UNIVERSITY OF CALCUTTA

Notification No. CSR/12/18

It is notified for information of all concerned that the Syndicate in its meeting held on 28.05.2018 (vide Item No.14) approved the Syllabi of different subjects in Undergraduate Honours / General / Major courses of studies (CBCS) under this University, as laid down in the accompanying pamphlet:

List of the subjects

<table>
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<tr>
<th>Sl. No.</th>
<th>Subject</th>
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<tr>
<td>1</td>
<td>Anthropology (Honours / General)</td>
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<td>Persian (Honours / General)</td>
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<td>Mol. Biology (General)</td>
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<td>4</td>
<td>Bengali (Honours / General / LCC2 / AECC1)</td>
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<td>Philosophy (Honours / General)</td>
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<td>5</td>
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<td>6</td>
<td>Botany (Honours / General)</td>
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<td>Physics (Honours / General)</td>
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<td>7</td>
<td>Chemistry (Honours / General)</td>
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<td>Physiology (Honours / General)</td>
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<td>Computer Science (Honours / General)</td>
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<td>Political Science (Honours / General)</td>
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<td>9</td>
<td>Defence Studies (General)</td>
<td>37</td>
<td>Psychology (Honours / General)</td>
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<td>Sanskrit (Honours / General)</td>
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<td>Education (Honours / General)</td>
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<td>13</td>
<td>English ((Honours / General) LCC1 / LCC2 / AECC1)</td>
<td>41</td>
<td>Statistics (Honours / General)</td>
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<td>Urdu (Honours / General / LCC2 / AECC1)</td>
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<td>15</td>
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<td>Film Studies (General)</td>
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<td>Industrial Fish and Fisheries – IFP (Major)</td>
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<td>French (General)</td>
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<td>Sericulture – SRTV (Major)</td>
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<td>Computer Applications – CMAV (Major)</td>
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<td>Tourism and Travel Management – TTMV (Major)</td>
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<td>Hindi (Honours / General / LCC2 / AECC1)</td>
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<td>History (Honours / General)</td>
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<td>Clinical Nutrition and Dietetics CNDV (Major)</td>
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<td>House Hold Art (General)</td>
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<td>Bachelor of Fashion and Apparel Design – (B.F.A.D.) (Honours)</td>
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<td>Human Development (Honours / General)</td>
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<td>Bachelor of Fine Art (B.F.A.) (Honours)</td>
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<td>27</td>
<td>Human Rights (General)</td>
<td>55</td>
<td>B. Music (Honours / General) and Music (General)</td>
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<tr>
<td>28</td>
<td>Journalism and Mass Communication (Honours / General)</td>
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The above shall be effective from the academic session 2018-2019.

SENATE HOUSE
KOLKATA-700073
The 4th June, 2018

(Dr. Santanu Paul)
Deputy Registrar
Syllabus for B.Sc.(Hons.) Geology

Six Semester Course Under
Choice Based Credit System
Semester-wise Courses for B.A./B.Sc. (Honours)

<table>
<thead>
<tr>
<th></th>
<th>Sem-1</th>
<th>Sem-2</th>
<th>Sem-3</th>
<th>Sem-4</th>
<th>Sem-5</th>
<th>Sem-6</th>
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<td>2TH+2P/TU</td>
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<td>3TH+3P/TU</td>
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<td>CC-3&amp;4</td>
<td>CC-5,6 &amp;7</td>
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<td>GE-2</td>
<td>GE-3</td>
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<td><strong>Discipline Specific Elective (DSE)</strong></td>
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<td>B(1)</td>
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<td>1TH+0P/TU</td>
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<td></td>
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<td><strong>Skill Enhancement Course (SEC)</strong></td>
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<td><strong>Total No. of Courses and Marks</strong></td>
<td>4 × 100 = 400</td>
<td>4 × 100 = 400</td>
<td>5 × 100 = 500</td>
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TH= Theory  P= Practical  TU= Tutorial

- **CC/GE/ DSE**: Each Theory and Practical Course have 4 and 2 Credits respectively. Each Theory and Tutorial Course have 5 and 1 Credit(s) respectively.
- **GE**: Covering two subjects with two courses each; any subject in any semester; CC of a different subject in General course is to be treated as GE for Honours Course.
- **DSE/SEC**: Group (A & B) for specified semesters.
- **AECC/SEC**: Each Course has 2 Credits.
- **AECC-1**: Communicative English / MIL; AECC-2: Environmental Studies.
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<th>YEAR</th>
<th>SEMESTER</th>
<th>COURSE TYPE</th>
<th>COURSE NAMES WITH CODE</th>
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### Points Table

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**Note**

1. AEC courses are not included in the gradation.
2. Geology Hons Students must opt GE courses of other subject of equivalent credit. GE must cover two different subjects with two courses each, any subject in any semester. CC of General course of the chosen subjects is to be treated as GE for Honours course.
3. DSE and SEC choice must be group specific to each semester.
4. At least 50 lectures of an hour duration should be allotted for 4 credit theoretical course and 2 credit practical course.

**Total**

| Points | 2600 | 140 |

**CORE COURSE: GEOLOGY**
Unit 1: Earth as a Planet

Branches of Earth Sciences.
General characteristics and origin of the Universe, Solar System and its planets. The terrestrial and jovian planets.
Meteorites and Asteroids.
Earth in the solar system - origin, size, shape, mass, density, rotational and revolution parameters.
Origin of atmosphere, ocean and life.

Unit 2: Solid Earth, Hydrosphere, Atmosphere and Biosphere

Mechanical layering of the Earth: lithosphere, asthenosphere, mantle and core.
Earthquake and earthquake belts: seismic waves and internal constitution of the Earth.
Volcanoes and volcanism, distribution of volcanoes.
Concept of isostasy.
Formation of core, mantle, crust, atmosphere, hydrosphere and biosphere.
Convection in Earth's core and production of its magnetic field.
Geothermal gradient and internal heat of the Earth.

Unit 3: Cosmic abundance of elements

Distribution of elements in solar system and in Earth.
Composition of the Earth. General concepts about geochemical cycles.
Properties of common elements in Earth.
Concepts of geochemical cycles.

Unit 4: Hydrosphere and Atmosphere

Oceanic current system and effect of Coriolis force.
Concepts of eustasy.
Land-sea interaction: Wave erosion and beach processes.
Atmospheric circulation.
Weather and climatic changes.

Unit 5: Plate Tectonics

Historical development of the concept of continental drift and plate tectonics.
Plates and plate boundaries.
Geodynamic elements of Earth: mid oceanic ridges, trenches, transform faults and island arcs.
Plate tectonics: mountain belts and rift valleys.

Unit 6: Soil

Soils: types, soil profile, processes of formation of soil.

