

# WHAT IS GEOLOGY?

[ge.ol.o.gy](http://ge.ol.o.gy)

Geology is the study of the planet earth: its history, composition, and processes that shape the earth. Geology is the key to discover new sources of useful Earth materials. Geology is a very broad science with strong links to chemistry, physics, biology, mathematics and engineering.

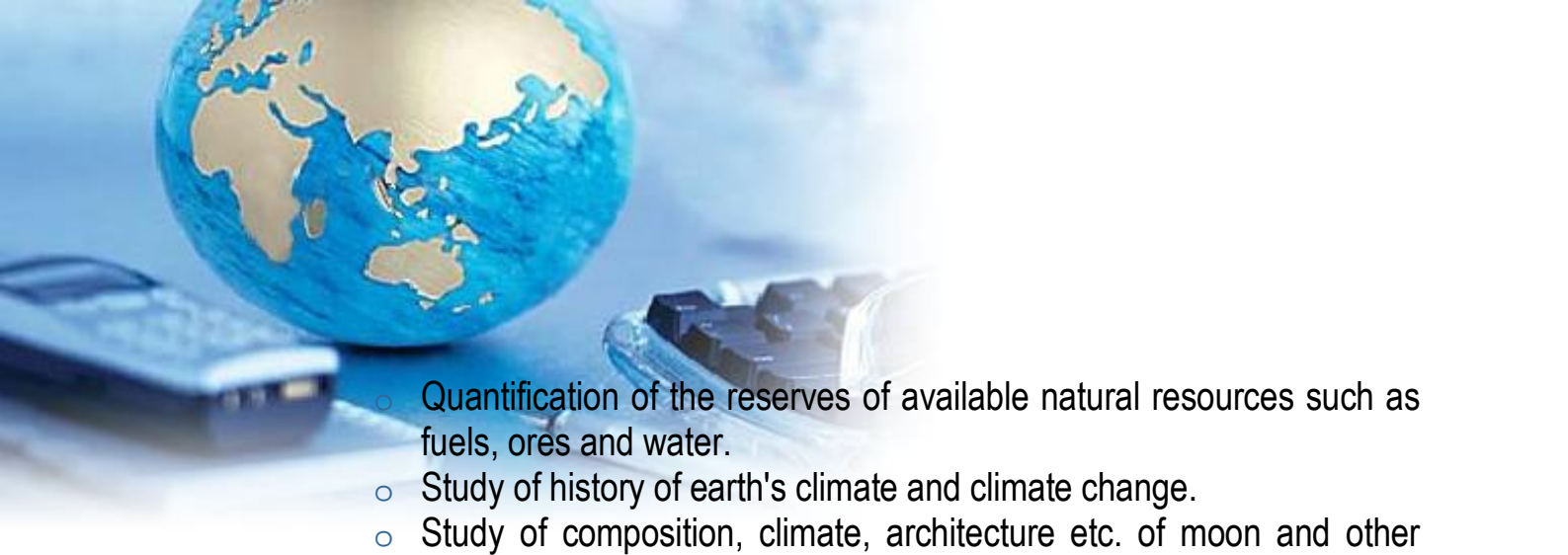
## What do geologists do?

Geologists are curious about the Earth. How was it formed? Is it changing? Is the Earth's climate warming? How can we satisfy society's growing demands for energy and other natural resources? Geologists provide basic information to society for solving problems and establishing policy related to resources management, environmental protection, public health, safety and welfare.

Geologists contribute in many ways to the prosperity of our country. They document ore and fuel occurrences and groundwater reserves, and conduct regional studies which may provide information on the potential for undiscovered resources. The results of these researches are made widely available for use by the private sector and other government agencies.

Geologists employed in the private sector explore for and develop new sources of minerals, petroleum construction materials and groundwater. Geologists study and help to mitigate natural hazards such as floods, swelling soils, and landslides. Geologists also work to solve problems involving pollution and waste disposal, and provide valuable input in land-use planning.

