

UNIVERSITY OF NORTH BENGAL



ENLIGHTENMENT TO PERFECTION

Syllabus for 2 year M.Sc. in Applied Geology

**Four Semester Course Under
Choice Based Credit System
2018-2019**

CBCS Syllabus Structure for Geology and Applied Geology - M.Sc.

(Course Duration = Four-Semester Two-year)

Total Credits = 64

Theory = 24 Credits Practical = 8 Credits

Elective theory =4 Credits Elective practical =2 Credits

Field Geology = 4 Credits Dissertation or Special Paper =6 Credits

Cont. Evaluation = 16 Credits

CBCS Syllabus Structure for M.Sc. in Geology and Applied Geology

FIRST SEMESTER

Sl. No.	COURSE ID (T/P)	COURSE	CREDIT POINTS	MARKS
1.	GEOL/T/101	Mineralogy and Geochemistry	2	50
2.	GEOL/T/102	Structural Geology	2	50
3.	GEOL/T/103	Sedimentology	2	50
4.	GEOL/T/104	Palaeontology	2	50
5.	GEOL/P/101	Mineralogy and Geochemistry	1	25
6.	GEOL/P/102	Structural Geology	1	25
7.	GEOL/P/103	Sedimentology	1	25
8.	GEOL/P/104	Palaeontology	1	25
9.	GEOL/CT/1	Continuous Evaluation	4	100
TOTAL			12+4	300+100

SECOND SEMESTER

Sl. No.	COURSE ID (TH/PR)	COURSE	CREDIT POINTS	MARKS
1.	GEOL/T/201	Igneous Petrology	2	50
2.	GEOL/T/202	Metamorphic Petrology	2	50
3.	GEOL/T/203	Stratigraphy	2	50
4.	GEOL/T/204	Geotectonics and Applied Geophysics	2	50
5.	GEOL/P/201	Igneous Petrology	1	25
6.	GEOL/P/202	Metamorphic Petrology	1	25
7.	GEOL/F/201	Field Geology	2	50
8.	GEOL/CT/2	Continuous Evaluation	4	100
TOTAL			12+4	300+100

THIRD SEMESTER

Sl. No.	COURSE ID (TH/PR)	COURSE	CREDIT POINTS	MARKS
1.	GEOL/T/301	Geomorphology and Engineering Geology	2	50
2.	GEOL/T/302	Economic Geology and Fuel Geology	2	50
3.	GEOL/T/303	Mineral Exploration, Mineral Beneficiation, Mining Geology	2	50
4.	GEOL/ET/301	Elective paper I	2	50
5.	GEOL/P/301	Ore Geology and Fuel Geology	1	25
6.	GEOL/EP/301	Elective Practical paper I	1	25
7.	GEOL/F/301	Field Geology	2	50
8.	GEOL/CT/3	Continuous Evaluation	4	100
TOTAL			12+4	300+100

FOURTH SEMESTER

Sl. No.	COURSE ID (TH/PR)	COURSE	CREDIT POINTS	MARKS
1.	GEOL/T/401	Remote Sensing and Hydrogeology	2	50
2.	GEOL/ET/401	Elective paper II	2	50
3.	GEOL/P/401	Remote Sensing and Hydrogeology	1	25
4.	GEOL/EP/401	Elective Practical paper II	1	25
5.	GEOL/D/401	Dissertation or Special paper and Viva Voce/Seminar	4+2 = 6	150 (100+50)
6.	GEOL/CT/4	Continuous Evaluation and Grand Viva	4	100
TOTAL			12+4	300+100

LIST OF COURSES OFFERED UNDER CBCS APPLIED GEOLOGY

A. CORE THEORETICAL COURSES:

- GEOL/T/101: Mineralogy and Geochemistry
- GEOL/T/102: Structural Geology
- GEOL/T/103: Sedimentology
- GEOL/T/104: Palaeontology
- GEOL/T/201: Igneous Petrology

GEOL/T/202: Metamorphic Petrology
GEOL/T/203: Stratigraphy
GEOL/T/204: Geotectonics and Applied Geophysics
GEOL/T/301: Geomorphology and Engineering Geology
GEOL/T/302: Economic Geology and Fuel Geology
GEOL/T/303: Mineral Exploration, Mineral Beneficiation, Mining Geology
GEOL/T/401: Remote Sensing and Hydrogeology