Unit 7: Understanding the past from Stratigraphic records

Nature of stratigraphic records.
Fundamental laws of stratigraphy: laws of superposition and faunal succession.
Absolute and relative time in Geology. Concept of time and geological time scale
Concept of radiometric dating. Radiometric dating of rocks and minerals: U-Pb, Pb-Pb, K-Ar, Rb-Sr, Sm-Nd methods. Dating igneous and sedimentary rocks.       
Concepts of neptunism, plutonism, uniformitarianism, and catastrophism.  
Geological time scale.  

**Paper –GEL-A-CC-1-1-P**  
[2 CREDITS]  
EARTH SYSTEM SCIENCE  

Study of major geomorphic features and their relationships with outcrops through maps and physiographic models. Detailed study of topographic sheets and preparation of physiographic description of an area.  
Study of soil profile of a specific area.  
Distribution of major lithostratigraphic units of India.  
Global distribution of cratons, mobile belts and major sedimentary basins. Distribution of cratons, mobile belts and major sedimentary basins in India  
Calculation of Richter magnitude from P and S wave interval data.  
Study of minerals in hand specimens (Silicates: olivine, garnet, andalusite, sillimanite, kyanite, staurolite, beryl, tourmaline, pyroxene, tremolite, hornblende-actinolite, serpentine, talc, muscovite, biotite, quartz, feldspar, nepheline, zeolite, asbestos; Quartz varieties: chert, chalcedony, agate, jasper, amethyst, rock crystal.  
Other minerals: pyrite, chalcopyrite, galena, sphalerite, barite and gypsum, magnetite, haematite, pyrolusite and psilomelane, corundum, ilmenite, chromite, bauxite; fluorspar, calcite, dolomite, apatite, graphite)  
Study of rocks in hand specimens  

**Suggested Readings**  

**Paper –GEL-A-CC-1-2-TH**  
[4 CREDITS]  
MINERAL SCIENCE  

**Unit 1: Crystallography**  
Concept of crystal and crystalline matter. Internal order in crystal.  
Crystal structure; elementary ideas about crystal morphology in relation to internal structures.  
Crystal parameters and indices; form and zone.  
Stereographic projection of crystal faces, Crystal symmetry, classification of crystals into systems. Lattice theory and 32 point groups. International symbol of point groups.  

**Unit 2: Atomic arrangements and Mineral structure**  
Atomic arrangements: unit cell, CCP, FCC and HCP.  
Ionic radius and coordination, Pauling's rules. Solid Solution, polymorphism, pseudomorphism.  
Atomic structure of silicate minerals.  

**Unit 3: Rock forming minerals**  
Minerals - definition and classification, physical and chemical properties.  
Chemical classification of minerals.  
Composition of common oxides, carbonates, sulfoles and sulphotates, phosphate.  
Composition of common rock-forming minerals – internal atomic structure, pyroxene, amphibole, and mica groups.
Unit 4: Crystal Optics
Nature of light and optical behaviour of crystals.
Introduction to petrological microscope.
Theory of light propagation in isotropic, uniaxial, and biaxial crystals.
Principles of orthoscopic and conoscopic studies of minerals under optical microscope.

Paper – GEL-A-CC-1-2-P
[2 CREDITS]
MINERAL SCIENCE

Study of the symmetry of crystals. Stereographic projection of crystals.
Derivation of structural formulae based on composition.
Study of optical properties of common rock-forming minerals: quartz, orthoclase, microcline, plagioclase, perthite, nepheline, olivine, orthopyroxene, clinopyroxene, hornblende, staurolite, garnet, muscovite, biotite, calcite, chlorite, epidote, kyanite, sillimanite, tourmaline, zircon, sphene, zoisite, apatite.
Determination of scheme of pleochroism and extinction angles of hornblende

Suggested Readings

Paper – GEL-A-CC-2-3-TH
[4 CREDITS]
ELEMENTS OF GEOCHEMISTRY

Unit 1: Basic Concepts
The periodic table.
Chemical bonding, states of matter and atomic environment of elements.
Geochemical classification of elements.
Cosmic abundance of elements in earth and meteorites.

Unit 2: Layered Structure of Earth and Geochemistry
Composition of crust: Continental and Oceanic.
Composition of mantle: depleted mantle and enriched mantle.
Composition of core.
Bulk chemical Composition of the Earth.
Isotope geology – radiogenic and stable isotopes in Earth materials.
Principles of radioactive dating (Rb-Sr method).

Unit 3: Element transport
Abundance of elements in river and ocean water
Constancy of elemental composition of ocean water
Concept of ionic and redox potential and pH
Aqueous geochemistry- basic concepts and speciation in solutions, Eh, pH relations.
Factors controlling chemical sedimentation.

**Unit 4: Geochemistry of solid Earth**

Geochemical variability of magma and its products. Melting processes.

**Unit 5: Geochemical behaviour of selected Elements during Magmatic Fractionation**

Si, Al, K, Na, Ca, Fe, Mg, Ti.

Geochemical variation diagrams and its interpretations: bivariate and trivariate plots to delineate the control of different compositional variables: Harker variation diagram, AFM diagram, MgO diagram. Chemical variation diagrams based on major elements: the alkali-lime index, iron enrichment index, aluminum saturation index and alkalinity index diagrams.

**Reference Books**

Unit 5: Fractures and faults
Basic idea of shear zone. Faults and joints.
Geometric classification of faults. Anderson’s dynamic analysis of faulting.
Effects of faulting on the outcrops.
Criteria for recognition of faults. Geometry of pinch and swell and boudin structure.

Paper –GEL-A-CC-2-4-P
[2 CREDITS]
STRUCTURAL GEOLOGY
Basic idea of topographic maps. Topographic sheets of various scales. Interpretation of topographic maps.
Interpretation of geological maps with unconformity, fault, fold and igneous bodies. Construction of structural cross section.
Stereographic projections of planes and lines.
True dip and apparent dip problems, 3-point problems, fold problems, fault problems and their solutions through stereographic projection methods.

Reference Books

Paper –GEL-A-CC-3-5-TH
[4 CREDITS]
IGNEOUS PETROLOGY

Unit 1: Introduction to Igneous Petrology
Modes of magma generation in the crust and upper mantle.
Physical properties of magma - temperature, viscosity, density and volatile content. Modes of emplacement of igneous rocks: volcanic, hypabyssal, plutonic.

Unit 2: Forms of Igneous rock bodies
Mode of occurrence of Igneous rocks.
Forms of igneous rocks.

Unit 3: Texture and Microstructure of Igneous rocks
Crystallinity, granularity, shapes and mutual relations of grains; nucleation and growth of igneous minerals.
Description of the following textures and microstructures with their occurrence in different rocks - panidiomorphic, hypidiomorphic, allotriomorphic, porphyritic, poikilitic, ophitic, sub-ophitic, intergranular, intersertal, pilotaxitic, trachytic, graphic, granophyric, rapakivi, orbicular, corona, perthitic, myrmekitic, variolitic, speherulitic and spinifex, vesicular, amygdaloidal.