**Many of the Imperative Studied Conducted by Geologists:**

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- Quantification of the reserves of available natural resources such as fuels, ores and water.
  - Study of history of earth's climate and climate change.
  - Study of composition, climate, architecture etc. of moon and other planets of the solar system.
  - Study of earth's surface using remote sensing techniques. Understanding processes that affect humans such as:
    - Earthquake.
    - Volcanic activity
    - Landslides.
    - Flood control.
    - Contaminant flow in groundwater

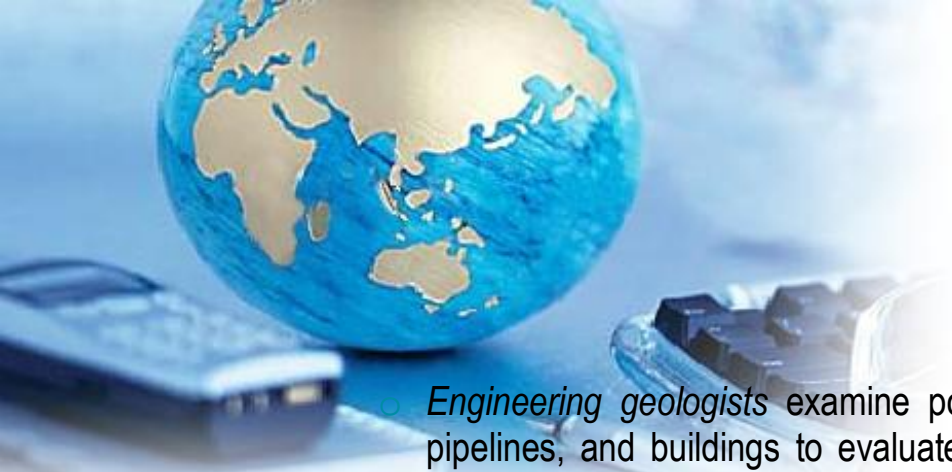
## What Can You Do With a Degree in Geology?

A person perusing a career with Geology has opportunities to serve in different state and central agencies and numerous consulting firms such as:

- Geological Survey of India (GSI)
- Central Ground Water Board (CGWB)
- Oil and Natural Gas Corporation Ltd. (ONGC)
- Indian Oil.
- Zinc India Limited
- Hindustan Copper Limited (HCL)
- Indian Bureau of Mines (IBM)
- Reliance, Tata, Birla Group (Mining Division).
- Environmental Consulting firms.

## Geologists can be classified by their specialties:

- *Economic and petroleum geologists* study the geological processes which produce deposits of mineral and energy resources



- *Engineering geologists* examine potential sites for dams, bridges, pipelines, and buildings to evaluate possible geologic hazards and provide information needed for proper design and construction
- *Geochemists* study the Earth's chemical composition and evolution, and use the relative abundances of chemical elements and their isotopes to date rocks and determine the pressure and temperatures at which they were formed
- *Geomorphologists* look at the shaping of the land by glaciers, wind, and flowing water.
- *Glaciologists* study the flow of glaciers and ice sheets, the landforms and deposits they produce, and their relation to climatic changes.
- *Hydrogeologists* investigate the flow of subsurface water and related environmental problems such as groundwater contamination by chemical and nuclear wastes.
- *Mineralogists* study the chemical compositions, crystallographic structures, physical, chemical and optical properties, and origins of minerals.
- *Paleontologists* investigate the origin and evolution of ancient life forms and the environmental changes that occurred in earth through geological time, using information contained in fossils.
- *Petrologists* examine the composition, texture, physical chemical properties of rocks and the processes by which rocks are formed.
- *Sedimentologists/Stratigraphers* study the transportation and deposition of sediments; origin, composition and structure of sedimentary rocks; the age of sedimentary strata and the relationship among sedimentary strata.



- *Structural geologists* deal with the deformation and faulting of rocks in the Earth's crust, the formation of major geological features, and the relation of these processes to the relative movement of lithospheric plates

Geologists knowledgeable in more than one of the specialties listed above can use various disciplines to solve complex geological problems.

## Geology @ Jogamaya Devi College

The Department of Geology prepares students for professional careers in the geosciences and provides the background required for advanced studies. The Department prepares students for careers with government agencies or private companies that deal with the solid earth environment. The Geology as an option requires courses in mineralogy, petrology, structural geology, paleontology, hydrology, geomorphology, stratigraphy and field geology. Examples of the varieties of topics that geologists study include beach and shore problems, river and stream flooding, groundwater use and contamination, land-use planning, geologic mapping and field investigations, and the petroleum and mining industries.

Geology students are prepared for careers as a geologist in both government and private industries. Geologist are involved with mineral and natural resource exploration, environmental protection, land use planning, study of water resources, study of river and stream flooding, and geologic mapping and field investigations – to mention a few. The geology program also prepares student to follow graduate studies in different branches of Earth Sciences.