B. CORE PRACTICAL COURSES:

GEOL/P/101: Mineralogy and Geochemistry
GEOL/P/102: Structural Geology
GEOL/P/103: Sedimentology
GEOL/P/104: Palaeontology
GEOL/P/201: Igneous Petrology
GEOL/P/202: Metamorphic Petrology
GEOL/P/301: Ore Geology and Fuel Geology
GEOL/P/401: Remote Sensing and Hydrogeology

C. ELECTIVE THEORY COURSES:

GEOL/ET/301: Elective Theory Course I
GEOL/ET/401: Elective Theory Course II

D. ELECTIVE PRACTICAL COURSES:

GEOL/EP/301: Elective Practical Course I
GEOL/EP/401: Elective Practical Course II

LIST OF ELECTIVE THEORY COURSES

(ANY TWO NON-REPITATIVE SUBJECT COMBINATION IN TWO SEMESTER)

1. Ocean Science
2. Sedimentary Basin Analysis
3. Environmental Geology and Climatology
4. Isotope Geochemistry
5. Quaternary Geology

E. FIELD GEOLOGY

GEOL/F/201: Field Geology I
GEOL/F/301: Field Geology II

F. DISSERTATION OR SPECIAL PAPER

Core Subjects Syllabus

First Semester

Course No. GEOL/T/ 101

2 credits

Mineralogy and Geochemistry (Theoretical)

Group A: Mineralogy

Bonding in crystal structures; Closed pack structures, CCP and HCP, body-centered cubic structure, Interstitial sites in close-packed structures; Structure types based on close packing; Structures built from polyhedral.

Crystal structure of silicates; The $[\text{SiO}_4]$ tetrahedron, generalized idea on silicate structure and composition; Effect of changing pressure, temperature and composition in silicate structures; Composition and generalized formula of different mineral groups.

X-Ray Crystallography: Bragg's Law, single crystal and powder methods - Principle and application in determination of crystal structure. Defects in minerals.

Group B: Geochemistry

Earth in relation to solar system and universe. Cosmic abundance of elements, Comparisons of planets and meteorites.

Isotope geochemistry: Geochronology - methods and limitations, Evolution of the Earth's isotopic reservoir, Application to petrogenesis. Stable isotopes - Nature, Abundance, Fractionation, Evolution, Fluid interactions. Applications in environmental problems.

General chemical characteristics of sedimentary rocks; role of ionic potential, H-ion concentration and oxidation-reduction potential in sedimentation. Eh-pH diagrams of Mn-H₂O systems and Fe- H₂O systems with/without CO₂.

Geochemical cycle, Biogeochemical cycle, Ocean-atmosphere interactions, the evolution of Atmosphere

Course No. GEOL/P/ 101

Mineralogy and Geochemistry (Practical)

1 credit

Study of the symmetry of crystals.

Study of physical properties of minerals in hand specimen

Study of optical properties of common rock-forming minerals

Geochemical analysis of geological samples

Geochemical variation diagrams and its interpretations

Stable Isotope analysis

Course No. GEOL/T/ 102

2 credits

Structural Geology (Theoretical)

Rheology: Behaviors of rocks under stress; Rheological models; Flow law for steady state creep; factors influencing flow of rocks; Deformation mechanism; Estimation of paleostress.

Stress: Basic concept of stress; Analysis of stress in three dimensions; stress field description; equilibrium condition; trajectory patterns and boundary condition.

Strain: Infinitesimal strain; measurement of strain; progressive deformation; Role of fluid in deformation; Stress –Strain curves for elastic, viscous and plastic; Concept of Rock deformation: Brittle and ductile deformation.

Folds; Geometric and genetic classification of folds, Fold interference in single and multilayer; Mechanism of folding and superposed folding; Structural analysis for deformed terrain.

Faults and Fractures; Origin, Mechanics, dynamics and significance.

Foliation; Lineation; Boudinage; Origin and significance.

Shear Zones, Grain scale deformation mechanism and its manifestation in microstructure: Solid State Diffusion Creep. Granular flow and Superplasticity.