Unit 4: Classification of Igneous rocks
Composition and texture of important igneous rocks: granitoids, pegmatite, syenite, monzonite, diorite, norite, gabbro, anthrothosite, dolerite, pyroxenites, peridotite, lamprophyres, carbonatite, rhyolite, andesite, dacite, basalt, komatiite.

Unit 5: Phase Diagrams

Unit 6: Petrogenesis of Igneous rocks
Magmatic processes; crystal settling in magma, magma convection, crystal mush theory, igneous cumulates, diversity of igneous rocks
Petrogenesis of felsic and mafic igneous rocks: granitoids, basalt, anorthosite, alkaline rocks, ultramafic rocks.

Unit 7: Magmatism in different tectonic settings
Fundamental ideas of magmatism in different tectonics settings.

Reference Books
Grain size: concept and size scale; particle shape and fabric; sedimentary textures. grain size analyses and environmental connotation

**Unit 3: Basic Hydraulics and Sedimentary Structures: sediment transport mechanism**
Fluid flow: flow rheology, fluid gravity flow, sediment gravity flow, flow regime, laminar and turbulent flow, particle entrainment in fluid flow.
Mass flow: types and deposits
Sedimentary structure: primary and penecontemporaneous deformation structures, biogenic structures.
Paleocurrent analysis: data acquisition, methodology, different palaeocurrent patterns.

**Unit 4: Sedimentary rocks**
Siliciclastic rocks: components and classification(s) of conglomerates, sandstones, mudrocks.
General introduction to carbonate rocks, BIF, chert;
Components and classifications of limestone, dolomites and dolomitisation.

**Unit 5: Sedimentary environments**
Classification, sedimentary facies.
Facies models for glacier, meandering, fluvial, deltaic, and shelf depositional settings

**Unit 6: Diagenesis**
Concepts of diagenesis
Stages of diagenesis: diagenetic changes in sand and carbonate deposits, lithification.

**Paper –GEL-A-CC-3-6-P**
[2 CREDITS]
SEDIMENTARY PETROLOGY

Identification of sedimentary structures in hand specimens.
Statistical analysis of particle size distribution.
Paleocurrent analysis.
Petrographic study of clastic and non-clastic rocks in thin sections.

**Reference Books**


**Paper –GEL-A-CC-3-7-TH**
[4 CREDITS]
PALEONTOLOGY

**Unit 1: Fossilization and fossil record**
Nature and importance of fossil record; Fossilization processes and modes of preservation

**Unit 2: Taxonomy and Species concept**
Species concept with special reference to paleontology, Taxonomic hierarchy Theory of organic evolution interpreted from fossil record

**Unit 3: Invertebrates**
Brief introduction to important invertebrate groups (Mollusca and Brachiopoda) and their biostratigraphic significance
Significance of ammonites in Mesozoic biostratigraphy and their paleobiogeographic implications
Functional adaptation in trilobites and ammonoids.
Origin of invertebrates and major steps in their evolution.

Unit 4: Vertebrates
Origin of vertebrates and major steps in vertebrate evolution.
Mesozoic reptiles with special reference to origin diversity and extinction of dinosaurs
Evolution of horse and intercontinental migrations.
Human evolution.

Unit 5. Introduction to Paleobotany, Gondwana Flora
Introduction to Ichnology.

Unit 6: Application of fossils in Stratigraphy
Biozones, index fossils, correlation
Role of fossils in sequence stratigraphy
Fossils and paleoenvironmental analysis
Fossils and paleobiogeography, biogeographic provinces, dispersals and barriers
Paleoecology – fossils as a window to the evolution of ecosystems

Reference Books

Paper –GEL-A-CC-3-7-P
[2 CREDITS]
PALEONTOLOGY
Study of fossils showing various modes of preservation
Study of morphological characters of various invertebrates, vertebrates and plant fossils
Elementary exercise on functional morphology of bivalves

Unit 1: Metamorphism: Controls and Types
Definition of metamorphism. Factors controlling metamorphism, Types of metamorphism – contact, regional, fault zone metamorphism, impact metamorphism.
Causes of metamorphism and concept of metamorphic P-T-t paths.

Unit 2: Metamorphic Facies and Grades. Metamorphic Structures and Textures
Index minerals, metamorphic zones and isograds. Structure and textures of metamorphic rocks.
Concept of metamorphic facies and grade.
Mineralogical phase rule of closed and open system.
Composition-paragenesis diagrams. ACF, AKF and AFM diagrams.
Metamorphic products of pelitic, carbonate and mafic igneous rocks.

Unit 3: Metamorphic reactions. Metamorphism and deformation.
Progressive and retrogressive metamorphism.
Prograde and retrograde metamorphic minerals reactions.
Relationship between metamorphism and deformation.

Unit 4: Migmatites and their origin
Metasomatism and role of fluids in metamorphism.
Brief idea of crustal anatexis. Migmatites and its origin.
Metamorphic differentiation.

Unit 5: Metamorphic rock associations and Plate Tectonic settings
Regional occurrence and tectonic significance of metamorphic rocks: metamorphism along convergent plate margins, in continent-continent collisions, in rifting terrains and sea floor metamorphism.
Metamorphic belts of India.

Hand specimen study of following metamorphic rocks: slate, phyllite, schist, gneiss, amphibolite, charnockite, khondalite, mafic granulite, marble.
Textural and mineralogical study of following metamorphic rocks in thin sections: slate, varieties of schists, gneiss, amphibolite, charnockite, khondalite, mafic granulite, eclogite, marble, high Mg-Al granulites.
Graphical plots of metamorphic mineral assemblages using chemographic diagrams (ACF and AKF) in greenschist and amphibolite facies.

Reference Books


Unit 1: Principles of stratigraphy
Fundamentals of litho-, bio- and chrono-stratigraphy
Introduction to concepts of dynamic stratigraphy (chemostratigraphy, seismic stratigraphy, sequence stratigraphy, magnetostratigraphy)

Unit 2: Code of stratigraphic nomenclature
Concepts of Stratotypes. Global Stratotype Section and Point (GSSP).
Principles of stratigraphy and principles of Precambrian stratigraphy
Unit 3: Facies concept in stratigraphy
Walther’s Law of Facies.

Unit 4: Paleogeography
Concept of paleogeographic reconstruction

Unit 5: Physiographic and tectonic subdivisions of India
Brief introduction to the physiographic and tectonic subdivisions of India.

