

**PRESCRIBED SYLLABUS  
FOR CBCS  
GEOLOGY NON HONOURS  
SEMESTER-WISE COURSES**

**Submitted to**



**Submitted by  
Department of Applied Geology, Dibrugarh University**

### OVERALL STRUCTURE

#### SEMWISE DISTRIBUTION OF COURSES IN B. Sc NON HONOURS IN GEOLOGY (CBCS)

Sem	Core Course (12)	AECC (2)	SEC (2)	DSE (6)
I	DSC 1A (6c)	AECC 1(2c)		
	DSC-2A(6c) DSC-3A(6c)	AECC 2 (2c)		
II	DSC 1B(6c) DSC-2B(6c) DSC-3B(6c)	AECC 3 (4c)		
III	DSC 1C(6c) DSC-2C(6c) DSC-3C(6c)		SEC 1.1(2c)	
IV	DSC 1D(6c) DSC-2D(6c) DSC-3D(6c)		SEC 2.1(2c)	
V			SEC 1.2(6c)	DSE 1A(6c) DSE 2A(6c) DSE 3A(6c)
VI			SEC 2.2(6c)	DSE 1B(6c) DSE 2B(6c) DSE 3B(6c)

#### CORE COURSE (14c) General Structure:

Semester	Core Course
I	DSC 1A: Introduction to Geology
	DSC 2A: Crystallography and Mineralogy
	DSC-3A: Geochemistry and Optical Mineralogy
II	DSC 1B: Thermodynamics and Igneous Petrology
	DSC 2B: Sedimentary and Metamorphic Petrology
	DSC-3B: Palaeontology
III	DSC 1C: Structural Geology and Tectonics
	DSC 2C: Surveying and Engineering Geology
	DSC-3C: Economic Geology
IV	DSC 1D: Geomorphology, Remote Sensing and GIS
	DSC 2D: Principles of Stratigraphy and Indian Stratigraphy
	DSC 3D: Coal and Petroleum

**Skill Enhancement Course SEC (2c) General Structure:**

Semester	Paper Structure	Papers available
III	SEC 1.1	Skills of basic Geological field studies
IV	SEC 2.1	Skills of advanced Geological field studies
V	SEC 1.2	Skills of Geological Field studies in igneous and metamorphic terrain
VI	SEC 2.2	Project Work

**Elective Discipline Specific DSE (4c) General Structure:**

Semester	Paper	Papers available for selection
V	DSE 1A	1. Geological Exploration 2. Geoinformatics 3. Fluvial Geomorphology 4. Environmental Geology
	DSE 2A	
	DSE 3A	
VI	DSE 1B	5. Mining Geology 6. Structural Geology 7. Hydrogeology 8. Earth and Climate
	DSE 2B	
	DSE 3B	

**SEMWISE DISTRIBUTION OF COURSES IN B. Sc HONOURS IN GEOLOGY (CBCS)**

Sem	Core Course(12)	Course code	AECC (2)	SEC (2)	Course code	DSE (6)	Course c code
I	DSC1A 6C		AECC (1)2c				
	DSC2A 6c		AECC(2) 2c				
	DSC3A6c						
II	DSC1B 6c						
	DSC2B6c						
	DSC3B6c						
III	DSC1C6c			SEC1.12c			
	DSC2c6c						
	DSC3C6c						
IV	DSC1D6c			SEC2.12c			
	DSC2D6c						
	DSC3D6c						
V				SEC1.22c		DSE1A 6c	
						DSE2A6c	
						DSE3A6c	
VI				SEC2.22c		DSE1B6c	
						DSE2B6c	
						DSE3B6	

**1<sup>st</sup> Sem**

	Course	Paper code	Title of the Course	Credit			Marks Distribution				
				Th	Prac	Total	Theory		Practical		Total
							End Sem	In- Sem	End Sem	In- Sem	
1 <sup>st</sup> Sem	DSC 1A	GEOG10 1T4	Introduction to Geology	4		6	48	12			100
		GEOG10 1P2			2				32	8	
	DSC 2A	GEOG10 2T4	Crystallography and Mineralogy	4		6	48	12			100
		GEOG10 2P2			2				32	8	

	DSC 3A(6 C)	GEOG GE101A T4	Geochemistry and optical mineralogy	4		6	48	12			100
		GEOG GE101A P2			2				32	8	
		Total				18					300