Course No. GEOL/P/ 102

Structural Geology (Practical)

1 credit

Interpretation of topographic and Geological maps, Stereographic projections; Interpretation of outcrop patterns of deformed lithounits involving folding and faulting on flat and undulating topography; Strain analysis.

Course No. GEOL/T/ 103

2 credits

Sedimentology (Theoretical)

Process-Product relationship: Sedimentation processes and products in major clastic and chemogenic depositional systems.

Sedimentary facies - philosophy and procedure, facies successions and facies models; Palaeogeographic and palaeoenvironmental reconstruction.

Tectonics and sedimentation: Role of extrabasinal and intrabasinal factors in sedimentation pattern.

Application of trace elements, rare earth elements and stable isotope geochemistry to sedimentological problems, Provenance determination, Palaeoclimate reconstruction

Sequence stratigraphy: Concept, methods and application

Course No. GEOL/P/ 103

1 credit

Sedimentology (Practical)

Description and interpretation of sedimentary structures in hand specimen; Analysis of granulometry; Microscopic study of sandstones and limestone; Palaeocurrent analysis.

Course No. GEOL/T/ 104

2 credits

Palaeontology (Theoretical)

Origin of life, Precambrian life, Adaptation and Functional Morphology; Organic Evolution – theories, modes, patterns and trends.

Evolutionary Systematics: Numerical Taxonomy, Cladistic Taxonomy.

Organic Evolution: theories, modes, patterns and trends, Ontogeny: patterns and its role in organic evolution.

Mass extinctions: Causes; rate of extinction and evolution.

Biostratigraphy: Application of fossils in age determination and correlation.

Microfossils: Types, environmental significance; Application to exploration geology and palaeoclimatic studies.

Palynology: introduction, palynomorphs, morphology of spores and pollens, Wall Stratification of Spore and Pollen.

Siwalik Fauna: their origin and occurrences; Trace Fossil: Classification and its application
Origin and major steps in vertebrate evolution.

Course No. GEOL/P/ 104

1 credit

Palaeontology (Practical)

Study of fossils with various modes of preservation; Study of hard part and functional morphology of different invertebrate groups; Identification of feeding habits from vertebrate teeth; Study of ontogenetic growth patterns through biometric analysis; Numerical techniques to study populations; Study of microfossils.

Second Semester

Course No. GEOL/T/ 201

2 credits

Igneous Petrology (Theoretical)

Magma generation, Mode of emplacement; Physical properties and forms of igneous rocks.

Mode of Occurrence, Classification, texture and microtexture of igneous rocks.

Thermodynamics and Phase Diagram: Introduction to thermodynamics, Phase rule, and its application to binary and ternary systems, Phase Diagrams in understanding crystal melt equilibria.

Physical, chemical and mineralogical composition of upper mantle; Partial melting; Segregation and ascent of magma.

Petrogenesis: Important felsic, mafic and ultramafic rocks.

Magmatism in relation to tectonic settings

Course No. GEOL/P/ 201

1 credit

Igneous Petrology (Practical)

Study of important igneous rocks and rock associations in hand specimen and in thin section with special reference to texture and structure; Norms calculation and determination of structural formula of minerals from given chemical data.

Course No. GEOL/T/ 202

2 credits

Metamorphic Petrology (Theoretical)

Index minerals, metamorphic zones; Metamorphic facies and grades, concept of metamorphic P-T-t paths.

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.

Metamorphism in different tectonic settings.

Mineralogical Geothermobarometry and its limitations; Ultrahigh temperature and pressure metamorphism - phase equilibria constraints, characterization, implications, Role of Fluids in metamorphism.

P - T - t paths of metamorphism, their derivation and their significance, Metamorphism and crustal evolution

Course No. GEOL/P/ 202

1 credit

Metamorphic Petrology (Practical)

Study of important metamorphic rocks in hand specimen and in thin section; Geometrical analysis of phase equilibria.

Course No. GEOL/T/ 203

2 credits

Stratigraphy (Theoretical)

Characteristics of different Archaean Cratons in Peninsular India; General overview of these Archaean Cratons and evolution of the Indian shield; Lithology, tectonics, Igneous activity,

metamorphism and broad stratigraphic subdivisions of Precambrians of India; Concept of supercontinent cycle: Proterozoic mobile belts of India.