Unit 6: Precambrian Stratigraphy
Introduction to Indian Shield
Concept of Archean nucleus: Dharwar and Singhbhum
Introduction to Proterozoic basins of India.
Geology of Vindhyan and Cudappah basins of India

Paper –GEL-A-CC-4-9-P
[2 CREDITS]
STRATIGRAPHIC PRINCIPLESAND INDIAN STRATIGRAPHY

Study of geological map of India and identification of major Precambrian stratigraphic units.
Drawing of various paleogeographic maps of Precambrian time
Study of different Proterozoic and Pangea supercontinent reconstructions.

Reference Books

Paper –GEL-A-CC-4-10-TH
[4 CREDITS]
PHANEROZOIC STRATIGRAPHY OF INDIA

Unit 1: Phanerozoic Stratigraphy of India
Paleozoic Succession of Kashmir and its correlatives from Spiti Stratigraphy
Structure of Gondwana basins.
Mesozoic stratigraphy of India: Triassic successions of Spiti, Jurassic of Kutch, Cretaceous successions of Cauvery basins
Cenozoic stratigraphy of India: Kutch basin, Siwalik successions, Assam and Andaman basins.
Stratigraphy and structure of Krishna-Godavari basin, Cauvery basin, Bombay offshore basin, Kutch and Saurashtra basins

Unit 2: Volcanic provinces of India
Deccan, Rajmahal, Sylhet Trap

Unit 3: Stratigraphic boundaries
Important Stratigraphic boundaries in India: Precambrian-Cambrian boundary, Permian-Triassic boundary, Cretaceous-Paleogene boundary
PHANEROZOIC STRATIGRAPHY OF INDIA

Study of geological map of India and identification of major Phanerozoic stratigraphic units.
Drawing of various paleogeographic maps of Phanerozoic time
Stratigraphic correlation of Phanerozoic stratigraphic units in geological map of India.

Reference Books

ECONOMIC GEOLOGY

Unit 1: Ores and Gangues
Ores, protor, gangue minerals, tenor, grade and lodes. Hypogene and supergene ore deposits, epigenetic and syngenic mineral deposits; mineral beneficiation
Resources and reserves- economic and academic definitions.

Unit 2: Mineral deposits and Classical concepts of Ore formation
Mineral occurrence, mineral deposit and ore deposit.
Historical concepts of ore genesis: Man’s earliest vocation- mining.
Mineral deposits and their litho-tectonic environments.
Metallogenic provinces and epochs.

Unit 3: Structure and texture of ore deposits
Concordant and discordant ore bodies.
Endogenous processes: magmatic concentration, skarns, greisens, and hydrothermal deposits.
Exogenous processes: weathering products and residual deposits, oxidation and supergene enrichment, placer deposits.

Unit 4: Ore grade and Reserve
Assessment of ore grade and reserve, reserve estimation.

Unit 5: Metallic and Nonmetallic ores
Important deposits of India including atomic minerals: study of geologic set up, mode of occurrence, mineralogy and genesis of the following ore deposits in India: iron ore in Singhbhum and Karnataka, Manganese of Central India, copper of Malanjkhand, lead-zinc of Zawar area, uranium of Singhbhum.
Non-metallic and industrial rocks and minerals in India.
Introduction to gemstones.

Reference Books

Paper –GEL-A-CC-5-12-TH
[4 CREDITS]
ENGINEERING GEOLOGY

Unit 1: Introduction
Role of Engineering geologists in planning, design and construction of major man-made structural features.

Unit 2: Site Investigation
Site investigation and characterization.

Unit 3: Foundation
Foundation treatment; Grouting, Rock Bolting and other support mechanisms.

Unit 4: Intact Rock and Rock Mass Properties
Rock aggregates; significance as construction material.

Unit 5: Rock Quality Designation (RQD)

Unit 6: Tunnels
Tunneling methods.

Unit 7: Landslides
Causes, factors and corrective/preventive measures.

Unit 8: Earthquakes
Corrective/preventive measures. Mitigating the damage caused by earthquake.

Paper –GEL-A-CC-5-12-P
[2 CREDITS]
ENGINEERING GEOLOGY
Computation of reservoir area, catchment area, reservoir capacity and reservoir life.
Merits, demerits and remedial measures based upon geological cross sections of project sites.
Computation of Index properties of rocks.
Computation of RQD, RSR, RMR, and ‘Q’.

Reference Books
HYDROGEOLOGY

Unit 1: Introduction and basic concepts
Scope of hydrogeology and its societal relevance
Hydrologic cycle: precipitation, evapo-transpiration, run-off, infiltration and subsurface movement of water.
Rock properties affecting groundwater, Vertical distribution of subsurface water
Types of aquifer, aquifer parameters, anisotropy and heterogeneity of aquifers

Unit 2: Groundwater flow
Darcy's law and its validity
Intrinsic permeability and hydraulic conductivity
Groundwater flow rates and flow direction
Laminar and turbulent groundwater flow

Unit 3: Groundwater provinces
Groundwater provinces of India and West Bengal

Unit 4: Groundwater chemistry
Physical and chemical properties of water and water quality
Sea water intrusion in coastal aquifers

Unit 5: Groundwater management
Surface and subsurface water interaction
Groundwater level fluctuations
Basic concepts of water balance studies, recharge and discharge
Rainwater harvesting and artificial recharge of groundwater

Paper –GEL-A-CC-6-13-P
[2 CREDITS]

HYDROGEOLOGY

Water potential zones of India (map study).
Graphical representation of chemical quality data and water classification (C-S and Trilinear diagrams)
Simple numerical problems related to: determination of permeability in field and laboratory,

Reference Books

Paper –GEL-A-CC-6-14-TH
[4 CREDITS]

GEOMORPHOLOGY, REMOTESENSING AND GIS

Unit 1: Introduction
Introduction to geomorphology; relationship between the landforms and the properties of earth material and different kind of processes.
Endogenic and exogenic processes.

Unit 2
Geoid, topography, hypsometry, major morphological features of the earth surface.
Large scale topography - plate tectonics overview, large scale mountain ranges (with emphasis on Himalayas).
Unit 3
Surficial processes and geomorphology; weathering and associated landforms.
Landforms produced by glacial, periglacial processes, fluvial processes, aeolian processes, coastal processes.
Landforms associated with igneous activities.

Unit 4
Endogenic-exogenic interactions; rates of uplift and denudation; tectonics and drainage development; sea-level change; long-term landscape development.
Landform dating techniques.

Unit 5: Photogeology
Types and acquisition of aerial photographs; scale and resolution; principles of stereoscopy, relief displacement, vertical exaggeration and distortion.
Elements of air photo interpretation.
Identification of sedimentary, igneous and metamorphic rocks and various aeolian, glacial, fluvial and marine landforms.

Unit 6: Remote Sensing
Sensors and scanners.
Satellites and their characteristics.
Data formats- Raster and Vector.