### 2<sup>nd</sup> Sem

	Course	Paper code	Title of the Course	Credit			Marks Distribution				
				Th	Prac	Total	Theory		Practical		Total
							End Sem	In- Sem	End Sem	In- Sem	
2n d Se m	DSC1 B 6C	GEOG20 1T4	Thermodynamics and Igneous petrology	4		6	48	12			100
		GEOG20 1P2			2				32	8	
	DSC2 B6C	GEOG20 2T4	Sedimentary and metamorphic petrology	4		6	48	12			100
		GEOG20 2P2			2				32	8	
	DSC3 B 6C	GEOG GE201A T4	Palaeontology	4		6	48	12			100
		GEOG GE201A P2			2				32	8	
	Total					18					300

### 3<sup>rd</sup> Sem

	Cour se	Paper code	Title of the Course	Credit			Marks Distribution				
				Th	Prac	Total	Theory		Practical		Total
							End Sem	In- Sem	End Sem	In- Sem	
3r d Se		GEOG30 1T4	Structural geology and tectonics	4		6	48	12			100
		GEOG30			2				32	8	

m	DSC 1C	1P2									
	DSC 2C	GEOG30 2T4	Surveying and engineering geology	4		6	48	12			100
		GEOG30 2P2			2				32	8	
	DSC 3C	GEOG30 2T4	Economic geology	4		6	48	12			100
		GEOG30 2P2			2				32	8	
	SEC 1.1- 2C	GEOGSE C301AT2	Skills of basic Geological field studies	2		2	24	6			30
	Total					20					330

#### 4<sup>th</sup> Sem

	Co urs e	Paper code	Title of the Course	Credit			Marks Distribution				
				Th	Prac	Total	Theory		Practical		Total
							End Sem	In- Sem	End Sem	In- Sem	
4 <sup>th</sup> Se m	DS C1 D	GEOG40 1T4	Geomorphology, Remote sensing and GIS	4		6	48	12			100
		GEOG40 1P2			2				32	8	
	DS C2 D	GEOG40 2T4	Principles of Stratigraphy and Indian stratigraphy	4		6	48	12			100
		GEOG40 2P2			2				32	8	
	DS C3 D	GEOG40 3T4	Coal and petroleum	4		6	48	12			100
		GEOG40 3P2			2				32	8	
	SE C 1.2 2C	GEOGSE C401AT2	Skills of advanced Geological field studies	2		2	24	6			30
	Total					26					430

### 5<sup>th</sup> Semester

	Course	Paper code	Title of the Course	Credit			Marks Distribution				
				Th	Prac	Total	Theory		Practical		Total
							End Sem	In- Sem	End Sem	In- Sem	
5 <sup>th</sup> Semester	SEC1.2 2C	GEOG501T4	Skills of Geological Field studies in igneous and metamorphic terrain	2		2	24	6			30
	DSE1A (6C)	GEOG DSE501 AT4	Geological Exploration	4		6	48	12			100
		GEOG DSE501 AP2			2				32	8	
	DSE2A(6c)	GEOG DSE502 AT4	Geoinformatics	4		6	48	12			100
		GEOG DSE502 AP2			2				32	8	
	DSE3A1(6C)	GEOG DSE503 AT4	Fluvial geomorphology	4		6	48	12			100
		GEOG DSE503 AP2			2				32	8	
		GEOGDS E503BT4	Environmental Geology	4		6	48	12	32	8	
		GEOGDS E503BP2			2						
	Total					20					330

### 6<sup>th</sup> Semester

	Course	Paper code	Title of the Course	Credit			Marks Distribution				
				Th	Prac	Total	Theory		Practical		Total
							End Sem	In- Sem	End Sem	In- Sem	
6 <sup>th</sup> Semester	SEC2.2 2C	GEOGSEC601Proj	Project work	2		2	24	6			30

Se		ect									
m	DSE1 B (6C)	GEOG DSE601B T4	Mining Geology	4		6	48	12			100
		GEOG DSE601B P2			2				32	8	
	DSE2 B(6c)	GEOG DSE602B T4	Structural Geology	4		6	48	12			100
		GEOG DSE602B P2			2				32	8	
	DSE3 B(6C )	GEOG DSE603B T4	Hydrogeology	4		6	48	12			100
		GEOG DSE603B P2			2				32	8	
		GEOGDS E603B1T 4	Earth and climate	4		6	48	12	32	8	
		GEOGDS E603B2P 2			2						
	Total					20					330

## 1<sup>st</sup> Sem

### DEPARTMENT SPECIFIC CORE COURSES (DSC)

#### DSE 1A: Introduction to Geology (6 Credits)

Theory (4 Credits) + Practical (2 Credits)

**48hrs**

**40 classes**

Solar system, planets, earth and moon, planetary orbital and rotational characteristics of earth, gravity, magnetic field, theories of origin, age of earth, evolution of life on earth. Interior of the Earth: core, mantle and crust.