Proterozoic Basins of India: Stratigraphic evolution of important Proterozoic basins of India.

Phanerozoic stratigraphy of India: Palaeozoic and Mesozoic stratigraphy of extra-peninsular India, Gondwana basins, Kutch basin; Rajasthan basins, Cauvery basin; Siwalik, Bengal and Assam basin; Quaternary Successions of India.

Boundary problems: A-P, Precambrian-Cambrian, P-T, K-T and Neogene-Quaternary boundaries

Course No. GEOL/T/ 203

2 credits

Geotectonics and Applied Geophysics (Theoretical)

Group A: Geotectonics

Geomagnetic field, paleomagnetism, Polar wander and continental drift, geomagnetic field reversals, seafloor spreading,

Plate motions and plate boundaries, geodynamic elements, earthquake focal mechanism, relative plate motions via seafloor spreading and earthquake focal mechanisms, satellite geodetic measurements of relative plate motions

Group B: Applied Geophysics

Seismology and Interior structure of the Earth: Elastic wave theory, Snell's Law, the ray parameter and theory of seismic waves, Earthquake seismology, Internal structure of the earth.

Gravity: Gravitational fields of the earth and anomalies, Geoid and figures of the Earth, Isostasy and structure of the crust; Gravity method: Gravity field Survey, Corrections Applied to gravity data, Preparation of gravity maps.

Geomagnetism: Earth's magnetic field, Magnetic behavior of rocks, Palaeomagnetism and its applications; Magnetic method: Principles, Preparation of Magnetic anomaly maps and interpretation.

Thermal and Electrical properties of the solid Earth: Source of heat. Heat flow mechanism in crust, mantle and core, Electric method: Principles, Resistivity methods: basic properties, field procedures, electrode arrays and equipment; Interpretation of electrical profile and sounding curves Application of electrical methods in groundwater prospecting and civil engineering problems.

Seismic Method: Principles of wave propagation; Refraction and Reflection seismic surveys for single interface both horizontal and dipping cases; Seismic velocity and interpretation of seismic data.

Third Semester

Course No. GEOL/T/ 301

2 credits

Geomorphology and Engineering Geology (Theoretical)

Group A: Geomorphology

Landform and Earth materials; Endogenic and Exogenic processes; Major geomorphological features.

Surficial Processes and Geomorphology: Important landscapes generated by different processes
Endogenic- Exogenic interference: Landform and tectonics; uplift and denudation; Hillslope.

Drainage pattern and Tectonics; Sea-level change; Geomorphic cycles

Group B: Engineering Geology

Stages of geological investigation for engineering projects.

Slope stability and mass movements: classifications, landslides, controlling factors of mass movements and their remedial measures.

Building materials and dimension stones: Concept, Properties; Indian Occurrence.

Dams and reservoir: Types, Parts of dams and reservoirs, stability of dams and reservoir, seepage and leakage.

Dam and reservoir failure: Causes and their remedial measures; Criteria for selecting sites for construction of dams and reservoirs.

Tunnels: Types, Parts of a tunnel, stability of tunnel.

Tunnel Failure: Causes and their remedial measures; criteria for selecting sites for construction of tunnels

Course No. GEOL/T/ 302

2 credits

Economic Geology and Fuel Geology (Theoretical)

Group A: Economic Geology

Ore-Forming Processes, Mode of Occurrence, Role of fluids in ore genesis.

Plate tectonics and mineral deposits.

Ore textures and their genesis: sulphide and oxide phase equilibria and its significance.

Ores of silicic igneous rock association, Ores of basic and ultrabasic plutonic rocks, Ores of sedimentary association: Sedimentary deposits, placer deposits, Ores of volcanic- Volcano-sedimentary association, Ores of metamorphic association, Ores associated with weathering surfaces; Metamorphism of ores.

Indian Occurrence of Fe, Mn, Cu, Pb, Zn, Cr, Ni, Sn and W deposits

Mode of Occurrence and origin of important non-metallic minerals: diamond, graphite, barite, gypsum, phosphorite, mica and asbestos.

Raw materials (with specifications) used in the following industry: Iron and Steel, Glass and ceramic, Cement and Fertilizer.

Group B: Fuel Geology

Introduction: Sources of energy, Indian scenario.

