

Syllabus
B.Sc. (Geology)



**Department of Geology
Ravenshaw University,
Cuttack-753003**

B. Sc Geology Syllabus (2012-13 onwards)

+3 1st Year		Semester I		
Paper No	Paper code	Paper	Marks	Credits
I	SH 1.1.1	* Understanding the dynamic earth	50	3
II	SH 1.1.2	Structural Geology	50	3
III (Lab.)	SH 1.1.3	Structural Geology	50	3
+3 1st Year		Semester II		
IV	SH 1.2.4	Geotectonics and Climate Change	50	3
V	SH 1.2.5	Mineralogy	50	3
VI (Lab.)	SH 1.2.6	Identification of minerals	50	3
+3 2nd Year		Semester III		
VII	SH 2.3.7	Marine and Coastal Geology	50	3
VIII	SH 2.3.8	Petrology	50	3
IX (Lab.)	SH 2.3.9	Identification of rocks	50	3
+3 2nd Year		Semester IV		
X	SH 2.4.10	Palaeontology	50	3
XI	SH 2.4.11	Fuel Geology	50	3
XII (Lab.)	SH 2.4.12	Palaeontology	50	3
+3 3rd Year		Semester V		
XIII	SH 3.5.13	Stratigraphy	50	3
XIV	SH 3.5.14	Economic Geology	50	3
XV	SH 3.5.15	Elementary Geochemistry	50	3
XVI	SH 3.5.16	Hydrogeology	50	3
XVII (Lab.)	SH 3.5.17	Ore and Industrial Minerals	50	3
XVIII (Lab.)	SH 3.5.18	Hydrogeology and Geochemistry	50	3
+3 3rd Year		Semester VI		
XIX	SH 3.6.19	Remote sensing and GIS	50	3
XX	SH 3.6.20	Environmental Geology	50	3
XXI	SH 3.6.21	Engineering Geology	50	3
XXII	SH 3.6.22	Exploration Geology	50	3
XXIII (Lab.)	SH 3.6.23	Engineering Geology and Remote Sensing	50	3
XXIV (Lab.)	SH 3.6.24	Field Report, Seminar and Grand Viva	50	3
		TOTAL	1200	72

***Choice based- inter disciplinary paper**

+ 3^{1st} Year

Semester I

Theory Paper-I (SH-1.1.1)

*Understanding the dynamic earth

- Unit 1 **Geological agents and their action:** Weathering (physical, chemical and biological) and Erosion Geological work of river, wind, glacier, sub-surface water, ocean and landforms produced by them, Topography, Elevation, and Relief Landforms, The evolutionary path of landscapes.
- Unit 2 **Understanding the earth system:** Igneous activity, Processes of sedimentation, and Metamorphism, Volcanism (Volcanic deposits, eruptive styles and landforms), Geologic Time Scale, Reconstructing Geologic history through relative dating.
- Unit 3 **Internal processes and external effects:** Earthquakes, Exploring the interior of Earth with seismic waves, Concept of Plate Tectonics (The mosaic of plates, Driving mechanism of plates)

Theory Paper-II (SH 1.1.2)

Structural Geology

- Unit 1 **Rock deformation, orientation and fold:** Behaviour of material, stress and strain, strike, dip, plunge, pitch. Fold – definition, classification, identification in field and on map, geological significance.
- Unit 2 **Fault and Unconformity:** Fault — definition, classification, identification in field and on map, geological significance; Unconformity— definition, types, identification in field and on map, geological significance, distinction between fault and unconformity.
- Unit 3 **Lineation, foliation and joint:** Lineation and foliation and their types and relation to major structures; Joint— geometry and classification of joints and their geological significance.

Paper III (Practical) (SH-1.1.3)

Structural geology

Drawing of geological sections. Completion of outcrops of bedding planes and beds. Use of equal area net to solve simple structural problems.

Laboratory records

Semester II

Theory Paper-IV (SH-1.2.4)

Geotectonics and Climate Change

- Unit 1 **Geotectonics:** Continental drift (supporting evidences-*Palaeoclimatic, Palaeomagnetic, Palaeontological, Geometric, Stratigraphic, Structural etc. evidences*), Plate Boundaries (Types of plate boundary- convergent, divergent, transcurrent fault)
- Unit 2 **Geodynamics:** Isostasy, Sea floor spreading, Mid-oceanic ridges, island arcs.
- Unit 3 **Climate Change-** Glacial periods, Quaternary Ice age, sea level change, Global warming, Desertification

Theory Paper-V (SH-1.2.5)

Mineralogy

- Unit 1 **Principles of Crystallography and Mineralogy:** Crystalline and non-crystalline materials. Classification of crystals into six systems, Classification of minerals, Physical properties of minerals, bonding in minerals, co-ordination number, atomic substitution, isomorphism, polymorphism, pseudomorphism, twinning
- Unit 2 **Silicate Minerals:** Structure of silicate minerals. Study of structure, chemistry, physical and optical character of following rock forming silicate mineral groups (Olivine, Garnet, Pyroxene, Amphibole, Mica, Feldspar, and Quartz).
- Unit 3 **Non-silicates, principles of optics and XRD:** Carbonates, Phosphates, Gemstones, Principles of optical mineralogy (Refractive Index, Double Refraction, Birefringence, Extinction, Pleochroism, Interference Colour), Principles of X-Ray Diffraction.