*4 classes*

Various branches of geology, minerals and rocks, rock forming minerals, igneous, metamorphic and sedimentary rocks and minerals

*3 classes*

Uniformitarianism, actualism, catastrophism

*2 classes*



Activities of running water, wind, gravity, ice and sea waves, rock weathering and erosion, soil profile and classification, geomorphic environments associated with fluvial, glacial, coastal, volcanic and desertic environments, physiographical divisions of Indian subcontinent. *6 classes*

Concept of plate tectonics, sea-floor spreading and continental drift, mid oceanic ridges and transform faults volcanic and island arcs, trenches, origin of oceans, continents, mountains and rift valleys and earthquake belts. *6 classes*

Rock cycle *3 classes*  
Volcanoes: types, types of lava and lava flow  
Magma: composition, physical and chemical properties of magma, intrusive igneous bodies

Sedimentary environment, clastic and non-clastic rocks *5 classes*

Metamorphism, metamorphic rocks, metasomatism *5 classes*

Brief idea about palaeontology, palynology, palaeobotany and palaeozoology  
Fossils, fossil taxonomy and nomenclature, modes of preservation of fossils, types of fossil *4 classes*

Application of fossil in geological science *2 classes*

### **PRACTICALS** **24 hrs**

Study of minerals in hand specimen: quartz, feldspar, mica, olivine, amphibole, gypsum, calcite  
Study of rocks in hands specimen: sandstone, shale, limestone, rhyolite, basalt, granite, gabbro, gneiss, schist, marble  
Study of geomorphic models  
Study of Geological maps

## **DSE 2A: Crystallography and Mineralogy(6 Credits) **48 hrs**** **Theory (4 Credits) + Practical (2 Credits)**

### **Unit 1: Crystallography** *15 classes*

Crystalline and non-crystalline matter, geometrical nature of order of crystal, crystal face, edge and solid angle, Laws of constancy of interfacial angles, axial systems and axial ratio  
Crystal symmetry operations, direction and planes in crystal structures, point group and space group symmetry, Classification of crystals into systems and classes of symmetry  
Study of the symmetry, forms, stereograms and examples of crystal/mineral of the important crystal classes  
Crystal growth and twinning, different types of crystal twins, causes of twinning and twin laws

**Unit 2: Mineralogy** *20 classes*  
Native elements, mineraloids, minerals, physical and chemical properties

Physical properties of minerals: Colour, luster, streak, density, sp.gr. and hardness; Moh's scale of hardness and determination of hardness of minerals. Cleavage, parting and fracture: their definition and mineral examples. Form and Habit of minerals; types, examples and use in identification

Classification of minerals: study of important minerals of silicate and non-silicate groups.

## **PRACTICALS**

**24 hrs**

Practical 1: Identification of crystal models

Practical 2: Study of crystals and symmetry elements of given crystal-models.

Practical 3: Study and stereographic projections of crystal models.

Practical 4: Study and identification of minerals in hand specimen

Practical 5: Study of rock forming minerals

## **DSE-3A: Geochemistry and Optical Mineralogy(6 Credits) Theory (4 Credits) + Practical (2 Credits)**

**48 hrs**

### **Unit 1: Concepts of Geochemistry**

*15 classes*

The periodic table, states of matter and atomic environment of elements, geochemical classification of elements

Composition of different Earth reservoirs and the nuclides and radioactivity. Conservation of mass, isotopic and elemental fractionation. Concept of radiogenic isotopes in geochronology and isotopic tracers

The solid Earth – geochemical variability of magma and its products, Meteorites

Geochemical distribution and mobility of elements, Chromatography, Aqueous geochemistry- basic concepts and speciation in solutions, Eh, pH relations

Geochemical behaviour of selected elements like Si, Al, K, Na .

### **Unit 2: Optical Mineralogy**

*20 classes*

Natural light, ordinary and polarized light, polarization of light and polaroids, refractive index and relief, becke line and its use, double refraction, birefringence, behavior of isotropic and anisotropic mineral, pleochroism and pleochroic scheme, interference colour, extinction, polarizing microscope, interference figure, optic sign and determination of optic sign.

Study of important rock forming mineral groups/species, their classification, physical and optical characters and paragenesis : 1) Quartz 2) Feldspar 3) Mica 4) Amphibole 5) Pyroxene 6) Olivine 7) Garnet 8) Chlorite 9) Calcite 10) Feldspathoids.

## **PRACTICALS**

**24 hrs**

Practical 1: Identification and understanding of different parts of petrological microscope.

Practical 2: Preparation of slides.

Practical 2: Identification of rock-forming minerals under petrological microscope.

