

The Course structure of B.Sc. (Hons.) in Geology under Choice Based Credit System

FIRST YEAR- First Semester-Total 20 credits

In all eight question of equal value (15 marks) will be set, out of which an examinee shall have to answer four questions. Question no. 1 will be compulsory, consisting of ten very short answer type questions, each of one and half (1.5) marks covering the entire syllabus.

Paper -1, CORE 1 (Theory) –Crystallography - 5 Credits (Teaching 5 hours per week and minimum 60 teaching hours). FM .60 (University examination), Time – 3 hours. (Sessional – 15 marks)

Crystallography

Elementary ideas about crystal structure. Crystalline and amorphous substances. Crystal: faces, edges, solid angles and interfacial angles. Crystallographic axes and axial angles. Crystallographic forms. Spherical and stereographic projection of crystals. Symmetry elements- plane, axis, centre and rotary inversion axis of symmetry. Parameter, indices and symbol. Laws of crystallography. Symmetry elements and common forms of normal classes of six crystal system.

Paper -2, CORE 2 (Theory) Geomorphology, Mathematical Geology - 5 Credits (Teaching 5 hours per week and minimum 60 teaching hours). FM – 60 + 15(Sessional)

Geomorphology & Mathematical Geology

Rock weathering and erosion. Geological work of wind, running water, glaciers and oceans. Earthquakes- types, causes and their distribution. Volcanoes- types, products and their distribution. Basic concepts of geomorphology. Karst topography. Drainage patterns and their significance. Application of statistics, trigonometry, algebra and calculus to the study of Geology.

Paper 3, CORE 1 & 2 Practical, 2 Credits (Teaching 4 hours per week and minimum 48 teaching hours). F.M. 40 + 10 (Sessional)

1. Study of toposheet,
2. Identification of drainage pattern in a topographic map
3. Calculation of Earthquake Epicentre with given data
4. Clinographic and stereographic projections of the following crystal models:
Cube, octahedron, dodecahedron, zircon and vesuvianite.
5. Records of laboratory work and viva-voce.

Books recommended

- | | |
|---|-----------------------|
| 1. A text book of Geology | P.K.Mukherjee |
| 2. Engineering & General Geology | Pravin singh |
| 3. Geomorphology | P.Dayal |
| 4. Principles of Physical Geology | Holmes |
| 5. A text book of Mineralogy | E.S. Dana |
| 6. Elements of crystallography and mineralogy | Wade & Mattox |
| 7. An introduction to Rock Forming Minerals | Deer, Howie & Zussman |

Paper 4, Generic Elective (GE-1) Theory , 5 Credit, FM 75

Paper 5, Generic Elective (GE-1) Practical, 1 Credit, FM 25

Paper 6, Ability Enhancement Compulsory Course (AECC), English/MIL , 2 Credit , FM 25

Second Semester –Total 20 Credits

Paper -1, CORE 3 (Theory), Computer Application ,General Geology & Physical Geology - 5 Credits (Teaching 5 hours per week and minimum 60 teaching hours). FM .75

Computer Application

Basic idea of Computer, Types of computers, Hardwares, operating Systems and programs, parts of computer, Storage devices, Functions of operating Systems, Window 7, Microsoft Word 2010, Microsoft Excel 2010, Microsoft Power Point 2010, Idea of Internet, Adobe photoshop, Corel Draw, Application of computers in Geology.

General Geology & Physical Geology

Geology- its branches and relation with other branches of Science. Earth in the solar system- size, shape, mass, density, rotational and revolution parameters. Origin of the Earth. An elementary idea of seismic waves and interior of the Earth. Radioactivity and age of the Earth. Study of atmosphere and hydrosphere. Concept of the theory of Isostasy, Continental Drift and plate tectonics.

Paper 2, CORE 4 (Theory) Optical mineralogy, Mineralogy - 5 Credits (Teaching 5 hours per week and minimum 60 teaching hours). FM .75

Optical mineralogy

Nature of light. Polarisation of light. Isotropic and anisotropic substances (minerals). Uniaxial and biaxial minerals. Phenomenon of double refraction. Nicol prism – its construction and function. Construction and function of petrological microscope. Optical properties of minerals- relief, colour and pleochroism, interference colours, birefringence, extinction and extinction angle, optic sign of uniaxial and biaxial minerals.

Mineralogy

Mineral- definition and types. Physical properties of minerals. Structure and classification of silicates. Structure, chemical composition, classification, physical and optical properties of Pyroxene group, Amphibole group and Feldspar group of minerals. Basic idea of Garnet, Olivine, Mica and Silica group of minerals. Physical properties, chemical composition and uses of the following minerals-quartz, orthoclase, microcline, kyanite, sillimanite, calcite, gypsum, apatite, talc, fluorite, corundum, topaz, garnet, biotite, muscovite, beryl.

