earth history; Concept and origin of monsoon; Elements of natural hazards.

Unit-3
Fundamentals of geological, geochemical and geophysical techniques employed in exploration of mineral deposits.

Unit-4
Elementary idea of computer knowledge in geological sciences; Use of MS-Excel and Power Point; Basic knowledge to graphics and drawing softwares (Adobe Illustrator, CorelDraw, Photoshop).

Books Recommended:
Keller, E.A. (1978): Environmental Geology, Bell and Howell, USA.

Course No.GLB604: ECONOMIC GEOLOGY
Credit: 3

Unit-1
Concept of ore, ore minerals and gangue in economic geology; Tenor of ores; Ore forming minerals – metallic and non-metallic; Common forms and structures of ore deposits; Paragenesis, paragenetic sequence and zoning in metallic ore deposits.

Unit-2
Processes of formation of ore deposits; Magmatic, contact metasomatic, pegmatitic, hydrothermal, sedimentation, residual concentration, mechanical concentration, oxidation and supergene sulphide enrichment and metamorphism.

Unit-3
Study of important industrial minerals of India with particular reference to the industries - cement, glass and ceramics, refractory, fertilizer and building stones, chemicals and gemstones.

Unit-4
Processes of formation, geological occurrence, uses and distribution of coal and petroleum in India; A brief study of atomic fuels.

Books Recommended:
Sharma, N.L. and Ram, K.V.S. (1972): Introduction to India’s Economic Minerals, Dhanbad Publ..

Course No.GLB605: Practicals (connected with GLB601)
Credit: 2

Study of morphological characters, systematic positions and age of about 30 representative genera belonging to the following groups -
Brachiopoda, Bivalvia, Cephalopoda, and Gastropoda.
A detailed systematic description of the following genera -
Rhynchonella, Terebratula, Arca, Modiolus, Perisphinctes, Nautilus, Natica and Conus.

Course No.GLB606: Practicals (connected with GLB602)
Credit: 2

Distribution of following geological formations on sedimentary basin map of India -
Marine Lower Permian, Gondwana Supergroup, Marine Mesozoics, Deccan Traps and equivalents,
Marine Cenozoic and Siwalik Group.
Preparation of land/sea distribution on sedimentary basin map of India during Late Precambrian/Early Cambrian, Early Permian, Jurassic, Cretaceous and Eocene; Study of rocks from important Indian stratigraphic horizons.

Course No.GLB607: Practicals (connected with GLB604)
Credit: 2
Study of ore and economic minerals in hand specimen as detailed in the theory syllabus; Preparation of maps showing distribution of important metallic and non-metallic deposits and important coal and oil fields of India.

Course No.GLB608: GEOLOGICAL FIELD TRAINING  
Credit:4