The Department has a wide range of resources that support our educational program. Our laboratories are well equipped with microscopes, topographic maps, geological maps etc. and has a good collection of minerals, rocks, and fossils to conduct the practical classes. The Department consists of six faculty members with expertise in the



areas of geology, palaeontology, mineralogy, structural geology, igneous petrology, geochemistry and ore mineralogy. Faculty members are dedicated to quality teaching and student learning and research. Faculty research interests include petrology, glaciology, paleontology, structural geology, igneous petrology, geochemistry and ore mineralogy.

The learning environment in the Department of Geology is characterised by small class size and close personal attention by faculty members. The Department promotes an active learning environment with shared experiences between students and faculty. A number of opportunities exist for out-of-class study and socialisation including use of the Central Library of the Head Quarter of the Geological Survey of India.

## The College

### Campus

The College is located in Kolkata, a city with wonderful geographical location in the Eastern India and a history steeped in cultural political and educational traditions. Kolkata, the capital of the state of West Bengal, is also known as the 'City of Joy' of India. Established almost three centuries ago the city of Kolkata has witnessed spectacular advancements while still retaining its ancient flavour and distinct character. The history of Kolkata is replete with legends of internationally famous scientists, educationalists, artists, and artisans of great talent, saints, sages and savants. The vast variety and contrasts of the Indian scene in the socioeconomic, religio-cultural, linguistic and political spheres are all present in this city. Being an old and rich city of East India Kolkata today is a centre for educational advancement, technological excellence and cultural exchange. It has often been called the cultural capital of India.

The main campus of the College at 92, Shyama Prasad Mukherjee Road, lies in close proximity to the Jatin Das Park Metro Railway Station, and is one of the landmarks in the city. It is one of the members of



esteemed 'Asutosh Group of Colleges'. Another Annex campus nearby provide additional activities for day-time Courses.

The JDC is an independent, **Women's institution** of higher education with nearly 3,000 students. The college is proud of the academic excellence of its faculties who have distinguished themselves in many fields. The college is interested in developing sound values, goals and commitments within the students to take responsible roles in society.

We are sure you will find everyone connected with the College - students, faculty, staff and administrators - helpful and friendly. If you have a question or problem and don't know to whom you should go, contact the Heads of the respective departments who will be happy to direct you to the right person or office.

## The Department


The standing of the Department of Geology at the Jogamaya Devi College traces back to the 1932. A combination of factors, including a long experience of 70 years, a clear vision and uncompromising emphasis on excellence in both teaching and research, established a departmental culture that has persisted through the last three decades.

In sum, our department—though relatively small—is held in high regard within the university administration because of (1) our significant per capita research productivity and (2) the upward trend in numbers of undergraduate and graduate students. As of spring 2005, our department is healthy and appears to be continuing to move in a direction favorable to both the faculty and the administration.

**A personal visit to the Department or with one of its faculty members or students is welcomed and encouraged.**

## Our Aim is ...



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1. To provide all students with the opportunity to learn about the nature of science and basic scientific principles through the study of geology.
  2. To introduce students to the many ways in which geology is interwoven into the fabric of modern civilization.
  3. To provide students with an understanding of the interrelationships of the basic parts of Earth Systems.
  4. To provide students who seek a career in geology with the sound background for productive work in the profession and in graduate studies.

## Geology - Admission Requirements

### Course Available: Honours Courses

1. B.Sc Honours in Geology with Chemistry and Mathematics as other two general subjects.
2. B.Sc Honours in Physics with Geology and Mathematics as other two general subjects.  
(Students with this combination may avail the opportunity to continue M.Sc. in Physics, Geophysics and Geology.)


### General Courses

1. B.Sc General Course with Geology, Zoology and Chemistry.  
(After successful completion of the course with above combinations candidates were allowed to study M.Sc. in Geology in the last three years.)

**Form Distribution Date:** Around June-July, just after the publication of Higher Secondary Result of West Bengal Council.

### Admission Procedure:

- \* Students applying for admission should come personally with relevant and valid documents and attested photocopies of all documents.

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- \* Applications for the admission should be immediately made after the publication of the results of the Higher Secondary Examinations.
  - \* Application forms should be collected from the college office.
  - \* Admit card, Mark sheet and Transfer Certificate (for students coming from other colleges) must accompany each application.
  - \* Students from other universities or boards may be provisionally admitted. Each student must submit Migration Certificate & Pass Certificate within one month from the date of admission.