Practical 3: Study of interference figure and determination of optic signs from mineral oriented sections.

**2nd Sem**  
**DEPARTMENT SPECIFIC CORE COURSES (DSC)**

**DSE 1B: Thermodynamics and Igneous Petrology (6 Credits)**  
**Theory (4 Credits) + Practical (2 Credits) 48 hrs**

**Unit 1: Thermodynamics**

*10 classes*

Energy and Matter, Types of Energy, Transformation of Energy  
Thermodynamic systems and boundaries, Laws of Thermodynamics  
Concept of Heat and Temperature  
Conversion between temperature Scale  
Thermodynamic properties: state functions  
Concept of entropy, enthalpy, activity, chemical potential, chemical equilibrium and equilibrium constants  
Concept of free energy, component, phase and degrees of freedom  
Phase rule for closed and open system  
Phase diagrams

**Unit 2: Igneous Petrology**

*25 classes*

General idea of igneous petrology, generation of magma, physical properties, composition & chemical properties, primary and magma derivatives, classification of magma

Concept of component, equilibrium, phase, degrees of freedom, phase rule: general idea, phase rule for open and closed systems, phase diagrams: one, two and three component systems, congruent and incongruent melting

Reaction principles, Evolution of Magma, Magmatic differentiation, Mixing and Assimilation, Role of volatiles in magma, Rock association (consanguinity)

Textures, structures and mode of occurrences of igneous rocks, Petrographical significances of igneous rocks.

Textural and IUGS Classification of igneous rocks

Petrogenesis of Igneous rocks: Petrogenesis of Felsic and Mafic igneous rocks, Komatiites, Granitoides, Basalt, Gabbros, Alkaline rocks, kimberlites and lamproites, Sylhet trap and AborVolcanics.

Formation of economic deposits from igneous processes

**PRACTICALS**

**24hrs**

Practical 1: Identification and study of igneous rocks in hand specimens

Practical 2: Identification and study of igneous rocks in thin sections

Practical 3: Identification of economic minerals derived from igneous processes

## **DSE 2B: Sedimentary and Metamorphic Petrology(6 Credits)**

### **Theory (4 Credits) + Practical (2 Credits)**

**48hrs**

#### **Unit 1: Sedimentary Petrology**

*20 classes*

Weathering and erosion of rocks, transportation of weathered rock via air, water, ice and gravity, residual sediments, source and provenance, sedimentary basins

Textural properties of sedimentary rocks- concept of size, grade scale, sphericity, roundness and fabric. Sedimentary textures, structures and environment, sedimentary structures

Textural and genetic classification of clastic and non-clastic rocks

Diagenesis: compaction, cementation, lithification, authigenesis, replacement and recrystallisation;

Concept of sedimentary facies, depositional environments,

Petrographic description of the following rock types: Sandstones (Arenite, Arkose and Wacke), siltstone, shale, limestone, dolomite, breccia, conglomerate and evaporate.

Formation of economic deposits from sedimentary processes

#### **Unit 2: Metamorphic Petrology**

*20 classes*

Metamorphism, types of metamorphism, mechanism of metamorphic transformation

Index minerals, metamorphic zones and isogrades, facies and grade

Structure and textures of metamorphic rocks

Relationship between metamorphism and deformation, Metamorphic mineral reactions (prograde and retrograde)

Regional metamorphism of argillaceous, calcareous and basic rocks, Metasomatism and role of fluids in metamorphism

Descriptive petrography of the following rocks: Slate, phyllite, schist, blue schists, gneiss, quartzite, marble, amphibolite, granulite, hornfels, eclogites, khashi greenstone, charnockite and khondalite.

Formation of economic deposits from metamorphic and metasomatic processes

#### **PRACTICALS**

**24hrs**

Practical 1: Identification and study of sedimentary rocks in hand specimens

Practical 2: Identification and study of metamorphic rocks in thin sections

**DSE-3B: Palaeontology(6 Credits)**  
**Theory (4 Credits) + Practical (2 Credits)**

**48hrs**  
*30 classes*

Palaeontology: definition, branches, allied subjects, scopes and applications of palaeontology.  
Fossil: definition, types, process of fossilization, mode of preservation

Nomenclature of fossil: two fold system of nomenclature, types of specimens (Prototype, Neotype, Lectotype etc.) Taxonomy and Species concept: Species concept with special reference to paleontology, Taxonomic hierarchy Theory of organic evolution interpreted from fossil record

Vertebrate fossils: Palaeozoic and Mesozoic vertebrate organisms, origin diversity and extinction of dinosaurs. Evolution of horse, Human evolution.