Coal Geology: Introduction, Origin of coal, Biochemical and dynamo-chemical changes in coal formation, Macroscopic and Microscopic constituents, Macerals and micro-lithotypes, Physical and chemical properties.

Grade and Rank of coal, Indian classification, Spatial and temporal distribution of coal, Indian scenario.

Petroleum Geology: Composition and physical properties of petroleum, Origin of Petroleum; Kerogen and their types.

Migration of natural hydrocarbon.

Petroleum Reservoir: source rock, reservoir rock, cap rocks.

Traps : Structural, stratigraphic and combination traps.

Petroliferous basins of India.

Nuclear Fuel: Mineralogy, Geochemistry, mode of occurrence; Distribution of radioactive minerals in India; Radiogenic waste disposal — geological constrains.

Gas-hydrates.

Course No. GEOL/T/ 303

2 credits

Mineral Exploration, Mineral Beneficiation, Mining Geology (Theoretical)

Group A: Mineral Exploration

Introduction: Principles; Prospecting and exploration.

Mineral exploration: Surface and Sub-surface exploration.

Drilling methods: Core and Non-core.

Geochemical methods for mineral exploration; Geobotanical and photogeochemical methods.

Mineral economics: Specialties inherent in mineral industry; Strategic, critical and essential minerals; Reserve — resources classification; Conservation and substitution, National Mineral Policy.

Group B: Mineral Beneficiation

Beneficiation: Definition, Scope, Importance, advantages; Operating steps in beneficiation.

Crushing: Primary and Secondary crushers, Construction and operational features.

Grinding: Theory, Construction and operation of Ball and Rod mills.

Laboratory sizing and industrial screening, rake, spiral and hydrocyclone classifiers.

Beneficiation Processes: Size, specific gravity and surface property dependent processes: Gravity concentration: theory and practice of Jigging, heavy media separation and flowing film concentration. Froth flotation. Drying and dewatering.

Group C: Mining Geology

Methods of mining- Placer/alluvial, opencast and underground mining.

Mining terminologies: Shaft sinking, drifting, cross-cutting, sloping, Mine subsidence, mine support, room & pillar, top slicing, caving (sublevel caving and block caving), mining hazards, mine inundation, fire and rock blast.

Sampling, bench mapping, underground mine mapping, preparation of plans and sections.

Planning, exploration and exploratory mining of surface and underground deposits.

Environmental impacts in mining industries.

Course No. GEOL/P/ 301

1 credit

Ore Geology and Fuel Geology (Practical)

Study of hand specimen of important ore mineral; Study of important ore minerals under microscope.

Study of hand specimen of coal, Reserve estimation of coal.

Fourth Semester

Course No. GEOL/T/ 401

2 credits

Remote Sensing and Hydrogeology

Group A: Remote Sensing

Definition, concept, Types scope and purpose; Photogeology: Digital and conventional.

Electromagnetic Radiation: Concepts and theories; Electromagnetic spectrum: Types, Common wavelength band in Remote sensing; Interaction with atmosphere and application in remote sensing; atmosphere windows.

Remote Sensing: data source, platforms and sensors; data products, geometric and radiometric corrections; Acquisition of data; Thermal and microwave remote sensing; Satellite Imagery; Indian Remote Sensing Satellites and Space Missions.

Photogeology: Aerial photography, definition, characteristics, Types and geometry; Aerial Photo Interpretation and Elements of photogrammetry.

Digital Image Processing: Image structure, Processing system, Restoration, enhancement, classification and application in geological exploration, landuse and natural hazards zonation.

Geographical Information System (GIS) and Global Positioning System (GPS)

Group B: Hydrogeology

Introduction and basic concept; Hydrological cycle, Aquifer; Groundwater flow: Governing laws; flow rates and flow directions; Groundwater fluctuation: types, controlling factors; Environmental influences in groundwater.

Groundwater Wells: Types and methods of construction; Well Performance test.

Groundwater Quality: Components of groundwater; Salinity in Groundwater: Salinity influxes in groundwater, Seawater intrusion and Ghyben-Herzberg Relation; Prevention and control of saline water intrusion; Classification and Indian salinity hazards.

Artificial recharge of groundwater: Concept, Methods and applications.

Groundwater Level Monitoring: Types, well networks, Timing and frequency of water level measurements, data collection, water level mapping and significance.