**Eligibility Criteria:** Higher Secondary with Physics, Chemistry and Mathematics as combination subjects.

*“Students who have passed the Higher Secondary Examination (10+2 Course) conducted by the Higher Secondary Council - West Bengal, or an equivalent examination recognised as such by the University, with five subjects, including at least one language paper, carrying not less than 100 marks, may be admitted to the 1st Year Degree Class of the College.”*

## Course Descriptions

Geology B. Sc. Degree General and Honours Courses are of three years' duration. Students will appear at the University Examination after each academic year. Honours students are to choose in addition two general course subjects.

### Honours Course

1. Geology Honours  
Part I  
Geology Honours: 200 marks  
Chemistry General: 100 marks  
Mathematics General: 100 marks  
Environmental Science: 50 marks  
Compulsory English: 50 marks  
Modern Indian Language: 50 marks



Part II      Geology Honours: 200 marks  
Chemistry General: 200 marks  
Mathematics General: 200 marks

Part III      Geology Honours: 400 marks

2.    Physics Honours with Geology

Part I      Physics Honours: 200 marks  
Geology General: 100 marks  
Mathematics General: 100 marks  
Environmental Science: 50 marks  
Compulsory English: 50 marks  
Modern Indian Language: 50 marks

Part II      Physics Honours: 200 marks  
Geology General: 200 marks  
Mathematics General: 200 marks

Part III      Physics Honours: 400 marks

**General Course**

Part I      Geology General: 100 marks  
Zoology General: 100 marks  
Chemistry General: 100 marks  
Environmental Science: 50 marks  
Compulsory English: 50 marks  
Modern Indian Language: 50 marks

Part II      Geology General: 200 marks  
Zoology General: 200 marks  
Chemistry General: 200 marks

Part III      Geology General: 100 marks  
Zoology General: 100 marks  
Chemistry General: 100 marks





## Field Trips

Most Geology courses have required laboratories and/or field trips. According to the Rules of the University of Calcutta Field Work is compulsory for honours students.

## Students' Insurance

Each students of this College is covered by insurance provided by United India Insurance Company on payment of Rs. 10/- per year for a minimum of Rs. 10,000/- against accidents.

## Information for Overseas Students and Students from Other States

There is no domicile restriction for joining in the Department. However, the student or her guardian has to present physically at the time of admission. There is no scope to get admission through any 'distant mode'. There is also no such service/wing for overseas students. The overseas student has to contact concerned Embassy/ Consulate regarding passport and/or visa related problems. The Department always assist the student and give necessary support regarding these matters.

The college has no hostel facility of its own. Students may get accommodation easily in any good private hostel or the hostels maintained by the University of Calcutta or they may opt for an alternative choice for 'Paying Guest' in a local family. The cost of living in Kolkata is not too high. Students may easily maintain a good lifestyle with moderate expenditure.



# Syllabus for Three-year B.Sc. Honours Course in Geology

PART – I: 200 Marks (Examination at the end of first year)

**Theory – 150 Marks.**

**Paper – I Group – A: Introduction to Earth System Sciences (60 Marks)**

1. Elementary information on solar system and lunar geology.
2. Origin of the Earth.
3. Earth System Science and its Evolution.
4. Surface processes: weathering and Erosion.
5. Geological Action of wind, river, glacier, groundwater and ocean.
6. Landform in relation to lithology, structure and exogenic processes.
7. Evidence of global glaciation, ice ages.
8. Lithospheric plates, present day configuration and relative motion of plates.
9. Internal processes: volcanoes and volcanism, distribution of volcanoes.
10. Earthquakes their effects, Seismic Zones of India.
11. Geothermal gradient, heat flow.
12. Internal constitution of the earth - evidence from seismic wave, meteorites and rocks.
13. Gravity measurement and gravity anomaly: concept of isostasy.
14. Relative ages of geological bodies. Absolute ages of rocks and minerals. Fundamental principles of radiometric dating.
15. The Age of the Earth.
16. The geological time scale up to the level of eras and periods.
17. Geological hazards and their mitigation: Earthquakes, Volcanoes, Landslides, floods, Elementary idea of remote sensing.
18. Oceanic and atmosphere circulations.



