

**Department of Geology**  
**SK Women's College, Nambol**  
**Government of Manipur**

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**Program Outcome of B. Sc in Geology**

The B.SC Course program of Geology comprises of 3 year integrated degree course consisting of six semesters with the combination of different subjects-Physics, Botany, Zoology, Chemistry, Statistics, and Geography.

- Provide a comprehensive education in the field of Earth Sciences and scientific reasoning and acquiring knowledge in other science subjects.
- Students will be able to correlate and apply Geology with other subjects so that clear scientific understanding can be achieved.
- Students can acquire experimental knowledge in collection of data, analyzing and interpretation of data
- Prospect to enter job as Geo- Scientist, Environmentalist, oil and exploration Scientist etc.

**Program Specific outcomes of B. Sc in Geology**

Geology is a specific subject of Science with a Multidisciplinary approach. Student doing graduation with B.Sc. in Geology should be able to: -

- Understand the basic geological concept, principles and theories and study of branches of geology.
- Learn, design and perform experiments in the labs to demonstrate the concepts, principles and theories learned in the classroom.
- Expose the student to the vast scope of Geosciences in the field of disaster management, watershed management, water pollution, oil exploration, mining etc.
- 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.

**Course Outcome of B. Sc. in Geology**

**Semester 1: GL-101 General geology, structural geology and geomorphology**

**1. General Geology:**

**Course Outcomes**

After completing the course, the students are able to

- i. Understanding of the Scope and Aim of Geology and relationship with other branches of Science.
- ii. Explains the structure and composition of the earth, and the fundamental geological processes that have shaped the Earth.
- iii. Discuss how different earth processes (for example plate tectonics, erosion, sedimentation) work and interact, and how different minerals, rocks and landforms that result from various processes.
- iv. Describe the major compositional and physical layers of the earth.

**2. Structural Geology**

**Course Outcomes**

After completing the course, the students are able to

- i. Give an account of Structural geology and associated primary and secondary structures
- ii. Give classification and describe various types of folds and their recognition criteria.
- iii. Describe faults on the basis of geometrical pattern and genetic classification and its uses. Recognize faults in the fields and in geological maps.
- iv. Give classification of joints and describe joints of tectonic origin.
- v. Out crop pattern, effect of structures in out crop of strata
- vi. Describe morphometry of joints. Give geometric and genetic classification.
- vii. Unconformity Types and recognition of unconformity.
- viii. Give an account of Offlap and Overlap, Outlier and Inlier.

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### **3. Geomorphology**

#### **Course Outcomes**

After completing the course, the students are able to

- i. What are the various geological processes involving in creation of various land forms due to different geological agents.
- ii. Give concept of isostasy, continental drift and ocean floor spreading and plate tectonics. Explain the relation of diastrophic movements with plate tectonics and significance.
- iii. Classify and describe landforms in a variety of environmental settings. Mitigating steps of environmental hazards earthquakes, landslide and floods.

## **SEMESTER II**

### **Gl-202 Descriptive Mineralogy, Optical Mineralogy, Crystallography And Geochemistry**

#### **1. Descriptive Mineralogy:**

#### **Course Outcomes**

After completing the course, the students are able to

- i. After learning this course a student will be able to describe the concepts of Physical properties different group or species of minerals.
- ii. Specific studies within mineralogy include the processes of mineral origin and formation, classification of minerals, their geographical distribution, as well as their utilization.

#### **2. Optical mineralogy**

#### **Course Outcomes:**

After completing the course, the students are able to

- i. Differentiate various parts of the polarizing microscope.
- ii. Differentiate the optical properties of minerals. Identify rock-forming minerals in thin sections. Describe various optical properties of minerals under microscope.

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- iii. Acquire knowledge in the properties of light such as electromagnetic spectrum, becke's effect, and double refraction.
- iv. Acquire knowledge in handling petrological microscope and identifying different rock forming minerals by studying their optical properties.