Paper 3, CORE 3 & 4 Practical , 2 Credits (Teaching 4 hours per week and minimum 48 teaching hours). F.M. 50

1. . Megascopic study the following rock forming minerals: (common rock forming minerals)
Quartz, orthoclase, talc, gypsum, calcite, fluorite, apatite, biotite, muscovite, corundum, topaz, tourmaline, beryl, garnet, hornblende, olivine.
2. Microscopic study of the following rock forming minerals -Quartz, orthoclase, plagioclase, microcline, olivine, biotite, muscovite, tourmaline, hornblende and hypersthene
3. Sign determination of uniaxial minerals
4. Determination of composition of Plagioclase feldspar
5. Pleochroic scheme of biotite
6. Records of laboratory work and viva-voce.

Books recommended

- | | |
|---|-------------------------|
| 1. Geomorphology | P.Dayal |
| 2. Principles of Physical Geology | Holmes |
| 3. Rutley's Mineralogy | H.H.read |
| 4. Optical Mineralogy | Phillips |
| 5. An introduction to rock forming minerals | Deer, Howie and Zussman |

Paper 4, Generic Elective (GE-2) Theory , 5 Credit, FM 75

Paper 5, Generic Elective (GE-2) Practical, 1 Credit, FM 25

Paper 6, Ability Enhancement Compulsory Course (AECC), Environmental Science, 2 Credit , FM 25

SECOND YEAR-Third Semester-Total 26 Credits

FM .75, Time – 3 hours.

In all eight question of equal value (15 marks) will be set, out of which an examinee shall have to answer four questions. Question no. 1 will be compulsory, consisting of ten very short answer type questions, each of one and half (1.5) marks covering the entire syllabus.

Paper 1, CORE 5 (Theory) – Igneous Petrology-5 Credits (Teaching 5 hours per week and minimum 60 teaching hours).

Igneous Petrology

Magma- its nature and composition. Crystallisation of unicomponent and bicomponent (immiscible and solid solution) magma. Form and structure of igneous rocks. Texture of igneous rocks. Classification of igneous rocks. Bowen's reaction series and its significance. Magmatic differentiation and assimilation. Petrographic notes on granite, granodiorite, diorite, rhyolite, trachyte, syenite, gabbro, basalt, dolerite, anorthosite, dunite and pyroxenite.

Paper 2, CORE 6 (Theory) – Sedimentary Petrology-5 Credits (Teaching 5 hours per week and minimum 60 teaching hours). FM .75

Sedimentary Petrology

Formation of sedimentary rocks. Lithification and diagenesis. Classification of sedimentary rocks. Structures of sedimentary rocks and their significance. Determination of top and bottom of sedimentary beds. Textures of sedimentary rocks. Concept of Provenance- mobility of oxides, stability of minerals and significance of light and heavy minerals. Petrographic notes on sandstones, arkose, shale, conglomerate, breccias, limestone and dolomite.

Paper 3, CORE7 (Theory) – Metamorphic Petrology-5 Credits (Teaching 5 hours per week and minimum 60 teaching hours). FM .75

Metamorphic Petrology

Metamorphism- definition, agents and types. Texture and structure of metamorphic rocks. Basic concepts of zone, grade and facies. Thermal metamorphism of calcareous rocks. Progressive regional metamorphism of argillaceous rocks. Petrographic notes on shale, slate, phyllite, shist, gneiss, quartzite, marble, amphibolites and charnokite.

Paper 4, CORE 5 , 6 & 7 Practical , 3 Credits (Teaching 6 hours per week and minimum 72 teaching hours). F.M. 75

1. Megascopic study of important igneous, sedimentary and metamorphic rocks.
2. Microscopic study of common igneous, sedimentary and metamorphic rocks.
3. Geological field work for 7 days
4. Practical records and viva-voce

Books Recommended

- | | |
|--------------------------------------|--------------------|
| 1. The Principles of Petrology | - G.W.Tyrrell |
| 2. Petrology | - Ehlers and Blatt |
| 3. Petrology of igneous rocks | - Hatch and Wells |
| 4. Sedimentary Rocks | - F.J. Pettijohn |
| 5. Igneous and metamorphic Petrology | - Best |

5. **Paper 5, Generic Elective (GE-3) Theory , 5 Credit, FM 75**
6. **Paper 5, Generic Elective (GE-3) Practical, 1 Credit, FM 25**
7. **Paper 7. Skill Enhancement Course (SEC-1), 2 Credits, FM 25**

Skill Enhancement Course -Gemology

Idea of Gemstone-its quality, colour, chatoyancy, asterism, hardness, luster, specific gravity. Gem testing. Man made stones. Organic gems, gem cuttings.