Semester II

Paper VI (Practical)

(SH- I.2.6)

Identification of minerals

Identification of minerals

Laboratory records

+3 2nd Year

Semester III

Theory Paper VII (SH-2.3.7)

Marine and Coastal Geology

- Unit 1 **Marine Geology**-Relief of ocean floor (Continental Shelf, Continental Slope, Continental Rise, Abyssal Plain and associated features), Density of sea water, Salinity of sea water.
- Unit 2 **Ocean deposits**- Marine sediments and their classification (Lithogenous, Biogenous, Hydrogenous, Cosmogenous), Sea floor mineral resources, Submarine canyons
- Unit 3 **Coastal Geology**-Coastal landforms—dunes, Spits and bars, estuaries, lagoons, deltas; Coral reefs and atolls, Coastal resources

Theory Paper VIII (SH-2.3.8)

Petrology

- Unit 1 **Igneous Petrology**: Concept of magmatism, primary magmas, Bowen's reaction series and its application, differentiation and assimilation. Form, classification, Texture, structure and characteristics of igneous rocks, Petrography and Indian distribution of granites, basalt, andesite, pegmatite, anorthosite, peridotite.
- Unit 2 **Sedimentary Petrology**: Processes of formation of sedimentary rocks, and classification of sedimentary rocks, provenance, heavy minerals and their significance. Texture and structure of sedimentary rocks, classification and petrography of sandstone and limestone, petrography of shale, conglomerate and breccia, Elementary idea on sedimentary Environment
- Unit 3 **Metamorphic Petrology**: Metamorphism; definition, agents, types, grades and zones, texture, structure and classification of metamorphic rocks, concept of metamorphic facies, Petrography of gneiss, schist, khondalite and charnockite.

Paper IX (Practical)

(SH- 2.3.9)

Petrology

Petrographic description and identification of igneous, sedimentary and metamorphic rocks

Identification of the rocks in thin section and determination of texture and microstructures

Laboratory records

Semester IV

Theory Paper X (SH-2.4.10)

Palaeontology

- Unit 1 **Invertebrate Palaeontology**: Life through geological ages, Fossils- definition, modes of preservation and utility, study of important plant fossils, Morphology, classification, geological history, evolution and Indian distribution of brachiopods, pelecypoda, gastropods, cephalopod, trilobite and echinoidea.
- Unit 2 **Vertebrate Palaeontology**: Evolution of man (evolutionary history and trend), horse (evolutionary history and trend) and elephant (evolutionary history and trend)
- Unit 3 **Palaeobotany and micro Palaeontology**: Introduction to Palynology, Gondwana flora and their significance, Microfossil groups, brief notes on foraminifera, ostracod

Theory Paper XI (SH-2.4.11)

Fuel Geology

- Unit 1 **Coal Petrology**: Coal – definition, origin, composition and types of coal, coal petrography (macro- and micro constituents), coal analysis; proximate and ultimate, geological and geographical distribution of coal, uses of coal.
- Unit 2 **Petroleum Geology** : Mode of occurrence, Origin of petroleum, Distribution in India of oil and natural gas fields, uses of petroleum products, Methods of exploration for petroleum, well logging
- Unit 3 **Nuclear Geology**: Mineralogy, mode of occurrence, origin, Indian distribution and uses of radioactive minerals (Uranium and Thorium)

Paper XII (Practical)

(SH- 2.4.12)

Palaeontology

Morphological description, labeling and identification of important invertebrate and plant fossils.

Laboratory records.

+3 3rd Year

Semester V

Theory Paper XIII (SH-3.5.13)

Stratigraphy

- Unit 1 **Principles of Stratigraphy and the Archeans**- Principles of Stratigraphy, Standard stratigraphic time scale and their Indian equivalence, Stratigraphic correlation, Stratigraphy and geology of Orissa, General character, Stratigraphy, structure, lithology and economic resources of Dharwar and Singhbhum
- Unit 2 **Proterozoic and Gondwana Stratigraphy**: Stratigraphy, structure, lithology, economic resources of Cuddapah, Vindhyan; General character, Stratigraphy, structure, lithology, economic resources and fossil content of Gondwana Supergroup, Deccan Trap
- Unit 3 **Post Cambrian Stratigraphy**: Stratigraphy, structure, lithology, economic resources and fossil content of type areas of Triassic of Spiti, Jurassic of Kutch, Cretaceous of Trichinopoly, Tertiary of Assam and the Siwaliks.