**Paper – I Group – B: Structural Geology (40 Marks)**

1. Deformation of rocks: concept of stress and strain.
2. Penetrative and non-penetrative structural elements.
3. Deformation of layered rocks: Different types of folds.
4. Fracturing of rocks. Joint sets and joint systems. Faults.
5. Foliation, Schistosity and Lineation.
6. Unconformity.

**Paper – II Unit – I Group – A: Crystallography (10 Marks)**

1. Essential characteristics of crystalline and non-crystalline states of matter.
2. Crystal measurements and Crystal symmetry.
3. Crystal habit, types of crystal aggregates, twinning in crystals.
4. Space lattice, unit cell.
5. Diffraction of X-ray by crystal lattice, Bragg's law.

**Paper – II Unit – I Group – B: Mineralogy – I (25 Marks)**

1. Physical properties of minerals.
2. Classification of minerals.
3. Chemical compositions and diagnostic physical properties of minerals.

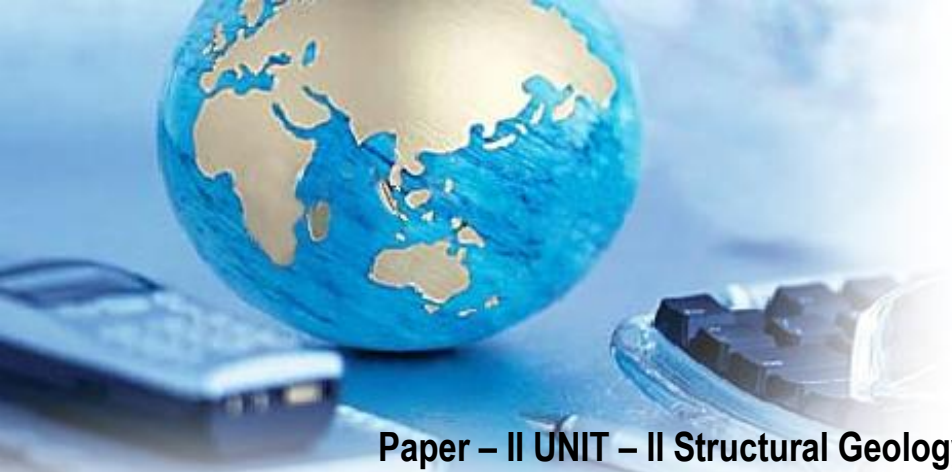
**Paper – II Unit – I Group – C: Elementary Petrology (15 Marks)**

1. Rocks: definition, types (igneous, sedimentary, metamorphic) and their characteristics.
2. Study of Igneous Rocks.
3. Study of Sedimentary rocks.
4. Study of Metamorphic rocks.

**Practical – 50 Marks**

**Paper – II UNIT – II Crystallography (10 Marks)**

1. Study of crystal models: symmetry elements and forms.
2. Stereograms (with and without stereonets) from given crystallographic data.



**Paper – II UNIT – II Structural Geology (20 Marks)**

1. Reading and interpretation of topographic contour maps.
2. Use of Clinometer and Brunton compass, measurement of attitude of planar and linear structural elements.
3. Graphical solution of true dip-apparent dip problems, three-point problems.
4. Stereographic projection of structural elements.
5. Construction of block diagrams.
6. Interpretation of maps.

**Paper – II UNIT – II Hand specimens or minerals (10 Marks)**

1. Systematic study in hand specimen of the minerals

**Paper – II UNIT – II Hand specimens of rocks (10 Marks)**

1. Study and identification of rocks in hand specimen.

PART - II: 200 Marks (Examination at the end of second year)

**Theory – 150 Marks**

**Paper – III Group A: Mineralogy – II (40 Marks)**


**Optical Mineralogy (Full Marks – 20)**

1. Optical behaviour of crystals.
2. Inteference phenomena in crystals.
3. Outline of methods of determination of refractive indices.
4. Interference phenomena.

**Crystal chemistry and rock forming minerals (Full Marks – 20)**

1. Crystal chemistry.
2. Classification of silicates on the basis of linking of  $\text{SiO}_4$  tetrahedra.
3. Classification of the rock-forming minerals.