Brief introduction to important invertebrate groups: Foraminifera, Brachiopoda, Pelecypoda, Gastropoda, Cephalopoda, Trilobita, Echinoidea and Anthozoa and their biostratigraphic significance

Gondwana Flora of India

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, Paleocology – fossils as a window to the evolution of ecosystems

**PRACTICALS**

**24hrs**

Practical 1: Study of fossils showing various modes of preservation

Practical 2: Study of diagnostic morphological characters, systematic position, stratigraphic position and age of various invertebrate, vertebrate and plant fossils

**3rd Sem**  
**DEPARTMENT SPECIFIC CORE COURSES (DSC)**

**DSE 1C: Structural Geology and Plate Tectonics(6 Credits)**  
**Theory (4 Credits) + Practical (2 Credits)** **48hrs**

**Unit 1: Structural Geology** *20 classes*

Deformation in rocks: stress and strain in rocks, type of stress and strain, strain ellipses,

Effects of topography on structural features, topographic and structural maps; importance representative factors of the map, concept of planar and linear structures; dip and strike;

Study of components, morphology, classification and occurrences of deformational features: fold, joint-fracture, faults, lineation and foliation

Role of structural features for the development of typical topographical landscapes, economic mineral reserves and in accumulation of oil and natural gas

**Unit 2: Tectonics***15 classes*

Concept of tectonic plates, continental and oceanic crust, boundaries between lithosphere and mantle, divergent, convergent and transform plate boundaries, important features associated with different plate boundaries

Theories of development of concept of plate tectonics, continental drifting, formation of ocean

Role of tectonic activities in rock deformation, development of structural features and typical landforms,

**PRACTICALS****24hrs**

Practical 1: study of structural maps

Practical 2: use of compass

Practical 3: 3 point problems of structural geology

Practical 4: stereo projections of beds, fold, fault, lineation etc.

**DSE 2C: Surveying and Engineering Geology (6 Credits)****Theory (4 Credits) + Practical (2 Credits)****48hrs****Unit 1: Surveying***10 classes*

The Great Trigonometrical Survey of India, Geodetic and Plane Surveying, Datum, Control Points, Horizontal and Vertical Controls, Geoid, Azimuth and bearing, Triangulation and Traversing.

Surveying with Compass, Chain and Plane Table Surveying, GPS and its use in surveying

Level, Types of levels and Methods of Levelling

Geology vs. Engineering, Role of Engineering geologists in planning, design and construction of major man-made structural features. Geological Field Investigation for engineering project. Reconnaissance study, Detail Site Investigation and Characterization and Regional Scale Study.

**Unit 2: Engineering Geology***20 classes*

Role and duties of geologist in engineering project: surveying, leveling, reconnaissance study, detail study, design and layout of engineering project, determining viability and risk, use of local construction materials

Intact Rock and Rock Mass properties, Rock Quality Designation (RQD), Rock Structure Rating (RSR), Rock Mass Rating (RMR)

Geological, Geotechnical and Environmental considerations for Dams and Reservoirs, Tunnels and Tunneling Methods.

Preventive measures for: landslides, earthquakes, structural disturbances.

Case histories related to Indian Civil Engineering Projects

**PRACTICALS****24hrs**

Practical 1: Use of compass for determining forward, backward bearing and azimuths

Practical 2: Surveying with compass, chain and plate table

Practical 3: Computation of reservoir area, catchment area, reservoir capacity and reservoir life.

Practical 4: Computation of Index properties of rocks.

**DSE-3C: Economic Geology(6 Credits)****Theory (4 Credits) + Practical (2 Credits)****48hrs**

Definition of ore, ore minerals, gangue and tenor

*30 classes*

Morphology of mineral deposit

Controls on ore localization

Processes of formation of Mineral deposit: volcanogenic, orthomagmatic, hydrothermal, supergene enrichment, sedimentary deposits, residual deposits, alluvial deposits, metasomatic alteration

Origin, occurrence and distribution in India and uses of the economic minerals/ores of aluminium, chromium, copper, gold, lead, zinc, iron, manganese and atomic minerals.

Deposits of minerals used as abrasives, refractories and in ceramics, cement, fertilizer, glass industries and their occurrences especially in N.E. India.

Origin and occurrence of coal and petroleum and their distribution in India with special reference of N.E. India.

National Mineral Policy.Strategic, Essential and Critical minerals of India.