### **3. Crystallography & Geochemistry:**

#### **Course outcome:**

After completing the course, the students are able to

- i. Ability to describe fundamental crystallographic concepts. Ability to extract the relevant information from a crystallographic paper
- ii. Ability to find specific tools for solution of a given crystallographic problem
- iii. The student can describe the composition of the Earth's and cosmos, periodic table, crystal bonding etc.
- iv. Can describe polymorphism, pseudomorphism, solid solutions and isomorphism. explain the geochemical classification of elements, chemical and mineralogical phase rule

### **SEMESTER III**

### **GL-303 PETROLOGY**

#### **1, IGNEOUS PETROLOGY**

#### **Course Outcome:**

After completing the course, the students are able to

- i. The students will be able to understand the formation of igneous and acquaint about various processes responsible for the formation of different types of igneous rocks
- ii. The students will understand the forms, structure, and texture of igneous rocks interpreting crystallization history. identify the connection between the nature of magmatic activity
- iii. Explain Bowen reaction series, Phase rule the differences between open and closed systems (unicomponent and Bicomponent). Explain the physical process of magma formation by partial melting of the mantle.

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- iv. Give an account of magmatic differentiation, mixing and contamination changing magmatic melts on their way to the surface.
- v. Recognize the petrological properties and identification of different types of igneous rock.

## **2. Sedimentary Petrology**

### **Course Outcomes**

After completing the course, the students are able to

- i. Explain the sedimentation processes and Describe sedimentary structure, texture and sedimentary processes
- ii. Recognize the principal types of rocks in hand specimen and relate each type of rock to its genesis and the temporal dimension.
- iii. Relate field observations of minerals and rocks to laboratory observations and to genetic theory, based on the textures.

## **3. Metamorphic petrology**

### **Course Outcomes**

At the end of this course students should be able to

1. Understanding metamorphism, agents and types of metamorphism. An understanding of effects of high temperature and pressure transforming affected rocks in to metamorphic rocks.
2. Understanding the forms, structure, and texture of metamorphic rocks, interpreting metamorphism history and classification and nomenclature of metamorphic rocks.
3. Concept of depth zones and grades of metamorphism and identification of common metamorphic rocks and their protoliths.

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**SEMESTER IV**

**GI-404 Paleontology and Stratigraphy**

**1. Principals of Palaeontology and Stratigraphy**

**Course Outcome**

After completing the course, the students are able to

- i. Students can able to correlate and relationship with the paleontology and stratigraphy of the particular area.
- ii. Understanding in the fossilization and significance in correlation.
- iii. Give knowledge on methods of collecting stratigraphic data using the stratigraphic contact.
- iv. Give stratigraphic column, distribution in India, fossil content and economic importance of a given geological formation and Clear views on the geologic time scale

**2. Palaeontology**

**Course Outcome**

After completing the course, the students are able to

- i. Application of fossils in establishing age of the rock unit and correlation with other area.
- ii. Use of fossils in finding mineral deposits and to recognize the age of sedimentary strata.
- iii. Ability to identify and description of morphology of the fossils in laboratory works.
- iv. Demonstrate understanding of the uses of fossils in solving geological problems: paleoenvironments, relative age, paleo-ecology

**3. Indian Stratigraphy**

**Course Outcome**

After completing the course, the students are able to

- i. Be able to determine the depositional environment from rock type and outcrop pattern.
- ii. Understand the age and significance of depositional sequences.
- iii. Be able to decipher the geological history of an area from a geological map.

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- iv. Give an account of various stratigraphic units and an account of criteria of stratigraphic correlation.
- v. Give stratigraphic column, distribution in India, fossil content and economic importance of a given geological formation.

**SEMESTER V**      **GI (H) 505: Structural Geology, Tectonics And Petrology**

**1. Structural Geology and Tectonics:**

**Course Outcome**

After completing the course, the students are able to

- i. Understand the geometry and mechanics of the various structures that result through rock deformation.
- ii. Get the knowledge of minor structures associated with fold and faults, mechanics of folding and faulting and their recognition in the field, classification of folds and faults.
- iii. Determine possible causes of formation of structures and forces-stress and strain and uses in structural geology. This course also helps to know the relation of structure with tectonics and Give an account of foliation and lineation.
- iv. Learn to use equipment and field tools to collect data for Laboratory analyses like stereographic projection and its use in structural geology.
- v. This course enables the students to appreciate the dynamic nature of the Earth processes. They will also be appraised about the geodynamics of the lithosphere and concept of isostasy, ocean floor spreading, continental drift, plate tectonics.
- vi. Able to get knowledge on the tectonic framework of the Himalayas and Indo-myanmar Ranges.