Fourth Semester-Total 26 Credits

Paper 1, CORE 8 (Theory) – Structural Geology -5 Credits (Teaching 5 hours per week and minimum 60 teaching hours). FM .75

Structural Geology

Concept of dip and strike. Clinometer and Brunton compass. Basic concepts of planar and linear structures. Folds- their classification and recognition. Faults- their classification and recognition. Unconformity and related structures such as offlap, overlap, outlier and inlier. Joints and their types.

Paper 2, CORE 9 (Theory) – Stratigraphy -5 Credits (Teaching 5 hours per week and minimum 60 teaching hours). FM .75

Stratigraphy

Principles of stratigraphy and stratigraphic correlation. Geological time scale. Classification, lithological characteristics, fossil contents and economic importance of the following: Precambrian of Singhbhum, Cuddapah Supergroup of Cuddapah Basin, Vindhyan Supergroup of Central India, Gondwana sequence of India with special reference to coal bearing formations, Deccan Trap and Tertiary of Assam.

Paper 3, CORE 10 (Theory) – Paleontology -5 Credits (Teaching 5 hours per week and minimum 60 teaching hours). FM .75

Paleontology

Definition of Fossils. Mode of preservation and uses of fossils. Classification, morphology and geological history of the following: Brachiopoda, Palecyopoda, Gastropoda and Trilobita. A brief study of Gondwana flora and Siwalik vertebrates. Morphological characteristic and geological age of the following: Spirifer, Terebratula, Rhynchonella, Productus, Arca, Gryphaea, Cardita, Unio, Murex, Natica, Voluta, Conus, Phacops, Calymene, Paradoxides, Glossopteris, Gangamopteris, Vertebraria.

Paper 4, CORE 8, 9&10 Practical, 3 Credits (Teaching 6 hours per week and minimum 72 teaching hours). F.M. 75

1. Drawing of geological cross section of important geological maps.
2. Structural problems related to dip and strike.
3. Identification of important invertebrate and plant fossils.
4. Plotting of important Geological formations on the political map of India
5. Records and Viva-voce

Paper 5, Generic Elective (GE-3) Theory , 5 Credit, FM 75

Paper 6, Generic Elective (GE-3) Practical, 1 Credit, FM 25

Paper 7. Skill Enhancement Course (SEC-2), 2 Credits, FM 25

Skill Enhancement Course –Survey and mapping

Survey and important surveying methods- The Compass and Clinometer method, The Plane-table method. Mapping techniques, Field indicators of minerals, rocks and structure.

Books Recommended

1. A guide to field geology-N W Gokhale
2. Structural Geology - M.P. Billings
3. Theory of Structural Geology - N.W. Gokhale
4. Structural Geology of Rocks & Regions - Davis
5. Structural Geology - S.K. Ghosh
6. Geology of India & Burma - M.S.Krishnan
7. Principle of Historical Geology - Ravindra Kumar
8. Invertebrate Palaeontology - Woods
9. Principles of Palaeontology - Raup and Stanley

THIRD YEAR -Fifth Semester-Total 24 Credits

In all eight question of equal value (15 marks) will be set, out of which an examinee shall have to answer four questions. Question no. 1 will be compulsory, consisting of ten very short answer type questions, each of one and half (1.5) marks covering the entire syllabus.

Paper 1, CORE 11 (Theory) – Hydrogeology -5 Credits (Teaching 5 hours per week and minimum 60 teaching hours). FM .75

Hydrogeology

Occurrence and vertical distribution of groundwater. Hydrological cycle. Porosity and permeability of rocks. Aquifers and their types. Specific yield, specific retention and storage coefficient. Darcy's law and its validity. Hydraulic conductivity and transmissivity. Water table and causes of its fluctuation. Groundwater provinces of India. Physical and chemical quality of groundwater.

Paper 2, CORE 12 (Theory) – Environmental Geology -5 Credits (Teaching 5 hours per week and minimum 60 teaching hours). FM .75

Environmental Geology

Definition and concept of environmental geology. Processes of soil formation, types of soil, soil degradation and mitigation. Environmental changes due to the influence of geological events and anthropogenic activities. Environmental degradation due to mining and related activities and remedies. Water and air pollution.