**PRACTICALS****24hrs**

Study and identification of economic minerals

Identification of set of Industrial Minerals

Ore Reserve Estimation

**3<sup>rd</sup> Sem****Skill Enhancement Courses (SEC)****SEC 1.1 Skills of basic Geological Field Studies (2 Credits)***20 classes*

Use of base map/topographic sheet in field, tracing data from base map/toposheet, bearing (front andback) and pacing, map reading, distance, height and pace approximation, reading contours and topography

Identification of rock types in field; structures and texture of rocks, Use of hand lense

Basic field measurement techniques: dip and strike, trend, plunge, rake

Collection of rock samples from field

**4<sup>th</sup> Sem**  
**DEPARTMENT SPECIFIC CORE COURSES (DSC)**

**DSE 1D: Geomorphology, Remote Sensing and GIS(6 Credits)**  
**Theory (4 Credits) + Practical (2 Credits) 48hrs**

**Unit 1: Geomorphology**

*20 classes*

Endogenic and Exogenic processes, geomorphic cycle,

Surficial Processes and geomorphology, Weathering and Erosion, activities of running water, wind, ice, gravity and sea waves, Soil, Soil Profile and its classification. Mass movement and debris flow processes.

Landforms of: Fluvial, Glacial, Aeolian, Coastal and Volcanic Environments.

Overview of Indian Geomorphology

**Unit 2: Remote Sensing**

*10 classes*

Photogeology, aerial photographs; scale and resolution, air photo interpretation: identification of sedimentary, igneous and metamorphic rocks and various aeolian, glacial, fluvial and marine landforms

Remote Sensing: definition, applications, sensors and scanners, satellites and their characteristics, data formats- raster and vector, Indian remote sensing satellites, satellite data products

Application of Remote Sensing in Geological Science

**Unit 3: Geographical Information System**

*10 classes*

Geographic Information System, Components of GIS, working mechanism of GIS, GIS Data types: Raster and Vector Data, Point Data, Line Data, Polygonal Data, Datum, Coordinate systems and Projection systems. Georeferencing. Spatial data models and data editing

General idea about of Global Positioning System (GPS) of America, Indian Regional Navigation Satellite System (IRNSS) and Indian Navigation System NAVIC

**PRACTICALS**

**24hrs**

Practical 1: Study of landforms from given geomorphic model/image/map

Practical 2: Interpretation of aerial photo/satellite image

Practical 3: Use of GPS



## **DSE 2D: Principles of Stratigraphy and Indian Stratigraphy (6 Credits)**

**Theory (4 Credits) + Practical (2 Credits)**

**48hrs**

### **Unit 1: Principles of Stratigraphy**

*15 classes*

Principles of stratigraphy: Fundamentals of litho-, bio- and chrono-stratigraphy

Codes of stratigraphic nomenclature: International Stratigraphic Code – development of a standardized stratigraphic nomenclature. Concepts of Stratotypes. Brief introduction to the concepts of lithostratigraphy, biostratigraphy, chronostratigraphy

Walther's Law of Facies. Concept of paleogeographic reconstruction

### **Unit 2: Stratigraphy of India**

*20 classes*

Physiographic and tectonic subdivisions of India

Stratigraphy, distribution and economic importances of: Dharwar, Vindhyan, Cudappah, Delhi supergroups, Gondwana of Indian subcontinent

Triassic successions of Spiti, Jurassic of Kutch, Mesozoic rocks of NE India  
Volcanic provinces of India: Deccan, Rajmahal, Sylhet Trap  
Siwalik successions, Tertiary of Meghalaya and Assam-Arakan basins.

### **PRACTICALS**

**24hrs**

Practical 1: Study of geological map of India and identification of major stratigraphic units.

Practical 2: Study of rocks in hand specimens from known Indian stratigraphic horizons

## **DSE 3D: Coal and Petroleum (6 Credits)**

**Theory (4 Credits) + Practical (2 Credits)**

**48hrs**

### **Unit 1: Coal**

*15 classes*

Coal: definition, type, formation, origin and occurrences

Application of coal as fossil fuel

Distribution of coal in space and time

Chemical composition, Proximate and ultimate composition, calorific value

Rank & Grade of coal

Distribution of coal in India with special reference to NE India

Introduction to coal bed methane

**Unit 2: Petroleum***15 classes*

Introduction to petroleum, natural gas and petroleum bearing shale sediments  
Process of formation of petroleum, maturation and migration, mode of occurrences  
Distribution of petroleum in time and space  
Geological conditions in favour of formation and accumulation of petroleum  
Physical properties and chemical composition  
Gas hydrates, Shale gas and shale oil  
Oil-Gas bearing territories of India with special reference to NE India

**Practical****24hrs**

Physical identification of types of coal  
Study of petroleum basin of India from given map  
Study of seismic profiles to identify possible lithological/structural features

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**SEC 2.1 Skills of advanced Geological Field Studies****(2 Credits)***20 classes*