Unit 7: Digital Image Processing
Image classification

Unit 8: GIS and GPS
Datum, Coordinate systems and projection systems.
Concepts of GPS.
Integrating GPS data with GIS.
Applications of GPS in earth system sciences.

Paper –GEL-A-CC-6-14-P
[2 CREDITS]
GEOMORPHOLOGY, REMOTESENSING ANDGIS

Reading topographic maps. Preparation of topographic profile.
Preparation of longitudinal profile of a river. Calculating stream length gradient index.
Morphometry of a drainage basin. Interpretation of geomorphic processes from the geomorphology of the area.
Aerial photo interpretation: identification of sedimentary, igneous and metamorphic rocks and various aeolian, glacial, fluvial and marine landforms.

Reference Books
DISCIPLINE SPECIFIC ELECTIVE

DSE- A


[4 CREDITS]

TECTONICS

Unit 1: Introduction

Unit 2: Historical Perspective: Continental Drift, Sea Floor Spreading and Plate Tectonics

Unit 3: Plate and Plate boundaries

Unit 4: Plate Tectonics: Past and Present


[2 CREDITS]

TECTONICS

Geometry of plate tectonics: Vector solutions in 2D and 3D of plate movements. Problems of plate movements - Rotations on sphere

Reference Books


[4 CREDITS]

EXPLORATION GEOLOGY
Unit 1: Mineral Resources
Resource reserve definitions, Mineral resources in industries – historical perspective and present, A brief overview of classification of mineral deposits with respect to processes of formation in relation to exploration strategies.

Unit 2: Prospecting and Exploration
Principles of mineral exploration, Prospecting and exploration- conceptualization, methodology and stages, Sampling, subsurface sampling including pitting, trenching and drilling, Geochemical exploration.

Unit 3: Evaluation of data
Evaluation of sampling data
Mean, mode, median, standard deviation and variance

Unit 4: Drilling and Logging
Core and non-core drilling
Planning of bore holes and location of boreholes on ground
Core-logging

Unit 5: Reserve estimations and Errors
Principles of reserve estimation, density and bulk density
Factors affecting reliability of reserve estimation
Reserve estimation based on geometrical models (square, rectangular, triangular and polygon blocks)
Regular and irregular grid patterns, statistics and error estimation

[2 CREDITS]
EXPLORATION GEOLOGY

Identification of anomaly
Concept of weighted average in anomaly detection
Geological cross-section
Models of reserve estimation

Reference Books
Arogyaswami, R.P.N. 1996 Courses in Mining Geology. 4th Ed. Oxford-IBH.

[4 CREDITS]
EARTH AND CLIMATE

Unit 1: Climate system: Forcing and Responses
Components of the climate system.
Climate forcing, Climate controlling factors.
Feedbacks in climate system (positive and negative).

Unit 2: **Heat budget of Earth**
Incoming solar radiation, receipt and storage of heat transformation.
Earth’s heat budget. Interactions amongst various sources of earth’s heat.

Unit 3: **Atmosphere – Hydrosphere**
Layering of atmosphere and atmospheric Circulation.
Atmosphere and ocean interaction and its effect on climate.
Surface and deep circulation.
Sea ice and glacial ice.

Unit 4: **Response of biosphere to Earth’s climate**
Climate change: natural vs. anthropogenic effects.
Future perspectives.
Brief introduction to archives of climate change.
Brief introduction to palaeoclimate.
Palaeoclimate data from India.

Unit 5: **Orbital cyclicity and climate**
Milankovitch cycles and variability in the climate.
Glacial-interglacial stages
The last glacial maximum (LGM)
Pleistocene Glacial-Interglacial cycles.

Unit 6: **Monsoon**
Mechanism of monsoon.
Monsoonal variation through time.
Factors associated with monsoonal intensity.
Effects of monsoon.

**Paper – GEL-A-DSE-A-6-1-P**
[2 CREDITS]
EARTH AND CLIMATE
Study of distribution of major climatic regimes of India on map
Distribution of major wind patterns on World map
Numerical exercises on interpretation of proxy records for palaeoclimate

**Reference Books**

[4 CREDITS]
EARTH SURFACE PROCESSES
Unit 1: Introduction to earth surface processes
Historical development in concepts, terrestrial relief, scales in geomorphology,


Unit 3: Rates and changes in surface processes. Techniques for measuring rates of processes: sediment budgeting, rock magnetism, isotope geochemical tracers, cosmogenic nuclides, OSL & C-14 dating

Unit 4: Controlling factors (tectonics, climate, sea level changes and anthropogenic) and surface processes. Climate change and geomorphic response of fluvial systems of arid and humid regions Geomorphic response to tectonics, sea level/base level change, anthropogenic affects Introduction to Anthropocene

Unit 5: Geomorphic concepts in cause-effect relationship. Spatial & temporal scales, geomorphic system, connectivity, buffering, magnitude-frequency concept, time lag, sensitivity, equilibrium, threshold, non-linearity & complexities. Mega geomorphology and process interrelationship. Surface processes and natural hazards; Applied aspects of geomorphology; Introduction to planetary geomorphology.

**Paper – GEL-A-DSE-A-6-2-P**

**[2 CREDITS]**

**EARTH SURFACE PROCESSES**

Mapping of different landforms and interpretation of surface processes. Exercises on hill slope development, fluvial channel, sediment erosion and transport, sediment budgeting, aggradation and degradation events, drainage basin, drainage morphometry. Basic exercises on computation of rate for different surface processes.

**Reference Books**

Summerfield M A 1991Goble *Geomorphology* Prentice Hall.
Unit 1: Coal
Definition and origin of Coal
Basic classification of coal
Fundamentals of Coal Petrology - Introduction to lithotypes, microlithotypes and macerals in coal
Proximate and Ultimate analysis

Unit 2: Coal as a fuel
Coal Bed Methane (CBM): global and Indian scenario

Unit 3: Petroleum
Chemical composition and physical properties of crudes in nature
Origin of petroleum

Unit 4: Petroleum Reservoirs and Traps
Reservoir rocks: general attributes
Classification of reservoir rocks - clastic and chemical.
Hydrocarbon traps: definition, anticlinal theory and trap theory
Classification of hydrocarbon traps - structural, stratigraphic and combination
Time of trap formation and time of hydrocarbon accumulation.
Cap rocks - definition and general properties.