Paper 3, CORE 11 & 12 Practical, 2 Credits (Teaching 4 hours per week and minimum 64 teaching hours). F.M. 50

1. Hydrological properties of rocks.

2. Preparation of hydrographs
3. Hydrological properties of Gondwana rocks of Jharkhand
4. Hydrological properties of Lower Vindhyan rocks of Jharkhand
5. Plotting of Ground water provinces of India on the political map of India
6. Record and viva-voce

Paper 4, Discipline Specific Elective (DSE)-1,Field Geology, 5 Credits (Teaching 5 hours per week and minimum 60 teaching hours). F.M. 75

Field Geology

General idea of field geology and its importance. Equipments and materials required during field work. Clinometer and Brunton Compass. Interpretation of topographic and geological maps. Methods of sampling.

Paper 5, Discipline Specific Elective (DSE)-2, Mineral Exploration, 5 Credits (Teaching 5 hours per week and minimum 60 teaching hours). F.M. 75

Mineral Exploration

Concept of mineral exploration. Principles and techniques of important methods of Geophysical exploration: Gravity method, Magnetic method, Seismic method and Electrical resistivity method. Geochemical exploration

Books recommended

- 1.Field Geology - Lahee
- 2.Hydrogeology - D.K.Todd
3. Environmental Geology - Keller
- 4.Economic Mineral Deposits - Jensen and Bateman
- 5.A Handbook of Economic Geology - A.K.Sen
- 6.Economic Geology - Umeshwar Prasad
- 7.Mineral Resources of India - D.K.Banerjee
- 8.Field Geology - Lahee
9. Geophysical Exploration and Mapping - T.S.Ramakrishna

Paper 6, Discipline Specific Elective (DSE)-Practical of DSE -1 &2, 2 Credits (Teaching 4 hours per week and minimum 64 teaching hours). F.M. 50

1. Measurement of Forward Bearing and Backward Bearing by Brunton Compass and Clinometer Compass
2. Bore hole problems

3. Determination of dip and strike
4. Completion of outcrop form partial outcrop
5. Record and viva-voce

Sixth Semester-Total 24 Credits

Paper 1, CORE 13 (Theory) – Engineering Geology -5 Credits (Teaching 5 hours per week and minimum 60 teaching hours). FM .75

Engineering Geology

Geological considerations in the selection of sites of dams and associate reservoir, tunnels and bridges. Assessment and management of land sliding in the hilly areas. Slope failure.

Paper 2, CORE 14 (Theory) – Economic Geology -5 Credits (Teaching 5 hours per week and minimum 60 teaching hours). FM .75

Definition of ore, ore minerals, gangue minerals, tenor of ore, mineral reserves and mineral resources. Processes of formation of mineral deposits with special reference to Magmatic concentration, Hydrothermal processes, Supergene sulphide enrichment and Mechanical concentration. Study of physical properties, chemical composition and uses of following minerals: Galena, Sphalerite, Chromite, Graphite, Asbestos, Kyanite, Sillimanite, Cassiterite, Baryl, Barite, Uraninite, Monazite.

Paper 3, CORE 13 &14 Practical, 2 Credits (Teaching 4 hours per week and minimum 64 teaching hours). F.M. 50

1. Identification and uses of important ores and industrial minerals.
2. Study of geological map for identification of dam establishment
3. Field work of at least one week duration in a geologically important area.
4. Records of laboratory work and viva- voce

Paper 4, Discipline Specific Elective (DSE)-3, Photo Geology , 5 Credits (Teaching 5 hours per week and minimum 60 teaching hours). F.M. 75

Photo Geology

Elementary idea of Photogeology. Aerial photography, types of aerial cameras and flight planning. Human eye and stereoscopic vision, depth perception. Stereoscopes- their types, construction and function. Geometric characteristics of aerial photographs. Photogrammetry- calculation of height of an object using relief displacement and stereoscopic parallax. Interpretation of geographical, geomorphological, structural and lithological features from aerial photographs. Application of photogeology in geological mapping and mineral exploration.

Paper 5, Discipline Specific Elective (DSE)-4, Indian Mineral Deposit, 5 Credits (Teaching 5 hours per week and minimum 60 teaching hours). F.M. 75

A detailed study of the following economic mineral deposits of India with reference to their ores, genesis, mode of occurrence and geographical distribution: Iron ores, Copper ores, Aluminium ores, Manganese ores and Mica deposits, kyanite deposits, china clay. Study of Coal, Petroleum and Radioactive minerals of India.