**Paper – III Group B: Igneous Petrology (40 Marks)**

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1. Igneous rocks and magma. Rock cycle.
  2. Composition of major crustal components and upper mantle.
  3. Distribution of igneous rocks in the continental and oceanic crusts.
  4. Forms of igneous rock bodies and their mode of emplacement: central eruptions, fissure eruptions, pyroclastic deposit, volcanic neck, sill, dyke, ring dyke, cone sheet, laccolith, lopolith, phacolith, stock, batholith.
  5. Salient factors controlling the ascent of magma.
  6. Description and origin of the igneous rocks.
  7. Physical properties of magmas: temperature, volatile content, viscosity, density.
  8. Concept of equilibrium and fractional crystallization.
  9. Basic thermodynamic principle and phase rule.
  10. Studies on crystallization of melts in different systems with particular reference to phase rule.
  11. Bowen's reaction series and its use in petrogenesis.
  12. Description of textures and microstructures of common igneous rocks.
  13. Classification of igneous rocks.
  14. Important mineralogical and textural features of different igneous rocks.
  15. Processes of diversification of igneous rocks.
  16. General knowledge on the petrogenesis of the Indian rocks.

**Paper – III Group C: Palaeontology – I (20 Marks)**

1. Introduction to Fossils.
2. Fossilization Processes. Uses of fossils.
3. Elementary ideas about taxonomy. Binominal system of nomenclature.
4. Stratigraphic palaeontology.
5. Palaeoecology.
6. Principles of palaeogeographic and palaeoclimatic reconstruction on the basis of fossils.
7. Hard part morphology of brachiopods, bivalves, and corals.



**Paper – IV UNIT – I Group A: Sedimentary Petrology (25 Marks)**

1. Introduction and brief idea about the processes of sedimentation.
2. Texture of sedimentary rocks.
3. Computation of grain size statistics (mean, median, mode, sorting index, skewness, kurtosis) - purpose and limitations.
4. Concept of maturity, mineralogical and textural indicators of maturity.
5. Siliciclastic rocks: conglomerate, sandstone and shale.
6. Petrography and origin of banded iron formation.
7. Sedimentary structures: bedding and lamination, ripple marks, cross-lamination, graded bedding, sole marks, mud cracks etc.

**Paper – IV UNIT – I Group B: Metamorphic Petrology (25 Marks)**

1. Concept of metamorphism, types of metamorphic changes.
2. Controlling factors of metamorphism: pressure, temperature, fluids.
3. Textures and structures of metamorphic rocks.
4. Concept of metamorphic grade, index minerals and metamorphic facies.
5. Concept of chemical equilibrium in metamorphic rocks.
6. Metamorphic phase diagrams. Different metamorphic reactions.
7. Regional metamorphism of pelitic and mafic rocks and contact metamorphism of impure limestones.
8. Brief idea of retrograde metamorphism, metasomatism and metamorphic differentiation.
9. Migmatites: Definition and types.

**Practical – 50 Marks**

**Paper – IV Unit – II Group A: (Full Marks - 35, Periods - 50)**

**Optical Mineralogy (Full Marks - 15, Periods - 50)**

1. Study of minerals in transmitted polarised light.
2. Becke test, determination of order of interference colour.
3. Determination of optic sign of uniaxial mineral from interference figure.



**Palaeontology (Full Marks - 15, Periods - 20)**

1. Morphology, systematic position and geologic age of different fossils.

**Paper – IV Unit – II Group B:** General Viva including field and laboratory notes and reports of first and second years. (Full Marks - 15)

**N.B.** Compulsory field work in each academic year.

1. First year (field work of approximately 10 days): Reconnaissance study of areas with sedimentary, igneous and metamorphic rocks in the field. Collection of samples and field data and preparation of field report.
2. Second year (field work of approximately 17 days):
  - a. Geological mapping of a small area, collection and study of samples and preparation of field report.
  - b. Tape and compass surveying and use of Branton compass.

PART – III: 400 Marks (Examination at the end of third year)


**Theory – 200 Marks**

**Paper – V Group – A: Principles of Stratigraphy (30 Marks)**

1. Introduction, concept of strata and sequence of strata formation, Different stratigraphic principles.
2. Stratigraphic units: lithostratigraphic, biostratigraphic and chronostratigraphic units. Geologic time scale.
3. Facies concept.
4. Sedimentary environment.
5. Principles of stratigraphic correlation.

**Paper – V Group – B: Paleontology II (40 Marks)**

1. Hard part morphology of invertebrates.
2. Brief account of Indian vertebrates with reference to Gondwana and Siwalik vertebrates.
3. Organic evolution.
4. Evolution of Horse, man and ammonite.