Groundwater Exploration: Surface geophysical methods — Electrical, Seismic, Magnetic, Gravity, Radiometric. Geophysical well logging.

Groundwater pollution: Arsenic, Fluoride and Nitrate.

Groundwater Management and Development: Methods and stages of Groundwater Investigations; Data Collection, Water level measurements, Recharge and discharge areas; Groundwater legislation.

Indian distribution of Groundwater.

Course No. GEOL/P/ 401

1 credit

Remote Sensing and Hydrogeology (Practical)

Hydrogeological maps: Depth to water table maps, groundwater contour maps, water table fluctuation maps.

Stereoscopic study of air-photos, parallax, vertical exaggeration and Interpretations; Elementary practical exercises on photogeological mapping.

Application of Software in Remote Sensing and Hydrogeology.

Application of Geophysical Instruments in Hydrogeological Exploration.

Application of Geochemical data in identification of Aquifer Recharge Zone.

Semester III and IV

Elective Papers

Course No. (Theoretical): GEOL/ET/301 and GEOL/ET/401

2 credits

Course No. (Practical): GEOL/EP/301 and GEOL/EP/401

1 credit

Elective paper: Ocean Science (Theoretical)

Ocean Science

Physical Oceanography: Different mixing processes; important water masses- Characteristics; T-S diagrams; Properties of waves: Propagation, refraction, and reflection of waves; Wave spectrum, wave forecasting: principles; Coastal processes: Factors; transformation of waves in shallow water; effects of stratification; effect of bottom friction, nourishment; harbour resonance; seiches; tsunami; interaction of waves and structure.

Tide: Cause and magnitudes; prediction of tides; tides and tidal currents in shallow seas, estuaries and rivers.

Estuaries: Introduction, classification and nomenclature; circulation and mixing: Different models; tides in estuaries; sedimentation; salinity intrusion in estuaries; effect of stratification; coastal pollution; coastal management.

Global Wind system; Ekman's theory; Sverdrup, Stommel and Munk's theories; upwelling and sinking: Indian ocean. Ocean currents: Inertial currents; divergences and convergences; geostrophic motion; barotropic and baroclinic conditions; oceanic eddies, relative and slope currents. Wind driven coastal currents; Global conveyor belt circulation: Characteristics and causes.

Subtropical gyres: Cause; western boundary currents; equatorial current systems; El Nino; monsoonal winds and currents: North Indian Ocean; Somali current; southern ocean; Arabian Sea: Upwelling processes.

Chemical Oceanography: Seawater Composition; Elements: Types, Classification and distribution; Behavior and chemical exchanges across interfaces and residence times in seawater. Chemistry of Element: estuaries, hydrothermal vents, anoxic basins, HNLC waters, sediment pore fluid and anthropogenic inputs.

Biological-Chemical interactions: Ionic interactions; nutrients cycle, trace metals and organic matter. Atmosphere-Ocean Interaction: Important biogenic dissolved gases; carbon dioxide - carbonate system; alkalinity and control of pH; biological pump.

Biological Oceanography: Marine environment and marine organisms; Important factors affecting marine life; Production of marine life: Types; Phytoplankton and Zooplankton: Abundance and diversity; nekton; benthic organisms; coastal communities; Ecology and community: estuaries, coral reefs and mangrove; deep-sea ecology.

Energy flow and mineral cycling: energy transfer and transfer efficiencies through different trophic levels; food webs.

Anthropogenic impacts on marine biota; climate change and marine biodiversity; Pollution and marine environments including fisheries.

Ocean Science (Practical)

Term paper/presentation/practical assigned by the Teacher(s)

Elective paper: Climatology and Environmental Geology (Theoretical)

Group A: Climatology

Introduction, Climate: Classification; Koppen's and Thornthwaite's classification; Composition and structure of the atmosphere; Energy Balance: Solar Radiation; Temperature and Moisture; Distribution of temperature.

General circulation of winds; Monsoons and Jet Streams; Air Masses; Fronts, Cyclones: temperate and tropical.

Precipitation: Types and distribution; Global warming; Changes in Atmospheric Chemistry; Climate changes: Past, present and future.

Group B: Environmental Geology

Fundamental concepts; Problems and issues: local, regional and global.