Unit 5: Other fuels
Gas Hydrate
Nuclear Fuel

Study of hand specimens of coal
Reserve estimation of coal

Reference Books
EVOLUTION OF LIFE THROUGH TIME

Unit 1: Life through ages
Fossils and chemical remains of ancient life.
Geological Time Scale with emphasis on major bio-events.
Fossilization processes and modes of fossil preservation.
Exceptional preservation sites- age and fauna

Unit 2: Geobiology
Biosphere as a system, processes and products
Biogeochemical cycles
Abundance and diversity of microbes, extremophiles
Microbes-mineral interactions, microbial mats

Unit 3: Origin of life
Possible life sustaining sites in the solar system, life sustaining elements and isotope records
Archean life: Earth’s oldest life, Transition from Archean to Proterozoic, the oxygen revolution and radiation of life
Precambrian macrofossils – The garden of Ediacara
The Snow Ball Earth Hypothesis

Unit 4: Paleozoic Life
The Cambrian Explosion.
Biomineralization and skeletalization
Origin of vertebrates and radiation of fishes
Origin of tetrapods - Life out of water
Early land plants and impact of land vegetation

Unit 5: Mesozoic Life
Life after the largest (P/T) mass extinction, life in the Jurassic seas
Origin of mammals
Rise and fall of dinosaurs
Origin of birds; and spread of flowering plants

Unit 6: Cenozoic Life
Aftermath of end Cretaceous mass extinction – radiation of placental mammals
Evolution of modern grasslands and co-evolution of hoofed grazers
Rise of modern plants and vegetation
Back to water – Evolution of Whales

Unit 7: The age of humans
Hominid dispersals and climate setting
Climate Change during the Phanerozoic - continental break-ups and collisions
Plate tectonics and its effects on climate and life
Effects of life on climate and geology
**Paper – GEL-A-DSE-B-5-2-P**  
[2 CREDITS]  
EVOLUTION OF LIFE THROUGH TIME

Study of modes of fossil preservation  
Study of fossils from different stratigraphic levels  
Exercises related to major evolutionary trends in important groups of animals and plants

**Reference Books**  
Stanley, S.M., 2008 Earth System History  
Cowen, R., 2000 History of Life, Blackwell

**Paper – GEL-A-DSE-B-6-1-TH**  
[4 CREDITS]  
FIELD GEOLOGY AND GRAND VIVA

**Unit 1: Grand viva**  
Viva-voce on all topics covered under six semester course curricula

**Paper – GEL-A-DSE-B-6-1-P**  
[2 CREDITS]  
FIELD GEOLOGY AND GRAND VIVA

**7-day fieldwork**  
Preparation of a Geological map of a small area with folded/faulted beds.  
Interrelation between different structural elements and their interpretations.  
Visit to one underground/open crust mine: mining operation, surface geological expression of mining site Visit to dam site  
Report writing.

**Paper – GEL-A-DSE-B-6-2-TH**  
[4 CREDITS]  
INTRODUCTION TO GEOPHYSICS

**Unit 1: Geology and Geophysics**  
Interrelationship between geology and geophysics, Role of geological and geophysical data in explaining geodynamical features of the earth.

**Unit 2: General and Exploration geophysics**  
Different types of geophysical methods - gravity, magnetic, electrical and seismic; their principles and applications  
Concepts and Usage of corrections in geophysical data

**Unit 3: Geophysical field operations**  
Different types of surveys, grid and route surveys, profiling and sounding techniques
Scales of survey, Presentation of geophysical data

Unit 4: Application of Geophysical methods
Regional geophysics, oil and gas geophysics, ore geophysics, groundwater geophysics, engineering geophysics

**Unit 5: Geophysical anomalies**
Correction to measured quantities, geophysical, anomaly, regional and residual (local) anomalies, factors controlling anomaly, and depth of exploration

Unit 6: Integrated geophysical methods
Ambiguities in geophysical interpretation, planning and execution of geophysical surveys

**Paper – GEL-A-DSE-B-6-2-P**

[2 CREDITS]
INTRODUCTION TO GEOPHYSICS

Anomaly and background- Graphical method
Study and interpretation of seismic reflector geometry
Problems on gravity anomaly

**Reference Books**
SKILL ENHANCEMENT COURSE

SEC-A


[2 CREDITS]

FieldWork

7-days fieldwork
Use of topographic sheets in field. Marking location in topographic sheet using physical features and bearing.
Identification of rock types in field.
Identification of primary and secondary structures in field.
Clinometer and Brunton compass: use of the instruments in measuring geological data in field. Techniques of measurement of orientation data in field.
Litholog measurement
Recording field data in maps and notebooks.
Report writing.


[2 CREDITS]

FieldWork

7-days fieldwork
Visit to any mineral deposit
Mode occurrence of ore, Ore mineralogy
Ore-Host rock interrelation
Ore formation process
Basic techniques of surveying, concept of outcrop mapping
Report writing.
FieldWork

7-day fieldwork
Map reading and geological mapping
stratigraphic and biogeographic correlation using fossils
Preparation of a geological map of a small area with homoclinal or gently folded beds.
Stereographic plots of orientation data and their interpretation.
Report writing.

FieldWork

7-day fieldwork
Field training along Phanerozoic basin of India
Documentation of stratigraphic details in the field
Collection of sedimentological, stratigraphic and paleontological details and their representation
Facies concept and its spatio-temporal relation (Walther’s Law) and concept of facies distribution
atbasinal-scale
Fossils sampling techniques and their descriptions
Report writing.
Syllabus for B.Sc.(General) Geology

Six Semester Course Under

Choice Based Credit System
### Semester-wise Courses for B. Sc. (General)

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<td><strong>Core Course (CC)</strong></td>
<td>3TH+3P/TU</td>
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<td>CC-1</td>
<td>CC-2</td>
<td>CC-3</td>
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<td><strong>Discipline Specific Elective (DSE)</strong></td>
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<td>3TH+3P/TU</td>
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<td>(1A+2A+3A)</td>
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<td><strong>Ability Enhancement Compulsory Course (AECC)</strong></td>
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<td>1TH+0P/TU</td>
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<td><strong>Skill Enhancement Elective (SEC)</strong></td>
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<td>1TH+0P/TU</td>
<td>1TH+0P/TU</td>
<td>1TH+0P/TU</td>
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<td>SEC-B</td>
<td>SEC-A</td>
<td>SEC-B</td>
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<td><strong>Total No. of Courses and Marks</strong></td>
<td>4×100 =400</td>
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TH= Theory  P= Practical  TU= Tutorial