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5. Brief account of Indian flora with special reference to Gondwana flora.

**Paper – V Group – C: Geodynamics (30 Marks)**


1. Continents and oceans, active and passive continental margins, shield, continental rift systems, island arc and trench, marginal basin, oceanic ridges.
2. Orogeny and epirogeny.
3. Eugeosyncline and miogeosyncline.
4. Continental drift theory.
5. Seafloor spreading.
6. Plate tectonics.
7. Plate tectonic models for the evolution of ocean basins and mountain belts, Wilson cycle.

**Paper – VI Group – A: Indian Stratigraphy (50 Marks)**

1. Physiographic divisions of India.
2. Subdivision of Precambrian eon – Archaean and Proterozoic. Distribution of Precambrian rocks in India.
3. Brief account of stratigraphy of the Cuddapah and Vindhyan Supergroups in their type areas.
4. Outline of Phanerozoic stratigraphy:
  - a. Extrapeninsular basins.
  - b. Peninsular basins.
  - c. Gondwana basins.
  - d. Siwalik basin.
5. A brief stratigraphy of the Deccan Traps.

**Paper – VI Group – B: Economic Geology (50 Marks)**

1. Scope of the subject. Useful earth materials: rocks, minerals, water, fossil fuels. Metallic and non-metallic deposits. Concept of conventional and non-conventional resources.
2. Definition of ore, protore, gangue, tenor etc. Forms and structures of ore deposits.
3. Processes of formation of mineral deposits.

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4. Classification of mineral deposits.
  5. Metallogenic epochs and provinces.
  6. Geologic and geographic distribution and resource position of the following important economic mineral deposits of India.  
Metallic: Fe, Mn, Cr, Ni, Cu, Pb-Zn-Ag, Au, U, Th, Ti, Sn, W.  
Non-metallic: Bauxite, mica, phosphate, fluorite, limestone, barite, refractories, asbestos, diamond, graphite, monazite.
  7. Mode of occurrence, geological set-up, mineralogy, geographic distribution and probable genesis of gold (Kolar, Hutti), copper (Singhbhum, Malanchkhand), iron (Bihar, Orissa), manganese (Central India), Pb-Zn-Ag (Zawar), Uranium (Singhbhum).
  8. Desirable specifications of the minerals used as essential raw materials in the following industries: iron and steel, cement, refractories, fertilizer.
  9. Coal.
  10. Petroleum.
  11. Groundwater.

### **Practical – 200 Marks**

#### **Paper – VII Group – A: Igneous Rocks (35 Marks)**

1. Study of igneous rocks under microscope.
2. Plotting of mineralogical and chemical data in triangular diagram.
3. C.I.P.W. norm calculation of granitic and basic rock.

#### **Paper – VII Group – B/1: Sedimentary Rocks (15 Marks)**

1. Study of sedimentary rocks under microscope.

#### **Paper – VII Group – B/2 Metamorphic Rocks (30 Marks)**

1. Study of metamorphic rocks under microscope.

#### **Paper – VII Group – C General Viva-voce (20 Marks)**

N.B. Compulsory field work (duration approximately 8 days)

Study in the field of two economic mineral deposits and study of surface geology of these two deposits.



**Paper – VIII Group – A: Structural Geology (50 Marks)**

1. Interpretation of maps.
2. Completion of outcrops of homoclinal beds.

**Paper – VIII Group – B: Palaeontology (50 Marks)**

1. Study of fossil specimens exemplifying various modes of preservation: body fossil, internal mould, external mould, impression, petrification.
2. Morphology, systematic position and geologic age of
  - (a) palnat fossils.
  - (b) Vertebrates (molar teeth) of Horse, Hipparion, Rhinoceros, Stegodon.
  - (c) Invertebrates.
3. Determination of the age of an assemblage of fossils.

## Faculty Members

Dr. Mohan Chand Boral [M.Sc., Ph.D.], Reader

Dr. Abhijit Chakraborty [M.Sc., M.Phil (Env. Sci.), Ph.D. (Head of the Department)], Reader

Sm. Mahua Ganguly [M.Sc], Lecturer – Selection Grade

Sri. Bhaskar Ghosh [M.Sc] Lecturer

Sri. Kaushik K Ghosh [M.Sc] Lecturer

Sr. Pankaj Laha [M.Sc] Laboratory Instructor (Senior)



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