Geological mapping, stratigraphic correlation  
Primary (scalars and vectors) and secondary structures (linear and planar)  
Determination of lithological contacts, unconformities, fault-shear zones  
Study of rock structures: genetic and deformational  
Procedure of oriented sample collection  
Stereoplots of linear and planar structures, orientation analyses

**5<sup>th</sup> Sem****Skill Enhancement Courses SEC****SEC 1.2 Skills of Geological Field Investigation-III (Advance)****(2 Credits)***20 classes*

Field transect in any Precambrian terrain  
Study of craton ensemble including basic intrusive suites  
Precambrian sedimentary basin  
Basement-Cover relation in: a. fold belts, b. sedimentary successions

## 5<sup>th</sup> Sem

### Department Specific Electives (DSE)

#### **DSE 1A: EXPLORATION GEOLOGY (6 Credits = Theory 4 + Practical 2) 48hrs**

##### **Unit 1: Mineral Resources**

*5 classes*

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**

*10 classes*

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**

*5 classes*

Evaluation of sampling data

Mean, mode, median, standard deviation and variance

##### **Unit 4: Drilling and Logging**

*10 classes*

Core and non-core drilling

Planning of bore holes and location of boreholes on ground

Core-logging

##### **Unit 5: Reserve estimations and Errors**

*5 classes*

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

#### **PRACTICALS**

**24hrs**

1. Identification of anomaly
2. Concept of weighted average in anomaly detection
3. Geological cross-section
4. Models of reserve estimation

#### **DSE 1B: GEOINFORMATICS(6 Credits = Theory 4 + Practical 2)**

**48hrs**

*35classes*

Introduction to geoinformatics: application of information technology in geological science, advantage and disadvantages of geoinformatics, scopes and prospects in the geoinformatics

Cartography, Remote Sensing, Geographical Information System, realtime, online and offline monitoring of earth

Introduction to information technology: hardware and software of computer, personal computer, workstation computer and super computer, FLOPS, components and peripherals of computer system

Operating system, programming language, introduction to HTML, C++, C# and ActionScript

Geographical information system: GIS data types: raster and vector data, point data, line data and polygonal data, georeferencing, Digital Elevation Model

**PRACTICALS**

**24hrs**

Simple programming in C++, C# and ActionScript  
Raster and Vector data processing and analyses  
Spatial analyses of DEM

**DSE 1C FLUVIAL GEOMORPHOLOGY(6 Credits = Theory 4 + Practical 2) 48 hrs**

Weathering of rock and transportation of weathered material through running water  
Water Cycle, surface and subsurface runoff, permanent, sessional and temporal flow of water *5 classes*

Stream flow, classification of streams *2 classes*

Drainage system: drainage basin, basinal area, network of streams, stream ordering  
Stream morphology, morphometric parameters and their signifincances *5 classes*

Stream patterns, controls over the development of stream patterns *5 classes*

Landforms associated with fluvial processes, waterfall, rapids, alluvial fans, flood plain features, delta  
Avulsion, River Capturing, Channel bar and islands, Bank Erosion *5 classes*

Estuaries, lagoons and lakes, outwash plains

Drainage system of North East India *5 classes*  
Major drainage system of Indian Subcontinents

Flood, Palaeoflood, Flood Monitoring, Disaster and Mitigation, Preparedness for flood condition  
*5 classes*

Significance of fluvial processes in gradational change in earth surface, determination of structural features and in exploration of economic deposits *3 classes*

**PRACTICALS**

**24hrs**

Tracing of drainage network and demarcation of drainage basin  
Morphometrical analyses of a particular drainage system  
Demarcation of areas vulnerable to flood from DEM

**DSE 2AENVIRONMENTAL GEOLOGY(6 Credits = Theory 4 + Practical 2) 48hrs**

*40 classes*

Introduction to Environmental Geology: Cosmic, Galactic and Physical Environments of Earth  
Natural and man-made activities and their effects on the Physical Environment of Earth *3 classes*

Natural resource, energy, radiation from terrestrial and extra-terrestrial objects, solar flare, solar wind, electric charge, magnetism, ecological units, habitats *5 classes*

Water on Earth: surface and subsurface water, ocean, streams, lakes, atmospheric water  
Climate and Weather, El Nino-La Nina Oscillations, Tide, Estuaries, Lagoons and Delta *10classes*

Gradational Processes: Weathering and erosion, activities of running water, moving ice, coastal activities, wind activities *5 classes*

Natural hazards: volcanic eruptions, release of poisonous gas and fluids, rainfall, floods, landslides, coastal erosions, earthquake and mitigation. *5 classes*