Paper 6, Discipline Specific Elective (DSE)-Practical of DSE -3 & 4, 2 Credits (Teaching 4 hours per week and minimum 64 teaching hours). F.M. 50

1. Visual interpretation of aerial photographs and satellite images.
2. Determination of scale of the photographs and images.
3. Height measurement using parallax bar.
4. Plotting of important Geological formations containing ores on the political map of India
5. Record and viva-voce

Books Recommended

1. Economic Mineral Deposits - Jensen and Bateman
2. A Handbook of Economic Geology - A.K.Sen
3. Economic Geology - Umeshwar Prasad
4. Principles and Applications of Photogeology- S.N. Pandey
5. Fundamentals of Remote Sensing & GIS—S.K.Sinha

Syllabus of Generic Elective (G.E.)

SEMESTER I

In all eight question of equal value (15 marks) will be set, out of which an examinee shall have to answer four questions. Question no. 1 will be compulsory, consisting of ten very short answer type questions, each of one and half (1.5) marks covering the entire syllabus.

Generic Elective (GE-I) Theory, Physical Geology, Structural, Crystallography, 5 Credits FM 75

1. Physical Geology-Origin of the Earth. Age of the Earth, Surface processes and geological agencies. Weathering and erosion. Geological work of river, glacier, wind, lake and underground water.

2. Structural Geology- Elementary Concepts of stratification and bedding. Dip and strike, clinometers compass. Common types of fold and fault.
3. Crystallography-Definition of crystals and idea of its general features, faces, edges, solid angles etc. Symmetry elements. Laws of crystallography. Contact Goniometer and its uses. Crystallographic axis and axial ratio. Crystal notations- Parameter, indices and symbol.

Generic Elective (GE-1) Practical, 1 Credit, FM 25

1. Crystal drawing of the following forms- cube, Octahedron, Rhomb- dodecahedron
2. Study of simple geological maps from No 1 to 8 involving simple Dip, Fold, Fault and Unconformity, Drawing of geological sections and detailed geological description.
3. Record and viva-voce

SEMESTER II

Generic Elective (GE-2) Theory, Optical Mineralogy, Descriptive mineralogy, Sedimentology, 5 Credits, FM 75

1. Optical Mineralogy-Elementary concepts of Propagation of light. Double refractions and polarization. Construction of Nicol Prism. Petrological microscope-its construction and function. Optical properties of minerals such as R.I, Relief, Birefringence, Pleochroism, Interference colours. Extinction and Extinction angles
2. Descriptive Mineralogy-

Minerals- its definitions, and physical properties such as Form, Structure, colour, streak, Lustre, Hardness, specific gravity, Cleavage, Fracture. Mineralogy of important groups of rock forming minerals-Feldspar, Amphibole and Pyroxene.
3. Sedimentology- Formation of sedimentary rocks. Structure and Texture of Sedimentary rocks. Classification of sedimentary rocks.

Generic Elective (GE-2) Practical, 1 Credit, FM 25

1. Megascopic identification of following rocks: Sandstone, Conglomerate, Breccia, Limestone, Shale
2. Identification of minerals in hand specimen-Quartz, Orthoclase, Biotite, Muscovite, Beryl, Gypsum, Talc, calcite etc.
3. Record and viva-voce

SEMESTER III

Generic Elective (GE-3) Theory, Igneous Petrology, Metamorphic Petrology, Economic Geology, 5 Credits, FM 75

1. Igneous Petrology- Magma, nature, composition and origin. Structure, texture, and classification of igneous rocks.
2. Metamorphic Petrology-Agents and types of metamorphism. Texture and structure of metamorphic rocks. Brief idea of Zone grade and facies.
3. Economic Geology- Definition of ore and ore minerals. Processes of mineral formation. Brief study of iron ore, copper ore, aluminum ore, mica, coal deposits of Jharkhand.

Generic Elective (GE-3) Practical, 1 Credit, FM 25

1. Megascopic identification of following rocks: Granite, Pegmatite, Rhyolite, Basalt, Dolerite, Gneiss, schist, Marble.
2. Megascopic identification of following ores-Chalcopyrite, Cuprite, Galena, Sphalerites, Hematite, Magnetite, Pyrite.
3. Record and Viva-voce

SEMESTER IV

Generic Elective (GE-4) Theory, Stratigraphy, Paleontology, 5 Credits, FM 75

1. Stratigraphy-Principles of stratigraphy. Geological time scale. A brief account of the important geological formation of India viz. Precambrian of Jharkhand, Gondwana Supergroup of Jharkhand and Vindhyan Supergroup.
2. Fossils and processes of fossilization. Morphology and geological distribution of Brachiopods, Lamellibranchia, and Trilobita.

Generic Elective (GE-4) Practical, 1 Credit, FM 25

1. Identification of important invertebrate and plant fossils.
2. Field visit for seven days in any sedimentary basin of Jharkhand
3. Record and Viva –voce