## **2. Igneous Petrology**

### **Course Outcome**

After completing the course, the students are able to

- i. Understand the genesis, types and evolution of magma. Explain evolution of magma by different processes takes place from origin to emplacement.
- ii. Explain crystallizing phase equilibrium of multi component magma system.
- iii. Give an outline of classification of igneous rocks commenting especially given by IUGS.
- iv. Forms and structures of igneous rocks. Types of texture and their significance interpreting cooling history.
- v. Petrogenesis of common igneous rock types. Intrusive forms of igneous rocks and comment on their creation.
- vi. Able describe the petrographic and microscopic features of common igneous rocks

## **3. Metamorphic Petrology**

### **Course Outcome**

After completing the course, the students are able to

- i. Explain phase rule and goldsmidt's mineralogical phase rule, chemical equilibrium in metamorphism and principles of metamorphic reactions.
- ii. Concept of prograde and retrograde metamorphism. Structures and textures of metamorphic rocks and their importance in understanding metamorphic reaction principle.
- iii. Metamorphic grades, facies and facies series and Types of Metasomatism and their important products.
- iv. Have an idea on graphical representation of minearal assemblages-ACF, AKF, AFM diagrams.
- v. Explain metamorphic reaction principle in delineating mineral zones. Describe progressive metamorphism of pelite litho unit.



## **4. Sedimentary Petrology**

### **Course Outcome**

After completing the course, the students are able to

- i. Explain the formation of sedimentary rocks and Classification, nomenclature and characters of the common sediments- rudites, arenites and argillites and carbonate.
- ii. Describe primary sedimentary structures and their role in paleo current analyses and Palaeocurrent analysis.
- iii. Explain various sedimentary processes involving origin of sediment. Textures of clastic and non-clastic sedimentary rocks and their significance. Paleocurrent analyses and granulometric analyses of sedimentary rocks.
- iv. Concepts of sedimentary basins, provenance and facies. Tectonic framework of sedimentation.
- v. Give an account of statistical measures of sediment particles analyses.
- vi. Understand petrographic details of important siliclastic and carbonate rocks. Discuss role of heavy minerals in sedimentary provenance analyses.

**GL-506**

**GL-(H) ECONOMIC GEOLOGY, MINERAL GEOLOGY, FUEL GEOLOGY, MINING AND EXPLORATION GEOLOGY**

### **1. ECONOMIC GEOLOGY**

#### **Course Outcome**

After completing the course, the students are able to

- i. Knowledge on ore and classification, mineralization and deposits
- ii. Describe magmatic concentration processes and resultant deposits, Hydrothermal processes and resultant deposits.
- iii. Give an account of mechanical and residual concentration processes and resultant deposits.
- iv. Describe Oxidation and supergene sulphide enrichment processes, resultant deposits.
- v. Give an account of sedimentary and metamorphic processes of ore formation.

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- vi. Give mode of occurrence, origin, compositions, distribution and economic importance of ore minerals found in Indian deposits.

## **2. Mineral Economics**

### **Course Outcome**

After completing the course, the students are able to

- I. Get knowledge on important industrial minerals of India – cement, glass, and ceramics
- II. Understanding in refractory, fertilizers and building stone.
- III. Significance and role of minerals in the economy of India.
- IV. Knowledge in the mineral resources reserves in India and their classification

## **3. Fuel Geology**

### **Course Outcome**

After the completion of the course the students are able to.

- i. A student will understand and learn about the basic concepts of Coal Petrology with respect to geology.
- ii. Understand Origin of coal and stratigraphy of coal Measures and overview of Indian Coal deposits
- iii. Basic concepts of Petroleum Geology and to study the process and the operations involved in Petroleum exploration
- iv. The students will be appraised about the origin, migration and accumulation of petroleum
- v. It will also provide basic knowledge in Onshore and off shore distribution of petroliferous basins in India and brief knowledge of atomic fuels.