- **CC/DSE**: Each Theory and Practical Course have 4 and 2 Credits respectively. Each Theory and Tutorial Course have 5 and 1 Credit(s) respectively.
- **CC**: 4 courses each from 3 subjects (one course from each subject under each semester)
- **DSE**: 2 courses each from 3 subjects (one course from each subject under each semester)
- **AECC/SEC**: Each Course has 2 credits
- **AECC-1**: Communicative English / MIL; AECC-2: Environmental Studies
- **SEC**: 4 courses; two courses each from two subjects
- **DSE/SEC**: Group (A & B) for specified semesters
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<th>YEAR</th>
<th>SEMESTER</th>
<th>COURSE</th>
<th>COURSE NAMES WITH CODE</th>
<th>CREDIT POINTS</th>
<th>EQUIVALENT MARKS</th>
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<td>I</td>
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<td>GEL-G-CC-1-1-TH / GEL-A-GE-1-1-TH: PHYSICAL and STRUCTURAL GEOOGY</td>
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<td>AECC-2: Environmental Studies</td>
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<td>CC</td>
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<td>DSE-A</td>
<td>GEL-G-DSE-A- 5-1-TH</td>
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<td>SEC-B</td>
<td>GEL-G-SEC-B- 6-2-TH / Subject 2-G-SEC-B- X-X-TH / Subject 3-G-SEC-B- X-X-TH</td>
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<td>DSE-B</td>
<td>GEL-G-DSE-B- 6-1-TH</td>
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<td>GEL-G-DSE-B- 6-1-P</td>
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<td>DSE-B</td>
<td>Subject 2-G-DSE-B- X-X-TH + Subject 2-G-DSE-B- X-X-P</td>
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Note:

1. SEC / DSE choice from two subjects and must be group specific
2. AEC courses are not included in the gradation
3. At least 50 lectures of an hour duration should be allotted for 4 credit theoretical course and 2 credit practical course.
CORE COURSES

[4 credits]

PHYSICAL and STRUCTURAL GEOLOGY

Unit-I: Introduction to geology and its scope, Earth and solar system: origin, size, shape, mass, density and its atmosphere.
Unit-II: A brief account of various theories regarding the origin and age of the earth; Brief idea of interior of earth and its composition.
Unit-III: Weathering and erosion: factors, types and their effects;
Unit-IV: Earthquakes: nature of seismic waves, their intensity and magnitude scale; Origin of earthquake; Volcanoes: types, products and causes of volcanism;
Unit-V: Introduction to Structural Geology; contours, topographic and geological maps; Elementary idea of bed, dip and strike; Outcrop, effects of various structures on outcrop. Clinometer/Brunton compass and its use.
Unit-VI: Elementary idea of types of deformation; Folds: nomenclature and types of folds;
Unit-VII: Faults: nomenclature, geometrical and genetic classifications, normal, thrust and slip faults;
Unit-VIII: definition, kinds and significance of joints and unconformity.

[2 credits]

PHYSICAL and STRUCTURAL GEOLOGY

• Physical Geology:
Study of important geomorphological models; Reading topographical maps of the Survey of India; Identification of geomorphic features.
• Structural Geology:
Study of clinometers/Brunton compass; Identification of different types of folds/faults from block models; Exercises on structural problems: preparation of cross section profile from a geological map.

Books Recommended:
[4 credits]

CRYSTALLOGRAPHY and MINERALOGY

Unit-I: Crystals and their characters:
Unit-II: Crystal form, face, edge, solid angle; Interfacial angle and their measurements;
Crystallographic axes and angles.
Unit-III: Crystal parameters, Weiss and Miller system of notations;
Unit-IV: Symmetry elements and description of normal class of Isometric, Tetragonal,
Hexagonal, Trigonal, Orthorhombic, Monoclinic and Triclinic systems.
Unit-V: Introduction to Mineralogy, Definition and characters of mineral;
Unit-VI: Common physical properties of minerals; Chemical composition and diagnostic
physical properties of minerals such as: Quartz, Orthoclase, Microcline, Hypersthene,
Hornblende, Garnet, Muscovite, Biotite, Chlorite, Olivine, Epidote, Calcite.
Unit-VII: Polarizing microscope, its parts and functioning; Ordinary and polarized lights;
Common optical properties observed under ordinary, polarized lights and crossed nicols.
Unit-VIII: Optical properties of some common rock forming minerals (Quartz, Orthoclase,
Microcline, Olivine, Augite, Hornblende, Muscovite, Biotite, Garnet, Calcite).

[2 credits]

CRYSTALLOGRAPHY and MINERALOGY

• Crystallography:
Study of symmetry elements of normal class of Isometric, Tetragonal, Hexagonal, Trigonal,
Orthorhombic, Monoclinic and Triclinic systems.
• Mineralogy:
Study of physical properties of minerals mentioned in theory course. Use of polarizing
microscope; Study of optical properties of common rock forming minerals mentioned in theory
course.

Books Recommended:
Igneous Petrology
Unit-I: Magma: definition, composition, types and origin; Forms of igneous rocks; textures of igneous rocks.
Unit-II: Reaction principle; Differentiation and Assimilation; Crystallization of unicomponent and bicomponent (mix-crystals); Bowen’s reaction series.
Unit-III: Mineralogical and chemical classification of igneous rocks:.
Unit-IV: Detailed petrographic description of Granite, Granodiorite, Rhyolite, Syenite, Phonolite, Diorite, Gabbro.

Sedimentary Petrology
Unit-V: Processes of formation of sedimentary rocks; Classification, textures and structures of sedimentary rocks;
Unit-VI: Petrographic details of important siliciclastic and carbonate rocks such as - conglomerate, breccia, sandstone, greywacke, shale, limestones.

Metamorphic Petrology
Unit-VII: Process and products of metamorphism; Type of metamorphism. Factors, zones and grade of metamorphism; Textures, structures and classification of metamorphic rocks.
Unit-VIII: Petrographic details of some important metamorphic rocks such as - slate, , schists, gneiss, quartzite, marble.

Books Recommended:

**Paper – GEL-G-CC-4-4-TH / GEL-A-GE-4-4-TH**

**[4 credits]**

**STRAIGRAPHY and PALAEONTOLOGY**

**Unit I:** Definition, Principle of stratigraphy; Geological Time Scale and stratigraphic classification; Physiographic division of India.

**Unit II:** Study of following Precambrian succession: Dharwar, Cuddapha, Vindhyan and Delhi Supergroups; Brief idea of Palaeozoic succession of northwestern Himalaya; Triassic of Spiti; Mesozoic type succession of Kutch and Rajasthan; Cretaceous of Tiruchirapalli;

**Unit III:** Study of following type localities: Gondwana and Deccan Trap.

**Unit IV:** Palaeogene-Neogene sequences of northwest Himalaya and Assam.

**Unit-V:** Palaeontology: definition, Fossils: definition, characters, binomial nomenclature in taxonomy, mode of preservation, condition of fossilization and significance of fossils;

**Unit VI:** Morphology and geological distribution of brachiopods, pelecypods, cephalopods.

**Unit VII:** Morphology and geological distribution of trilobite, echinoidea.

**Unit VIII:** Evolutionary history of horse; Morphology, distribution and significance of Gondwana flora.

**Paper – GEL-G-CC-4-4-P / GEL-A-GE-4-4-P**

**[2 credits]**

**STRAIGRAPHY and PALAEONTOLOGY**

I. Morphological characters, systematic position and age of fossil genera pertaining to brachiopods, pelecypods, cephalopods, trilobite and Echinacea.