Pollution: air, water and land. Nature and effects of air and water pollution, disposal of solid wastes and nuclear wastes.

Global climate change, deforestation, soil degradation.

Hazardous geological processes: Types, prediction and warning, disaster management.

Mineral resources: Mineral consumption on reserves, conservation of mineral resources, impact of mining activity on the environment, environmental management in mining.

Geological and environmental considerations for construction of dams, roads and tunnels;
Concepts of Environmental Impact Assessment (EIA).

Climatology and Environmental Geology (Practical)

Term paper/presentation/practical assigned by the Teacher(s)

Elective paper: Sedimentary Basin Analysis (Theoretical)

Mechanism of sedimentary basin formation: Rheological characteristics of the earth; basin formation and plate tectonics; Palaeocurrent analysis: Methods and use in basin analysis.

Sedimentary basin fills: Sediment routing system; Erosion and regolith; Terrestrial sediment and solute yield; BQART equation; Chemical weathering and global biogeochemical cycles; measurement of erosion rate.

Basin stratigraphy: Introduction; Accommodation, sediment supply and sea level; Stratigraphic cycles: definition and recognition; Hierarchy; Mechanism.

Subsidence: Introduction; compaction of porous sediments: fundamentals; Porosity and permeability of sediments and sedimentary rocks; Subsidence history and backstripping; Signatures of Tectonic subsidence.

Thermal history: Introduction; Arrhenius equation and maturation indices; Factors influencing temperatures and paleotemperatures in sedimentary basins; Measurements of thermal maturity in sedimentary basins.

Application to petroleum Geology: Petroleum system and concept of play; Source rock and source rock prediction; Reservoir rocks: Introduction, Reservoir properties: porosity and permeability; Factors controlling reservoir quality; diagenetic changes in reservoir rocks; Classic and unconventional plays.

Sedimentary Basin Analysis (Practical)

Term paper/presentation/practical assigned by the Teacher(s)

Elective paper: Isotope Geochemistry (Theoretical)

Introduction: General characteristics of Isotopes, Isotope effects, Isotope fractionation process of some important elements.

Mass Spectrometry: Basic principles; Equations of motion of ions; Ion Microprobe and Electrostatic Tandem Accelerators; Isotope Dilution Analysis.

Principles of Radioactivity, Decay mechanism of radioactive atoms; Radioactive decay and growth, Radiogenic isotope in Geochronology and Petrogenesis, Fission-track dating.

Stable isotope geochemistry: Scope of Stable Isotope Geochemistry, Variations of Stable Isotope Ratios in Nature, Isotope Geothermometry, Isotope Fractionation in the Hydrologic and Biological System.

Isotope Geochemistry (Practical)

Term paper/presentation/practical assigned by the Teacher(s)

Elective paper: Quaternary Geology (Theoretical)

Introduction: Definition and scope of Quaternary Geology.

Quaternary Geomorphology: Evolution of landscape and interactions between tectonic, climatic, and geomorphic processes.

Quaternary Geochronology: Radiogenic Carbon and Optical stimulated luminescence (OSL) dating method.

Quaternary Stratigraphy: Glacial varves; Dendrochronology; Tephrochronology, Climatostratigraphy, Magnetostratigraphy.

Global climate pattern, Climate controlling factors and Milankovitch Hypothesis, Quaternary Environments, Quaternary Sea-level changes.

Fossil records of the Quaternary; Pollen analysis, Mammalian fauna, Deep sea Biostratigraphy Continental and marine Quaternary record of India; Neotectonic, stratigraphic, sedimentologic and geomorphic evolution of Quaternary terrain of India.

Paleoclimatic reconstruction; Pleistocene Glacial-Interglacial cycles, Anthropocene; Effect of Anthropogenic activity on Global climate

Quaternary Geology (Practical)

Term paper/presentation/practical assigned by the Teacher(s)

Field Geology

Course No. GEOL/F/201

2 credits

Course No. GEOL/F/301

2 credits

Geological Fieldwork for structural mapping, lithological mapping, sedimentological, palaeontological, Economic geology, or any other selected problems of any age (Precambrian to Recent) in India.

Dissertation or Special paper and Viva Voce/Seminar 6 credits

Course No. GEOL/D/401