Artificial hazards: urbanization, sanitary, septic tanks, open-cast and underground mining, drilling, industrial and radioactive waste disposal *5 classes*

Pollution of ground water and surface water, marine pollution, pollution from agricultural practices *5 classes*

Environmental protection-legislative measures in India *3 classes*

### **PRACTICALS**

**24hrs**

Study of Environmental impacts of rapid urbanization, agriculture, industrialization and mining from field visit and preparation of report

## **6<sup>th</sup> Sem**

### **SEC 2.2 Project Work**

**(2 Credits)**

Project work on specific discipline

### **DSE 1B MINING GEOLOGY(6 Credits = Theory 4 + Practical 2)**

**48hrs**

*30 classes*

Ore, gangue, tenor

Development of mining technology in human history

Ancient techniques of mining of iron, gold, copper, aluminium and coal

General idea on the exploration of economic deposit, estimation of volume and reserve of the ore deposit

Mining terminologies used in surface and sub-surface mining

Classification of mining methods

Selection of mining technique from the structure of ore, lithology of host and orientation of ore deposit

Description of alluvial, surface (open-cast) and subsurface mining methods and discussion on tools used

Mine safety measures, lining: types and needs, ventilation of air, water and electricity, transportation of workers

### **PRACTICALS**

**24hrs**

Estimation of volume of overburden, ore body

Estimation of reserve

Modeling of ore deposits from given geological map

**DSE 2B Structural geology (6 credits=Theory 4+ Practical 2)****48 hrs**  
*40classes*

Relation between the geological structure and topography. Outcrop patterns of different structures  
*3classes*

Concept of stress and strain. Brittle and ductile behaviors of rocks. Stress-strain relationships for different substances  
*4 classes*

Folds: Definition, terminologies, classifications (geometric, genetic and morphological) *4classes*

Faults: Definition, terminologies, classification (geometric and genetic). Recognition of faults in the field. *4 classes*

Foliations: Definition, terminologies and classification *4 classes*

Lineations: Definition, terminologies and classification *4 classes*

Joints: Definition, terminologies and classification *4 classes*

Unconformities: Definition, terminologies, types. Recognition of unconformities in the field *4classes*

Concept of plate tectonics. Types of plate boundaries. Subduction zones, mid oceanic ridges. Island arcs, earthquake and volcanic belts *6 classes*

Structural framework of North East India *3 classes*

**PRACTICALS****24hrs**

Use of Clinometers and Brunton compass for measurements

Study of contour maps and structural maps and construction of profiles

Three point structural problems and structural projections

**DSE 2CHydrogeology (6 Credits = Theory 4 + Practical 2)****48hrs**  
*35classes*  
*3 classes*

Occurrence and origin of groundwater;

Hydrologic cycle; Hydrological properties of water bearing formations: porosity, permeability, transmissivity, specific yield, storage coefficient. *5 classes*

Movement of ground water; types of openings in rocks; types of springs. *5 classes*

Concept of water table and piezometric surface, free and confined water; Aquifer- different types; *8 classes*

Quality of ground water- problems of fluoride and arsenic in ground water; *4 classes*

Exploration for ground water; Groundwater recharge- concept of safe yield and overdraft. Rainwater harvesting. *7 classes*

Groundwater provinces of India. *3 classes*

**PRACTICALS**

Preparation of water table contour map using supplied water level data and interpretation of the same  
Interpretation of supplied water table map

Determination of flow well area from supplied ground level contour and piezometric level contours

Solution of hydrogeological problems using Darcy's equation

<b>DSE 3B Earth and climate (6 Credits = Theory 4 + Practical 2)</b>	<b>48hrs</b>
	<i>35 classes</i>
Components of the climate system	
Climate system response, response rates and interactions within the climate system	<i>6classes</i>
Incoming solar radiation, receipt and storage of heat	
Heat transformation	<i>6classes</i>
Layering of atmosphere and atmospheric Circulation	
Atmosphere and ocean interaction and its effect on climate	
Heat transfer in ocean	<i>8 classes</i>
Climate Change: natural vs. anthropogenic effects	
Humans and climate change	<i>6classes</i>
Milankovitch cycles and variability in the climate	
Glacial-interglacial stages	
The Last Glacial maximum (LGM)	<i>6 classes</i>
Mechanism of monsoon	
Monsoonal variation through time	<i>3classes</i>

<b>DSE3B (PRACTICAL)</b>	<b>24 Hours</b>
Study of distribution of major climatic regimes of India on map	
Distribution of major wind patterns on World map	
Preparation of paleogeographic maps (distribution of land and sea) of India during specific geological time intervals	