Theory Paper XIV (SH-3.5.14)

Economic Geology

- Unit 1 **Processes of formation of ore deposits**: Objectives, definition of ore, gangue, grade and tenor: mode of origin and processes of formation of mineral deposits – Magmatic concentration, contact metasomatism, hydrothermal, oxidation and supergene sulphide enrichment, residual and mechanical concentration, classification of mineral deposits, geological thermometry.
- Unit 2 **Ore minerals**: Mode of occurrence, mineralogy, genesis, distribution in India and uses of the following ore deposits – Iron, Manganese, Chromium, Aluminium, Copper, Gold, Lead & Zinc
- Unit 3 **Industrial minerals**: Mode of occurrence, genesis, distribution in India and uses of the following industrial minerals – Mica, Asbestos, Barytes, Graphite, limestone, Dolomite, and Magnesite.

Theory Paper-XV (SH-3.5.15)

Elementary Geochemistry

- Unit 1 **Fundamentals of Geochemistry**- Cosmic abundance of elements, geochemical classifications of elements, distribution of trace elements in rocks, primary geochemical differentiation of earth
- Unit 2 **Phase Equilibria**- Crystallisation of Unicomponent and Bi-component Magma, Eutectic, Solid Solution (Ab-An Series), Incongruent Melting, Ternary Magma (Di-Ab-An), mineralogical phase rule and its application
- Unit 3 **Geochemical Cycle**- Geochemistry of hydrosphere, geochemical cycle of nitrogen, sulphur, carbon and phosphorus

Theory Paper-XVI (SH-3.5.16)

Hydrogeology

- Unit 1 **Elements of Hydrogeology**: Hydrological cycle, vertical zones of ground water, classification of aquifers, hydrologic properties of rocks- porosity, permeability, specific retention, Darcy's law, specific yield, coefficient of transmissibility
- Unit 2 **Quality of groundwater**: Quality criteria for different uses, Sources of salinity, Measures of water quality, Physical, chemical and biological analysis, Graphic representation of water quality, Monitoring of Drinking water quality
- Unit 3 **Groundwater exploration**: Methods of Groundwater exploration, Artificial groundwater recharge, Rain water harvesting, Groundwater management, Groundwater provinces of Orissa and India

Paper XVII (Practical)

(SH-3.5.17)

Ore and Industrial Minerals

Study and identification of ore and industrial minerals and their uses,
Laboratory records and Viva Voce

Semester V

Paper-XVIII (Practical)

(SH-3.5.18)

Hydrogeology and Geochemistry

Problems related to porosity and permeability
Geochemical analysis of ores and rocks
Laboratory records and Viva Voce

+3 3rd Year

Semester VI

Theory Paper-XIX (SH-3.6.19)

Remote sensing and GIS

- Unit 1 **Principles and Application of satellite imaging:** Introduction, types of aerial photography, stereoscopy, photo acquisition, interpretation Elements: tone, texture, size, shape, scale, vertical exaggeration. Drainage in aerial photo-interpretation.
- Unit 2 **Principles of Remote Sensing:** Fundamentals of remote sensing, the electromagnetic energy, spectral bands, reflectance characteristics of earth surfaces in different spectral bands, sensing devices and data products.
- Unit 3 **Applications of Remote Sensing:** Application of remote sensing in geology, geomorphology, mineral resources, hydrology and water resources, oceanography, concept of GIS.

Theory Paper-XX (SH-3.6.20)

Environmental Geology

- Unit 1. **Energy resources:** Geothermal energy; Solar energy (Solar heating devices: Solar cooker, Solar water heater, Solar Cells, Wind energy (wind devices), Tidal energy.
- Unit 2 **Resource Conservation and Management:** Conservation of mineral resources, sustainable mining, impact of mining on environment and its management.
- Unit 3 **Natural Disasters:** Landslide and their control. Flood and its management, coastal hazards: Hazards on Indian coasts, cyclone and their genesis, coastal hazard mitigation measures.

Theory Paper-XXI (SH-3.6.21)

Engineering Geology

- Unit 1 **Fundamentals of Engineering Geology:** Engineering properties of rocks and soil, building stones and road materials
- Unit 2 **Applications:** Application of geosciences for engineering site investigations for dams, reservoirs, bridges and tunnels, river valley project
- Unit 3 **Soil science:** soil texture, soil structure, soil temperature, classification of soil, soil types of India

Theory Paper-XXII (SH-3.6.22)

Exploration Geology

- Unit 1 **Exploration Geology:** Principles of mineral exploration: geological, geochemical and geobotanical exploration. Controls of ore localization – structural, stratigraphic, physical and chemical controls, metallogenic epochs and provinces.
- Unit 2 **Geophysical exploration:** Geophysical Exploration: Gravity, Magnetic, Seismic, Electrical, Radiometric methods
- Unit 3 **Mineral Economics:** Sampling, assaying, ore reserve calculation, methods of mining, National Mineral Policy

Semester VI

Paper XXIII (Practical)

(SH-3.6.23)

Engineering Geology and Remote Sensing

Interpretation of problems with engineering structures like Dam, Reservoir and tunnel, study and identification of buildings stones
Mapping through satellite data
Laboratory records

Paper XXIV (Practical)

(SH-3.6.24)

Seminar, Field report and Grand Viva