## **4. Mining and Exploration Geology**

### **Course Outcome**

After completing the course, the students are able to

- i. Know essential relationship between geology and mining and different terms used in mining
- ii. Understanding in basic concepts of mineral exploration methods and techniques and the art and science of mining mineral resources.

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- iii. Detail knowledge in surface mining, alluvial mining, mineral sand, open pit cast mining and underground mining.
- iv. The course envisages to expose the students to the topics such as geology in mining industry, methods of exploration, Sampling Principle, Methods, estimation of reserves, Ore Dressing and Beneficiation
- v. This course tries to impart skills related to Geology in mining and enable him/her to perform duties of a geologist at the mining site.

## **SEMESTER VI**

### **GeI (H) 608: GEOPHYSICS, ENGINEERING GEOLOGY AND HYDROLOGY**

#### **Course Outcome**

##### **1. Geophysics:**

After completing the course, the students are able to

- i. Understand the relationship between Geology and Geophysics
- ii. Get the idea to explain the geological and geophysical data.
- iii. Have the knowledge of application of different type of geophysical method like gravity, magnetic, Electrical and seismic for exploration oil, gas, minerals and groundwater.

##### **2. Engineering Geology**

After the course, the students are able to

- i. Get the idea of difference between geology and engineering.
- ii. Understanding the role of engineering geology in planning, design and Construction of major man - made structural features.
- iii. Have the concepts of rock machines, soil, machines, site investigation and problems related to civil engineering projects.
- iv. Get the knowledge of geotechnical investigation for dams, reservoirs and spillways, tunnels, underground caverns, bridges, highways and shorelines

##### **3. Engineering Geology**

After the completion of the course the students are able to.

- i. Have the knowledge of environmental consideration related to civil engineering projects.

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- ii. Understand the causes and preventive measures of geological hazard like landslide and earthquake.
- iii. Understand and have the knowledge of slope stability studies, Earth-quake, zonation and a seismic design of structure.
- iv. Get the idea of geotechnical engineering.

#### **4. Hydrogeology**

After the completion of the course the students are able to.

- i. Have the knowledge of vertical distribution of groundwater, types of aquifers,
- ii. Porosity and Permeability, springs and their formations.
- iii. Origin of ground water and vertical distribution of groundwater, types of aquifers and water bearing properties of rock
- iv. Further get the idea of Dissolve constituent of ground water and salinization and Groundwater province in India.

### **GL- (H) 609 ENVIRONMENTAL GEOLOGY, QUATERNARY GEOLOGY, PHOTO GEOLOGY, REMOTE SENSING AND COMPUTER APPLICATION**

#### **Course Outcome**

##### **1. Environmental Geology.**

After the completing the course, the students are able to:

- i. Get the idea of Fundamental concept of Environmental Geology.
- ii. Understand the Environmental Hazard Caused by Rivers, Landslide, Volcanoes, cyclone and management and pollution caused by solid waste disposal and radioactive waste.
- iii. Have the knowledge of Environmental impact of recycling resources and land-use planning in relating to engineering project.

##### **2. Quaternary Geology**

After the course of the students are able to:

- i. Understand Quaternary Stratigraphy such as oxygen isotope stratigraphy, biostratigraphy and magneto-stratigraphy.
- ii. Have the idea of neo-tectonics and their application to natural hazard management.

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- iii. Have the knowledge of Quaternary dating method -Radiocarbon, Uranium series, Luminescence Amino acid and application of pollen, spores and phytoliths in Quaternary stratigraphy.

### **3. Photogeology and Remote Sensing**

After the course the students are able

- i. Understand what is photogeology and principle of Remote Sensing and acquisition of aerial photograph.
- ii. Understand the principal of stereoscopes and mirror stereoscopes, element of aerial photo interpretation and identification of difference types of rocks.
- iii. Have knowledge of interpretation of images like LANSAT 1 to 7, SPOT IRSS and basic idea of Rader Image.

### **4. Computer Application**

After the course the students are able

- i. Understands the fundamentals of computer operating systems, MS office packages
- ii. Understanding in the application software in geological science software- Georient, ROCKPACK III and software norm calculations
- iii. Acquire knowledge of using Map Info 8 and Arc GIS 9.2 for preparation of geological maps and lithology.