II. Preparation of lithostratigraphic maps of India showing distribution of important geological formations.

**Books Recommended:**
DISCIPLINE SPECIFIC ELECTIVE

DSE- A


[4 CREDITS]

ECONOMIC GEOLOGY and HYDROLOGY

Unit-I: Concept of ore and ore deposits, ore minerals and gangue minerals; Tenor of ores; Metallic and non-metallic ore minerals; Strategic, Critical and essential minerals.

Unit-II: Processes of formation of ore deposits; Magmatic, contact metasomatic, hydrothermal, sedimentation.

Unit-III: Study of important metallic (Cu, Pb, Zn Mn, Fe, Au, Al) and non-metallic (industrial) minerals (gypsum, magnesite, mica).

Unit-IV: Distribution of coal and petroleum in India;

Unit-V: Definition of hydrogeology, Hydrological cycle;

Unit-VI: Hydrological parameters - Precipitation, evaporation, transpiration and infiltration.

Unit-VII: Origin of groundwater; Vertical distribution of groundwater; Types of aquifers; Water bearing properties of rocks - Porosity and Permeability; specific yield, specific retention.

Unit-VIII: Surface and subsurface geophysical and geological methods of ground water exploration; Groundwater provinces of India.


[2 CREDITS]

ECONOMIC GEOLOGY and HYDROLOGY

I) Economic Geology:
Study of ore and economic minerals in hand specimen; Preparation of maps showing distribution of important metallic and non-metallic deposits and important coal and oil fields of India.

II) Hydrology:
Study of hydro-geological models, Estimation of porosity and permeability from the given data; Preparation and interpretation of water table maps.

Books Recommended:


**NATURAL HAZARDS AND DISASTER MANAGEMENT**

[4 CREDITS]

Unit 1: The Lithosphere and Related Hazards
Atmospheric Hazards, Hydrosphere and Related Hazards
Unit 2: Concepts of disaster
Types of disaster: natural and manmade - cyclone, flood, land slide, land subsidence, fire and earthquake, tsunami and volcanic eruption
Unit 3: Tectonics and Climate, Meteorite Impacts
Issues and concern for various causes of disasters
Disaster management, mitigation, and preparedness
Techniques of monitoring and design against the disasters
Management issues related to disaster


**NATURAL HAZARDS AND DISASTER MANAGEMENT**

[2 CREDITS]

Remote-sensing and GIS applications in real time disaster monitoring

**Reference Books**
DSE- B

Paper – GEL-G-DSE-B-6-1-TH

[4 CREDITS]

ELEMENTS OF APPLIED GEOLOGY

Unit-I: Engineering properties of rocks and Soils.
Unit-II: Soil and Soil groups of India.
Unit-III: Dam, Types and their geological and environmental considerations; Geological problem of reservoirs.
Unit-IV: Tunnels: geology, structure, seepage problem and role of water table;
Unit-V: Landslides: classification, causes and preventative measures.
Unit-VI: Mineral exploration: Elementary idea of geological and geophysical prospecting.
Unit-VII: Elementary idea of mining.
Unit-VIII: Environmental considerations for mining.

Paper – GEL-G-DSE-B-6-1-P

[2 CREDITS]

ELEMENTS OF APPLIED GEOLOGY

Engineering properties and identification of building stones. Identification of various models of landslide, tunnel and dam. Study of soil profiles.

Books Recommended:

Paper – GEL-G-DSE-B-X-X-TH

INTRODUCTION TO SUSTAINABILITY

[4 CREDITS]

Unit 1: Introduction to Sustainability; basic concepts
Human Population – Past and Future trends
Unit 2: Ecosystems
Extinctions and Tragedy of Commons
Climate and Energy
Water Resources and Agriculture
Unit 3: National Resources Accounting
Environmental Economics and Policy
Measuring Sustainability
Systems interconnectivity among Primary Sustainability challenges
Sustainability Solutions: Some examples

Paper – GEL-G-DSE-B-X-X-P

INTRODUCTION TO SUSTAINABILITY

[2 CREDITS]

Study of Climatic maps, ecological maps, natural resources maps.

Reference Books
SKILL ENHANCEMENT COURSE
SEC-A

Paper – GEL-G-SEC-A-3-1-TH

[2 CREDITS]

FIELD GEOLOGY
Students will be required to carry out 03 days field work in a suitable geological area to study the elementary aspects of field geology and submit a report thereon.


[2 CREDITS]

GEOMORPHOLOGY and GEOTECTONICS

Unit-I: Basic principles of Geomorphology, geomorphological cycles, weathering and erosion; Geomorphic mapping- tools and techniques.

Unit-II: Epigene/exogenic processes: degradation and aggradation. Hypogene/endogenic processes; Diastrophism and volcanism, Extraterrestrial processes; Geological work of wind, glacier, river, underground water and ocean.

Unit-III: Earth as a dynamic system. Elementary idea of continental drift, sea-floor spreading and mid-oceanic ridges. Paleomagnetism and its application.

Unit-IV: Plate Tectonics: the concept, plate margins, orogeny, deep sea trenches, island arcs and volcanic arcs.

Books Recommended:
GEOCHEMISTRY

Unit-I: Introduction to geochemistry: basic knowledge about crystal chemistry. Types of chemical bonds, coordination number; Colloids in geological systems, ion exchanges and geological evidence for earlier colloids; Elementary idea of Periodic Table.

Unit-II: Cosmic abundance of elements; Composition of the planets and meteorites; Geochemical evolution of the earth and geochemical cycles;

Unit-III: Gold Schmidt's geochemical classification of elements; Distribution of major, minor and trace elements in igneous, metamorphic and sedimentary rocks.

Unit-IV: Elements of geochemical thermodynamics; Isomorphism and polymorphism; Isotope geochemistry.

Books Recommended:

PHOTO GEOLOGY and REMOTE SENSING

Unit-I: Elementary idea about photogeology: electro-magnetic spectrum, types & geometry of aerial photographs; factors affecting aerial photography; types of camera, film and filters; factors affecting scale;

Unit-II: Fundamentals of remote sensing; remote sensing systems; remote sensing sensors; signatures of rocks, minerals and soils. Application of remote sensing in geoscience and geomorphological studies.

Unit-III: Types of Indian and Foreign Remote Sensing Satellites, Digital image processing; fundamental steps in image processing; elements of pattern recognition and image classification.

Unit-IV: Introduction to Geographic Information System (GIS); components of GIS; product generation in GIS; tools for map analysis; integration of GIS with remote sensing.

Books Recommended: