

# **BACHELOR OF SCIENCE (HONORS) GEOLOGY**

## **Academic Ordinances**

**(Admission, Study, Curriculum & Examination)**

**Programme Code: GEOB**

**Duration: 3 Years**



**EFFECTIVE FROM SESSION: 2021-2022**

**Department of Basic Sciences**

**Faculty of Science**

**CHHATRAPATI SHIVAJI MAHARAJ  
UNIVERSITY PANVEL, NAVI MUMBAI**

**(STATE PRIVATE UNIVERSITY ESTABLISHED UNDER ACT XXXII OF GOVT. OF  
MAHARASHTRA 2018 AND RECOGNIZED BY THE UGC)**

## About the Programme

The B. Sc. (Hons.) Geology programme is aimed at imparting knowledge on the fundamental principles of Geology. This programme is beneficial for the students in the area of higher studies, career opportunities in both private and public sectors.

## Ordinances

### 1 Eligibility:

All such Candidates who have been awarded or are qualified for 10+2 Std. Examination or equivalent certificate with 10+2 with PCM/PCB are eligible to apply for admission to the **B. Sc. (Hons.) Geology** programme.

### 2 Duration:

The **B. Sc. (Hons.) Geology** programme will normally be of three academic years duration spanning over **six semesters**.

### 3 Programme Structure:

**3.1 B.Sc. (Hons.) Geology** programme is structured on choice based credit system (CBCS) following the semester pattern with continuous evaluation.

**3.2** The CBCS implemented in the **B. Sc. (Hons.) Geology** programme in view of the model curriculum recommended by the UGC.

**3.3** Each semester/year shall have minimum 90/180 instruction days;

**3.4** The **B. Sc. (Hons.) Geology** programme will be consists of the various types of courses as given below:

- i. Department Specific Core Courses (DSC)
- ii. Department Specific Elective Courses (DSE)
- iii. Ability Enhancement Compulsory Courses (AECC)
- iv. Generic Elective Courses (GE)
- v. Skill Enhancement Courses (SEC)
- vi. Project work – Theory/Lab/Field Work based
- vii. Industrial Training ( as and where and where required

**4.** A Student can opt for GE, SEC, DSE courses and project works from the lists given with the course scheme subject to the approval of the HOD as per availability and demand of the opted courses.

**5.** An undergraduate degree with Honors in a discipline may be awarded if a student completes 14 core papers in that discipline, 2 Ability Enhancement Compulsory Courses (AECC), minimum 2 Skill Enhancement Courses (SEC) and 4 papers each from a list of Discipline Specific Elective and Generic Elective papers respectively.

6 The curriculum of B. Sc. (Hons.) Geology programme is designed to have a minimum of 135 and a maximum of 155 credits for the award of the degree.

**7 Credit Assignment:**

7.1 Credit of 1 is assigned for one hour of instruction per week comprised of theory classes. Credit of 0.5 is assigned for one hour of instructions per week comprised of practical classes, and Credit of 1 is assigned for one hour of instruction per week comprised of tutorial classes.

7.2 For DSC, DSE, and GE courses, each course is designed to have 6 credits in total, 4 credits from theory and 2 credits from practical; or 5 credits from theory and 1 credit from tutorial for theoretical-only subjects.

7.3 AECC and SEC courses have 2-4 credits, each, either from theory, practical or tutorial, depending on the subject.

7.4 Projects, Field Works and Industrial visits have 6-8 credits, depending on duration and hours/week assigned. Evaluation of the project/field work will be based on a report, presentation and viva-voce.

### 8. The Course Scheme of B. Sc. (Hons.) Geology programme in tabulated form:

Semester	Department Specific Course (DSC)			Generic Elective Course (GE)	Ability Enhancement Core Course (AECC)	Skill Enhancement Course (SEC)	Weekly Contact hours	Total Credits
I	DSC-1 (4-0-4) 6	DSC-2 (4-0-4) 6		GE-1 Generic Elective -1 (4-0-4) 6	AECC-1 Environmental Studies (2-0-0) 2		26	20
II	DSC-3 (4-0-4) 6	DSC-4 (4-0-4) 6		GE-2 Generic Elective -2 (4-0-4) 6	AECC -2 English Communications (2-0-0) 2		26	20
III	DSC-5 (4-0-4) 6	DSC-6 (4-0-4) 6	DSC-7 (4-0-4) 6	GE-3 Generic Elective -3 (4-0-4) 6		SEC -1 Skill Enhancement Courses -1 (2-0-0) 2	34	26
IV	DSC-8 (4-0-4) 6	DSC-9 (4-0-4) 6	DSC-10 (4-0-4) 6	GE-4 (4-0-4) 6		SEC -2 Skill Enhancement Courses -2 (2-0-0) 2	34	26
V	DSC-11 (4-0-4) 6	DSC-12 (4-0-4) 6	DSE-1 (4-0-4) 6	DSE-2 (4-0-4) 6			32	24
VI	DSC-13 (4-0-4) 6	DSC-14 (4-0-4) 6	DSE-3 (4-0-4) 6	DSE-4 (4-0-4) 6			32	24
<b>Total</b>								<b>140</b>

### 9 Elective Courses:

The elective courses will be offered based on students' options, subject to the condition that the number of students opting for an elective course should be at least 25% of the total intake of the programme.

## 10 Semester-wise Teaching and Evaluation scheme:

**SEMESTER I**

Course Type	Course Code	Course Name	L	T	P	IA	UE	Total Marks	Credits
DSC	GEOB1010	Earth System Science	4	0	0	30	70	100	4
DSC	GEOB1020	Mineral Science	4	0	0	30	70	100	4
GE	**	General Elective - I	4	0	0	30	70	100	4
AECC	EVSG1000	Environmental Studies	2	0	0	15	35	50	2
GE	**	General Elective - I Lab	0	0	4	15	35	50	2
DSC	GEOB1011	Earth System Science Lab	0	0	4	15	35	50	2
DSC		Mineral Science Lab	0	0	4	15	35	50	2
		<b>Total</b>	<b>14</b>	<b>0</b>	<b>12</b>	<b>150</b>	<b>350</b>	<b>500</b>	<b>20</b>

**SEMESTER II**

Course Type	Course Code	Course Name	L	T	P	IA	UE	Total Marks	Credits
DSC	GEOB2010	Elements of Geochemistry	4	0	0	30	70	100	4
DSC	GEOB2020	Structural Geology	4	0	0	30	70	100	4
GE	**	Generic Elective - II	4	0	0	30	70	100	4

AECC	ENGG1000	English Communication	2	0	0	15	35	50	2
GE	**	Generic Elective - II Lab	0	0	4	15	35	50	2
DSC	GEOB2011	Elements of Geochemistry	0	0	4	15	35	50	2
DSC	GEOB2022	Structural Geology	0	0	4	15	35	50	2
		<b>Total</b>	<b>16</b>	<b>0</b>	<b>12</b>	<b>150</b>	<b>350</b>	<b>500</b>	<b>20</b>

**SEMESTER III**

Course Type	Course Code	Course Name	L	T	P	IA	UE	Total Marks	Credits
DSC	GEOB3010	Igneous Petrology	4	0	0	30	70	100	4
DSC	GEOB3020	Sedimentary Petrology	4	0	0	30	70	100	4
DSC	GEOB3030	Paleontology	4	0	0	30	70	100	4
GE	**	Generic Elective - I	4/5	0	0	30	70	100	4/5
SEC	GEOB1000	Field Geology-I	2	0	0	30	70	100	2
DSC	GEOB3011	Igneous Petrology Lab	0	0	4	15	35	50	2
DSC	GEOB3021	Sedimentary Petrology Lab	0	0	4	15	35	50	2
DSC	GEOB3031	Paleontology Lab	0	0	4	15	35	50	2
GE	**	Generic Elective - I Lab	0	0/1	4/0	15	35	50	2/1
		<b>Total</b>	<b>18</b>	<b>0</b>	<b>16</b>	<b>210</b>	<b>490</b>	<b>700</b>	<b>26</b>

**SEMESTER IV**

Course Type	Course Code	Course Name	L	T	P	IA	UE	Total Marks	Credits
DSC	GEOB4010	Metamorphic Petrology	4	0	0	30	70	100	4
DSC	GEOB4020	Stratigraphy Principles and Indian Stratigraphy	4	0	0	30	70	100	4
DSC	GEOB4030	Hydrogeology	4			30	70	100	4
GE	**	Generic Elective	4/5	0	0	30	70	100	4/5
SEC	GEOB2000	Field Geology-II	2	0	0	30	70	100	2
DSC	GEOB4011	Metamorphic Petrology Lab	0	0	4	15	35	50	2
DSC	GEOB4021	Stratigraphy Lab	0	0	4	15	35	50	2
	GEOB4031	Hydrogeology Lab	0	0	4	15	35	50	2
GE	**	Generic Elective Lab	0	0/1	4/0	15	35	50	2/1
		<b>Total</b>	<b>18</b>	<b>0</b>	<b>16</b>	<b>210</b>	<b>490</b>	<b>700</b>	<b>26</b>

**SEMESTER V**

Course Type	Course Code	Course Name	L	T	P	IA	UE	Total Marks	Credits
DSC	GEOB5010	Economic Geology	4	0	0	30	70	100	4
DSC	GEOB5020	Geomorphology	4	0	0	30	70	100	4
DSE	GEOB5030	Exploration Geology	4	0	0	30	70	100	4
DSE	GEOB5040	Earth and Climate	4/5	0	0	30	70	100	4/5

DSC	GEOB5011	Economic Geology Lab	0	0	4	15	35	50	2
DSC	GEOB5021	Geomorphology Lab	0	0	4	15	35	50	2
DSE	GEOB5031	Exploration Geology Lab	0	0	4	15	35	50	2
DSE	GEOB5041	Earth and Climate Lab	0	0/1	4/0	15	35	50	2/1
		<b>Total</b>	<b>14</b>	<b>0</b>	<b>12</b>	<b>180</b>	<b>420</b>	<b>600</b>	<b>24</b>

**SEMESTER VI**

Course Type	Course Code	Course Name	L	T	P	IA	UE	Total Marks	Credits
DSC	GEOB6010	Engineering Geology	4	0	0	30	70	100	4
DSC	GEOB6020	Remote Sensing and GIS	4	0	0	30	70	100	4
DSE	GEOB6030	Fuel Geology	4	0	0	30	70	100	4/5
DSE	GEOB6040	Introduction to Geophysics	4	0	0	30	70	100	4
DSC	GEOB6011	Engineering Geology Lab	0	0	4	15	35	50	2
DSC	GEOB6021	Remote Sensing and GIS Lab	0	0	4	15	35	50	2
DSE	GEOB6031	Fuel Geology Lab	0	0/1	4/0	15	35	50	2/1
DSE	GEOB6041	Introduction to Geophysics Lab	0	0	4	15	35	50	2
		<b>Total</b>	<b>16</b>	<b>0</b>	<b>16</b>	<b>180</b>	<b>420</b>	<b>600</b>	<b>24</b>



**11 Ability Enhancement Compulsory Courses (AECC)**

Semester	Offering Department	Course Code	Course Name	(L-T-P)	Credits
I	English	ENGG1000	English Communication	2-0-0	2
II	Basic Sciences	EVSG2000	Environmental Studies	2-0-0	2

**12 List of Generic Electives offered by Department for students in B.Sc. (Hons.) in Allied Programmes (Chemistry, Physics, Geology, Psychology etc.)**

Semester	Course Code (T+P)	Course Name	(L-T-P)	Credits
I	CHYB1010 + CHYB1011	Inorganic Chemistry	4-0-4	6
II	CHYB2010 + CHYB2011	Organic Chemistry	4-0-4	6
III	CHYB3010 + CHYB3011	Physical Chemistry	4-0-4	6
IV	CHYB4010 + CHYB4011	Basic Analytical Chemistry	4-0-4	6

**13 List of Skill Enhancement Course offered by the Department (any Two, 1 in each Sem III & Sem IV) (Credit: 02 each)**

Semester	Course Code	Course Name	(L-T-P)	Credits
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III	GEOB1000	Field Geology-I	2-0-0	2
IV	GEOB2000	Field Geology-II	2-0-0	2

**14 List of Discipline Specific Elective Papers (DSE-1 to DSE-4) offered by the Department for students in B.Sc. (Hons.) Geology.**

Semester	Course Code (T+P)	Course Name	(L-T-P)	Credits
V	GEOB5030	Exploration Geology	4-0-0	4
V	GEOB5040	Earth and Climate	4-0-0	4
V	GEOB5031	Exploration Geology Lab	0-0-4	2
V	GEOB5041	Earth and Climate Lab	0-0-4	2
VI	GEOB6030	Fuel Geology	4-0-0	4
VI	GEOB6040	Introduction to Geophysics	4-0-0	4
VI	GEOB6031	Fuel Geology Lab	0-0-4	2
VI	GEOB6041	Introduction to Geophysics Lab	0-0-4	2

\*Optional Dissertation or project work in place of one Discipline Specific Elective paper (DSE-4)(6 credits) in 6th Semester

**Detailed Syllabus for B.Sc. (Hons.) Geology is Annexed Herewith:  
Annexure - I**

# Annexure - I: Detailed Syllabus

## **B.Sc. (Hons.) Geology**

# **BACHELOR OF SCIENCE (HONORS) GEOLOGY**

## **Detailed Syllabus**

**Programme Code: GEOB**

**Duration: 3 Years**

**EFFECTIVE FROM SESSION: 2019-2020**



**Faculty of Science  
CHHATRAPATI SHIVAJI MAHARAJ  
UNIVERSITY, PANVEL, NAVI MUMBAI**

**SEMESTER I**

Course Type	Course Code	Course Name	L	T	P	IA	UE	Total Marks	Credits
DSC	GEOB1010	Earth System Science	4	0	0	30	70	100	4
DSC	GEOB1020	Mineral Science	4	0	0	30	70	100	4
GE	**	Generic Elective - I	4/5	0	0	30	70	100	4/5
AECC	ENGG1000	English Communication	2	0	0	15	35	50	2
DSC	GEOB1011	Earth System Science Lab	0	0	4	15	35	50	2
DSC	GEOB1021	Mineral Science Lab	0	0	4	15	35	50	2
GE	**	Generic Elective - I Lab	0	0/1	4/0	15	35	50	2/1
		<b>Total</b>	<b>14</b>	<b>0</b>	<b>12</b>	<b>150</b>	<b>350</b>	<b>500</b>	<b>20</b>

**Ability Enhancement Compulsory Courses (AECC)**

Semester	Offering Department	Course Code	Course Name	(L-T-P)	Credits
I	English	ENGG1000	English Communication	2-0-0	2

<b>GEOB1010</b>	<b>Earth System Science</b>	<b>4L:0T:0P</b>	<b>4 Credits</b>
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**Unit 1: Earth as a planet**

Holistic understanding of dynamic planet 'Earth' through Astronomy, Geology, Meteorology and Oceanography. Introduction to various 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 and its age.

**Unit 2: Earth's magnetic field**

Earth's magnetic field

Formation of core, mantle, crust, hydrosphere, atmosphere and biosphere

Convection in Earth's core and production of its magnetic field

Mechanical layering of the Earth.

**Unit 3: Plate Tectonics**

Concept of plate tectonics, sea-floor spreading and continental drift

Geodynamic elements of Earth- Mid Oceanic Ridges, trenches, transform faults and island arcs

Origin of oceans, continents, mountains and rift valleys

Earthquake and earthquake belts

Volcanoes- types, products and their distribution.

**Unit 4: Hydrosphere and Atmosphere**

Oceanic current system and effect of Coriolis force

Concepts of eustasy

Land-air-sea interaction

Wave erosion and beach processes

Atmospheric circulation

Weather and climatic changes

Earth's heat budget.

**Unit 5: Soil**

Soils- processes of formation, soil profile and soil types.

**Unit 6: Understanding the past from stratigraphic records**

Nature of stratigraphic records

Standard stratigraphic time scale and introduction to the concept of time in geological studies

Introduction to geochronological methods and their application in geological studies

History of development in concepts of uniformitarianism, catastrophism and neptunism

Laws of superposition and faunal succession

Introduction to geology and geomorphology of Indian subcontinent.

**Unit 7: Cosmic abundance of elements**

Distribution of elements in solar system and in Earth

Chemical differentiation and composition of the Earth

General concepts about geochemical cycles and mass balance

Properties of elements

Geochemical behavior of major elements

Mass conservation of elements and isotopic fractionation.

<b>GEOB1011</b>	<b>Earth System Science Lab</b>	<b>0L:0T:4P</b>	<b>2 Credits</b>
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**LIST OF EXPERIMENTS:**

1. Study of major geomorphic features and their relationships with outcrops through physiographic models.
2. Detailed study of topographic sheets and preparation of physiographic description of an area
3. Study of soil profile of any specific area
4. Study of distribution of major lithostratigraphic units on the map of India
5. Study of distribution of major dams on map of India and their impact on river systems
6. Study of major ocean currents of the World
7. Study of seismic profile of a specific area and its interpretation

**SUGGESTED READINGS:**

1. Duff, P. M. D., & Duff, D. (Eds.). (1993). Holmes' principles of physical geology. Taylor &

Francis.

2. Emiliani, C. (1992). Planet earth: cosmology, geology, and the evolution of life and environment.

Cambridge University Press.

3. Gross, M. G. (1977). Oceanography: A view of the earth.

<b>GEOB1020</b>	<b>Mineral Science</b>	<b>4L:0T:0P</b>	<b>4 Credits</b>
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**Unit 1: Crystallography**

Elementary ideas about crystal morphology in relation to internal structures

Crystal parameters and indices

Crystal symmetry and classification of crystals into six systems and 32 point groups

**Unit 2: Crystal symmetry and projections**

Elements of crystal chemistry and aspects of crystal structures

Stereographic projections of symmetry elements and forms

**Unit 3: Rock forming minerals**

Minerals - definition and classification, physical and chemical properties

Composition of common rock-forming minerals

Silicate and non-silicate structures; CCP and HCP structures

**Unit 4: Properties of light and optical microscopy**

Nature of light and principles of optical mineralogy

Introduction to the petrological microscope and identification of common rock-forming minerals

<b>GEOB1011</b>	<b>Mineral Science Lab</b>	<b>0L:0T:4P</b>	<b>2 Credits</b>
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**LIST OF EXPERIMENTS:**

1. Observation and documentation on symmetry of crystals
2. Study of physical properties of minerals in hand specimen
3. Silicates: Olivine, Garnet, Andalusite, Sillimanite, Kyanite, Staurolite, Beryl, Tourmaline, Augite, Actinolite, Tremolite, Hornblende, Serpentine, Talc, Muscovite, Biotite, Phlogopite, Quartz, Orthoclase, Plagioclase, Microcline, Nepheline, Sodalite, Zeolite
4. Quartz varieties: Chert, Flint, Chalcedony, Agate, Jasper, Amethyst, Rose quartz, Smoky quartz, Rock crystal.
5. Native Metals/non-metals, Sulfides, Oxides- Copper, Sulfur, Graphite, Pyrite, Corundum, Magnetite, Hydroxides, Halides, Carbonates, Sulfates, Phosphates: Psilomelane, Fluorite, Calcite, Malachite, Gypsum, Apatite.
6. Study of some key silicate minerals under optical microscope and their characteristic properties

**SUGGESTED READINGS:**

1. Klein, C., Dutrow, B., Dwight, J., & Klein, C. (2007). The 23rd Edition of the Manual of Mineral

Science (after James D. Dana). J. Wiley & Sons.

2. Kerr, P. F. (1959). Optical Mineralogy. McGraw-Hill.

3. Verma, P. K. (2010). Optical Mineralogy (Four Colour). Ane Books Pvt Ltd.

4. Deer, W. A., Howie, R. A., & Zussman, J. (1992). An introduction to the rock-forming minerals (Vol. 696). London: Longman.



# Annexure - I: Detailed Syllabus

## **B.Sc. (Hons.) Geology**

# **BACHELOR OF SCIENCE (HONORS) GEOLOGY**

## **Detailed Syllabus**

**Programme Code: GEOB**

**Duration: 3 Years**

**EFFECTIVE FROM SESSION: 2019-2020**



**Faculty of Science  
CHHATRAPATI SHIVAJI MAHARAJ UNIVERSITY,  
PANVEL, NAVI MUMBAI**

**SEMESTER II**

Course Type	Course Code	Course Name	L	T	P	IA	UE	Total Marks	Credits
DSC	GEOB2010	Elements of Geochemistry	4	0	0	30	70	100	4
DSC	GEOB2020	Structural Geology	4	0	0	30	70	100	4
GE	**	Generic Elective - I	4/5	0	0	30	70	100	4/5
AECC	ENGG1000	English Communication	2	0	0	15	35	50	2
DSC	GEOB2011	Elements of Geochemistry Lab	0	0	4	15	35	50	2
DSC	GEOB2021	Structural Geology Lab	0	0	4	15	35	50	2
GE	**	Generic Elective - I Lab	0	0/1	4/0	15	35	50	2/1
		<b>Total</b>	<b>14</b>	<b>0</b>	<b>12</b>	<b>150</b>	<b>350</b>	<b>500</b>	<b>20</b>

**Ability Enhancement Compulsory Courses (AECC)**

Semester	Offering Department	Course Code	Course Name	(L-T-P)	Credits
II	English	ENGG1000	English Communication	2-0-0	2

<b>GEOB2010</b>	<b>Elements of Geochemistry</b>	<b>4L:0T:0P</b>	<b>4 Credits</b>
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**Course Objectives**

The main objective of learner to understand geology is our planet earth. As this course is among the introductory courses at the undergraduate level, it needs to communicate and also attempt at the learner becoming acquainted with the various theories about the cosmic abundance of elements. The students will also learn the geochemistry of solid earth and the distribution of elements.

**Unit 1: Concepts of geochemistry**

Introduction to properties of elements: The periodic table. Chemical bonding, states of matter and atomic environment of elements. Geochemical classification of elements

**Unit 2: Layered structure of Earth and geochemistry**

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

**Unit 3: Element transport**

Advection and diffusion. Chromatography.

Aqueous geochemistry- basic concepts and speciation in solutions, Eh, pH relations

**Unit 4: Geochemistry of solid Earth**

The solid Earth – geochemical variability of magma and its products.

The Earth in the solar system, the formation of solar system

Composition of the bulk silicate Earth. Meteorites

**Unit 5: Cosmic abundance of elements**

Distribution of elements in solar system and in Earth

Chemical differentiation and composition of the Earth

General concepts about geochemical cycles and mass balance

Properties of elements. Geochemical behavior of major elements

Mass conservation of elements and isotopic fractionation.

<b>GEOB2011</b>	<b>Elements of Geochemistry Lab</b>	<b>0L:0T:4P</b>	<b>2 Credits</b>
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**LIST OF EXPERIMENTS:**

- Use of common geochemical plots
- Normalization of geochemical data and interpretation
- Common bi-variate and tri-variate plots and their interpretations
- Calculation of Oxidation ratio and Mg Number from given Geochemical data.

**SUGGESTED READINGS:**

1.Mason, B (1986). Principles of Geochemistry. 3rd Edition, Wiley New York.

2.Hugh Rollinson (2007) Using geochemical data - evaluation, presentation and interpretation. 2nd Edition.

Publisher Longman Scientific & Technical.

3.Walther John, V., 2009. Essentials of geochemistry, student edition. Jones and Bartlett Publishers.

4.Albarede, F., 2003. An introduction to geochemistry. Cambridge University Press.

<b>GEOB2020</b>	<b>Structural Geology</b>	<b>4L:0T:0P</b>	<b>4 Credits</b>
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### Course Objectives

To provide students a systematic approach to understand different structural features. To understand the concept of stress and strain and how rock behave under different stress regimes. This course aims at preparing the students to analyze the different structural features like fold, fault, joint, fracture etc.

### Unit 1: Structure and Topography

Effects of topography on structural features, Topographic and structural maps; Importance representative factors of the map

### Unit 2: Stress and strain in rocks

Concept of rock deformation: Stress and Strain in rocks, Strain ellipses of different types and their geological significance.

Planar and linear structures; Concept of dip and strike; Outcrop patterns of different structures.

### Unit 3: Folds

Fold morphology; Geometric and genetic classification of folds; Introduction to the mechanics of folding:

Buckling, Bending, Flexural slip and flow folding

### Unit 4: Foliation and lineation

Description and origin of foliations, axial plane cleavage and its tectonic significance

Description and origin of lineation and relationship with the major structures

### Unit 5: Fractures and faults

Geometric and genetic classification of fractures and faults

Effects of faulting on the outcrops

Geologic/geomorphic criteria for recognition of faults and fault plane solutions

<b>GEOB2021</b>	<b>Structural Geology Lab</b>	<b>0L:0T:4P</b>	<b>2 Credits</b>
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### LIST OF EXPERIMENTS:

- Introduction to Geological maps: lithological and Structural maps.
- Drawing profile sections and interpretation of geological maps of different complexities: Unconformities, Fold and fault.
- Solving problems of Dip and Strike using Geometric method.
- Solving problems of Dip and Strike using Stereographic Projection method.

**Course Learning Outcome**

Gain an understanding about different Geological structure

Acquire a knowledge to solve different structural problem

**SUGGESTED READINGS:**

- ❖ Davis, GR. 1984. Structural Geology of Rocks and Region. John Wiley
- ❖ Billings, M.P. 1987. Structural Geology, 4th edition, Prentice-Hall.
- ❖ Park, R.G. 2004. Foundations of Structural Geology. Chapman & Hall.
- ❖ Pollard, D.D. 2005. Fundamental of Structural Geology. Cambridge University Press.
- ❖ Ragan, D.M. 2009. Structural Geology: an introduction to geometrical techniques (4th Ed). Cambridge University Press (For Practicals)

## SEMESTER-III

Course Type	Course Code	Course Name	L	T	P	IA	UE	Total Marks	Credits
DSC	GEOB3010	Igneous Petrology	4	0	0	30	70	100	4
DSC	GEOB3020	Sedimentary Petrology	4	0	0	30	70	100	4
DSC	GEOB3030	Paleontology	4	0	0	30	70	100	4
GE	**	Generic Elective - I	4/5	0	0	30	70	100	4/5
AECC	GEOB1000	Field Geology-I	2	0	0	30	70	100	2
DSC	GEOB3011	Igneous Petrology Lab	0	0	4	15	35	50	2
DSC	GEOB3021	Sedimentary Petrology Lab	0	0	4	15	35	50	2
DSC	GEOB3031	Paleontology Lab	0	0	4	15	35	50	2
GE	**	Generic Elective - I Lab	0	0/1	4/0	15	35	50	2/1
		<b>Total</b>	<b>18</b>	<b>0</b>	<b>16</b>	<b>210</b>	<b>490</b>	<b>700</b>	<b>26</b>

<b>GEOB3010</b>	<b>Igneous petrology</b>	<b>4L:0T:0P</b>	<b>4 Credits</b>
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**Unit 1: Concepts of Igneous petrology:**

- Introduction to Petrology
- Geothermal gradient
- Nature and Composition of magma.

**Unit 2: Classification and texture**

- Classification of igneous rocks.
- Forms of extrusive and intrusive rocks.
- Textures and structures of igneous rocks.

**Unit 3: Phase diagrams and magma geochemistry**

- .Phase Equilibrium relations: System, Phase, Component; Phase Rule.
- One component, Bicomponent and Ternary Systems.
- Bowen's reaction Series.
- Magmatic Differentiation aQdAssimilation.

**Unit 4: Magmatism in different tectonic settings**

- Basic concepts about Magmatism in the oceanic domains (MORB, OIB)
- Basic concepts about Magmatism along the plate margins (Island arcs/continental arcs)

**Unit 5:**

Petrographic description of following: Granite, Pegmatite, Syenite, Diorite, Gabbro, Norite, Anorthosite, peridotite, Lamprophyre,  
Introduction to Ophiolites, Komatiites and Kimberlites

**Suggested Books**

- ❖ Principles of Igneous and Metamorphic Petrology by Anthony R. Philphots and Jay J. Ague. Second Edition, Cambridge University Press.
- ❖ An Introduction to Igneous and Metamorphic Petrology by John D. Winter. Prentice Hall
- ❖ Using Geochemical Data: evaluation, presentation and interpretation by Hugh Rollinson. Longman Scientific and Technical.
- ❖ The study of Igneous, Sedimentary and Metamorphic rocks by Loren A. Raymond. McGraw Hill

<b>GEOB3020</b>	<b>Sedimentary petrology</b>	<b>4L:0T:0P</b>	<b>4 Credits</b>
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**Unit 1: Origin of sediments**

- Weathering: Physical and Chemical weathering.

**Unit 2: Fluids; particle-fluid interaction, flows**

- Fluid flow and sediment transport: Laminar vs turbulent flow, Particle entrainment, transport and deposition.
- Concept of flow regimes and bed forms, sediment gravity flows.

**Unit 3: Sediment Granulometry**

- Sedimentary texture: Grain size, Shape of the particles and Fabric.

**Unit 4: Sedimentary structures**

- Structure of Sedimentary Rocks: Primary and Secondary sedimentary structures.
- Basic concepts of Paleocurrent analysis.

**Unit 5: Varieties of sedimentary rocks**

- Origin and Classification of Sandstone.
- Petrographic description of Conglomerates, Sandstones and shale.
- Origin and Classification of Limestone and Dolomite.

**Unit 6: Diagenesis**

- Concepts of diagenesis.
- Stages of diagenesis.

**Suggested Books:**

- ❖ Prothero and Schwab, 2004, Sedimentary Geology, Freeman and Co. New York, 557p
- ❖ Maurice E. Tucker, 2006, Sedimentary Petrology, Blackwell Publishing, 262p.
- ❖ Collinson, J.D. and Thompson, D.B. 1988, Sedimentary structures, Unwin Hyman, London, 207p.
- ❖ Gary Nichols, 2009. Sedimentology and Stratigraphy Second Edition. Wiley Blackwell



AECC	Field Geology	2 Credits
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**Unit 1:**

- Orientation of topographic sheet in field, marking location in topographic sheet-
- Bearing (front and back).
- Concepts of map reading, distance, height and pace approximation.

**Unit 2:**

- Identification of rock types in field.
- Structures and texture of rocks.
- Use of hand lens.

**Unit 3:**

- Basic field measurement techniques: Bedding, dip and strike.
- Basic concepts of Lithology measurement,

**Unit 4:**

Reading contours and topography

GEOB3030	Paleontology	4L:0T:0P	4 Credits
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**Unit 1: Fossilization and fossil record**

- Fossilization processes and modes of preservation.

**Unit 2: Taxonomy and Species concept**

- Species concept with special reference to palaeontology.
- Concept of organic evolution.

**Unit 3: Invertebrates**

- Morphology, classification and geological history of following groups:  
Lamellibranchia, Gastropoda, Brachiopoda and their biostratigraphic significance.

**Unit 4: Vertebrates**

- Mesozoic reptiles with special reference to origin, diversity and extinction of dinosaurs.
- Evolution of horse and its intercontinental migrations.

**Unit 5: Introduction to palaeobotany, Ichnology**

- Gondwana flora.
- Ichnology and its application.

**Unit 6: Application of fossils in Stratigraphy**

- Biozones, index fossils, correlation.
- Role of fossils in sequence stratigraphy.
- Fossils and palaeoenvironmental analysis.

<b>GEOB3011</b>	<b>Igneous Petrology Lab</b>	<b>0L:0T:4P</b>	<b>2Credits</b>
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- Study of various intrusive bodies.
- Megascopic study of important igneous rocks.
- Study of important igneous rocks in thin sections:
- Plotting of major and trace element data on binary and triangular diagrams.

<b>GEOB3021</b>	<b>Sedimentary Petrology Lab</b>	<b>0L:0T:4P</b>	<b>2Credits</b>
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- Observation and documentation of important Sedimentary Structures.
- Particle size distribution and Statistical treatment
- Paleocurrent analysis.
- Exercises based on vertical sedimentary sequences of different terrestrial,
- Coastal and marine environments.
- Petrography of clastic and non-clastic rocks in hand specimens and thin sections.

<b>GEOB3031</b>	<b>Paleontology Lab</b>	<b>0L:0T:4P</b>	<b>2Credits</b>
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- Study of fossils showing various modes of preservation.
- Study of diagnostic morphological characters, systematic position, stratigraphic position and age of various invertebrate and plant fossils.
- Drawing and labelling of important fossils.

## SEMESTER-IV

Course Type	Course Code	Course Name	L	T	P	IA	UE	Total Marks	Credits
DSC	GEOB4010	Metamorphic Petrology	4	0	0	30	70	100	4
DSC	GEOB4020	Stratigraphy Principles and Indian Stratigraphy	4	0	0	30	70	100	4
DSC	GEOB4030	Hydrogeology	4			30	70	100	4
GE	**	Generic Elective	4/5	0	0	30	70	100	4/5
AECC	GEOB1000	Field Geology-II	2	0	0	30	70	100	2
DSC	GEOB4011	Metamorphic Petrology Lab	0	0	4	15	35	50	2
DSC	GEOB4021	Stratigraphy Lab	0	0	4	15	35	50	2
	GEOB4031	Hydrogeology Lab	0	0	4	15	35	50	2
GE	**	Generic Elective Lab	0	0/1	4/0	15	35	50	2/1
		<b>Total</b>	<b>18</b>	<b>0</b>	<b>16</b>	<b>210</b>	<b>490</b>	<b>700</b>	<b>26</b>

<b>GEOB4010</b>	<b>Metamorphic Petrology</b>	<b>4L:0T:0P</b>	<b>4Credits</b>
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**Unit 1:**

Metamorphism: controls and types

- Definition of metamorphism.
- Agents of metamorphism.
- Types of metamorphism.
- Structure and textures of metamorphic rocks.

**Unit 2:**

Metamorphic Zone, Grade and facies

- Index minerals.
- Chemographic projections: ACF and AKF diagrams.
- Metamorphic zones and isogrades.
- Concept of metamorphic facies and grade.
- Mineralogical phase rule.

**Unit 3:**

Metamorphism and Tectonism

- Relationship between metamorphism and deformation.
- Basic concepts of retrograde and repeated metamorphism.
- Thermal Metamorphism of calcareous rocks.
- Regional Metamorphism of argillaceous rocks.

**Unit 4:**

Migmatites

- Origin of migmatities
- Metasomatism and role of fluids in metamorphism

**Unit 5:**

Petrographic description of following: Marble, Quartzite, Slate, Phyllite, Schists, Gneisses, khondolite, Chamockite, Amphibolite and Eclogite.

**Suggested Books**

- ❖ Anthony R. Philphots and Jay J. Ague Principles of Igneous and Metamorphic Petrology Second Edition, Cambridge University Press.
- ❖ John D. Winter. An Introduction to Igneous and Metamorphic Petrology Prentice Hall
- ❖ Hugh Rollinson Using Geochemical Data: evaluation, presentation and interpretation Longman Scientific and Technical.
- ❖ Loren A. Raymond The study of Igneous, Sedimentary and Metamorphic rocks McGraw Hill
- ❖ Introduction to metamorphic petrology by B.W.D Yardley

<b>GEOB4020</b>	<b>Stratigraphy Principles and Indian Stratigraphy</b>	<b>4L:0T:0P</b>	<b>4Credits</b>
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**Unit 1:**

Principles of Stratigraphy

- Fundamentals of litho, bio and chrono-stratigraphy.
- Introduction to concept of dynamic stratigraphy ( chemostratigraphy, seismic stratigraphy, sequence stratigraphy)

**Unit 2:**

Code of stratigraphic nomenclature

- International Stratigraphic Code - development of a standardized stratigraphic nomenclature.
- Concepts of Stratotypes. Global Stratotype Section and Point (GSSP).

**Unit 3:**

Principles of Stratigraphy analysis

- Facies concept in stratigraphy.
- .Concept of palaeogeographic reconstruction.

**Unit 4:**

Physiographic and tectonic subdivisions Of India

- Brief introduction to the physiographic and tectonic subdivisions of India.
- Precambrian Stratigraphy of Singhbhum
- Introduction to proterozoic basins of India:Geology of Vindhyan and Cudappah Successions of India.

**Unit 5:**

Phanerozoio Stratigraphy of India

- Stratigraphy, structure and hydrocarbon potential of Gondwana basins.
- Mesozoic stratigraphy of India:
  - a. Triassic successions of Spiti
  - b. Jurassic of Kutch
  - c. Cretaceous, successions of Cauvery basins
- Cenozoic stratigraphy of India:
  - a. Siwalik successions
  - b. Assam and Arakan basins.

**Unit 6:**

Volcanic provinces of India

- a. Deccan,
- b. Rajmahal trap

**Suggested Books**

- ❖ I.Krishnan, M.S. 1982. Geology of India and Burma, CBS Publishers, Delhi
- ❖ 2.Doyle, P. & Bennett, M.R. 1996. Unlocking the Stratigraphic Record. John Wiley
- ❖ 3.Ramakrishnan, M. &Vaidyanadhap, R. 2008. Geology of India Volumes 1 & 2, geological society of India, Bangalore.
- ❖ 4.Valdiya, K.S. 2010. The making of India, Macmillan India Pvt. Ltd.
- ❖ 5. Wadia D N, 2015, Geology of India, Macmillan India Pvt. Ltd.

<b>GEOB4030</b>	<b>Hydrogeology</b>	<b>4L:0T:0P</b>	<b>4Credits</b>
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**Unit 1: Introduction and basic concepts**

- Scope of hydrogeology and its societal relevance.
- Hydrologic cycle: precipitation, evapo-transpiration, runoff, infiltration, subsurface movement of water.
- Rock properties affecting groundwater.
- Vertical distribution of subsurface water.
- Aquifer: definition and types.

**Unit 2: Groundwater flow**

- .Darcy's law and its validity.
- Intrinsic permeability and hydraulic conductivity.

**Unit 3: Well hydraulics and Groundwater exploration**

- Basic Concepts (drawdown; specific capacity, specific yield)
- Surface based geophysical methods for groundwater exploration.
- Introduction to subsurface borehole logging methods.

**Unit 4: Groundwater.chemistry**

- Physical and Chemical properties of water and water quality.
- Introduction to methods of interpreting groundwater quality data using standard graphical plots.

**Unit 5: Groundwater management**

- Groundwater level fluctuations.
- Rainwater harvesting and artificial recharge of groundwater.

<b>GEOB4011</b>	<b>Metamorphic Petrology Lab</b>	<b>0L:0T:4P</b>	<b>2Credits</b>
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- Megascopic and microscopic study (textural and mineralogical) of the representative metamorphic rocks.
- Observation and documentation of important metamorphic structures.
- Laboratory exercises in graphic plots for petrochemistry and .interpretation of assemblages: ACF and AKF diagrams.

<b>GEOB4021</b>	<b>Stratigraphy Lab</b>	<b>0L:0T:4P</b>	<b>2Credits</b>
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- Study of geological map of India and Maharashtra.
- Study of rocks in hand specimens from known Indian stratigraphic horizons
- Plotting major stratigraphic units in the outline map of India.
- Plotting major tectonic units in the outline map of India
- Study of different Proterozoic supercontinent reconstructions.

<b>GEOB4031</b>	<b>Hydrogeology Lab</b>	<b>0L:0T:4P</b>	<b>2Credits</b>
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- Morphometric analysis from topographical maps: -identification of stream order and drainage pattern.
- Preparation and interpretation of water level contour maps.
- Water potential zones of India (map study).
- Graphical representation of chemical quality data.
- Simple numerical problems related to Darcy's law, hydraulic conductivity and intrinsic permeability.

<b>SEMESTER-V</b>
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Course Type	Course Code	Course Name	L	T	P	IA	UE	Total Marks	Credits
DSC	GEOB5010	Economic Geology	4	0	0	30	70	100	4
DSC	GEOB5020	Geomorphology	4	0	0	30	70	100	4
DSC	GEOB5030	Exploration Geology	4	0	0	30	70	100	4
DSE	GEOB5040	Earth and Climate	4/5	0	0	30	70	100	4/5
DSC	GEOB5011	Metamorphic Petrology Lab	0	0	4	15	35	50	2
DSC	GEOB5021	Geomorphology Lab	0	0	4	15	35	50	2
DSC	GEOB5031	Exploration Geology Lab	0	0	4	15	35	50	2
DSC	GEOB5041	Earth and Climate Lab	0	0/1	4/0	15	35	50	2/1
		<b>Total</b>	<b>14</b>	<b>0</b>	<b>12</b>	<b>180</b>	<b>420</b>	<b>600</b>	<b>24</b>

<b>GEOB5010</b>	<b>Economic Geology</b>	<b>4L:0T:0P</b>	<b>4 Credits</b>
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**Unit 1: Ores and Gangues**

- ores, gangue minerals, tenor, grade and lodes.
- resources and reserves: definitions.

**Unit 2: Mineral deposits and Concepts of Ore formation**

- classification of economic deposits.
- concept of ore formation under different P-T conditions

**Unit 3: Field aspects of Ore study**

- basic concepts of geological mapping at different scales

**Unit 4: Structure and morphology of ore deposits**

- Processes involved: Endogenous processes: Magmatic concentration, Contact metasomatism, and Hydrothermal deposits (Metasomatic replacement and Cavity filling deposits).  
Exogenous processes: Oxidation and supergene enrichment; Mechanical concentration ..

**Unit 5: Metallic and Nonmetallic ores**

- Oxides of Fe, Mn, Cr, Al and Sulphides of Cu, Pb, Zn.
- Mode of Occurrence, chemical composition, uses and distribution in India of following:  
Metallic deposits: Ores of Iron, Aluminium, Copper, Manganese, Lead and Zinc.  
Non-metallic deposits: Mica, Asbestos and Limestone.

- An introduction to atomic minerals and gemstone

### Suggested Books

- ❖ Guilbert, J.M. and Park Jr., C.F. 1986. The Geology of Ore deposits.
- ❖ Freeman & Co. Bateman, A.M. and Jensen, M.L. 1990. Economic Mineral Deposits.
- ❖ John Wiley. Evans, A.M., 1993. Ore Geology and Industrial minerals. Wiley
- ❖ Laurence Robb, 2005. Introduction to are forming processes. Wiley.
- ❖ Gokhale, K.V.O.K. and Rao, T.C. 1978. Ore deposits of India their distribution and processing, Tata-McGraw Hill, New Delhi.
- ❖ Deb, S. 1980. Industrial minerals and rocks of India. Allied Publishers.
- ❖ Sarkar, S.C. and Gupta, A. 2014 'Crustal Evolution and Metallogeny in India' Cambridge Publications.

<b>GEOB5020</b>	<b>Geomorphology</b>	<b>4L:0T:0P</b>	<b>4 Credits</b>
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#### Unit 1: Introduction to Geomorphology

- Some key concepts and guiding principles.
- Endogenic and Exogenic processes.

#### Unit 2: Morphological features

- Geoid, Topography, Hypsometry.
- Major Morphological features: Large Scale Topography of Ocean basins. In light of Plate tectonics.
- Topographical characteristics of mountain ranges with emphasis on Himalaya.

#### Unit 3: Surficial Processes and Geomorphology

- Processes and landforms due to: Weathering, Glacier, River, Wind, Ocean and Igneous activities.

#### Unit 4: Endogenic - Exogenic interactions

- Rates of uplift and denudation.
- Drainage pattern and its development.
- Sea-level change.
- Long-term landscape development.

#### Unit 5: Overview of Indian Geomorphology

<b>GEOB5030</b>	<b>Exploration Geology</b>	<b>L:0T:4P</b>	<b>4 Credits</b>
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#### Unit 1: Mineral resources

- Resource reserve definitions.
- Mineral resources in industries - historical and present perspective.

#### Unit 2: Prospecting and Exploration

- Principles of mineral exploration: Prospecting and exploration conceptualization, methodology and stages.
- Sampling and sampling techniques.



- Geochemical exploration- nature of samples, anomaly, strength of anomaly and controlling factors; coefficient of aqueous migration.
- Introduction to geophysical methods of exploration.

**Unit 3:** Evaluation of data

- Evaluation of sampling data. Mean, Mode, Median, Standard Deviation and Variance (symmetrical and non symmetrical).

**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.

<b>GEOB5040</b>	<b>Earth and Climate</b>	<b>4L:0T:0P</b>	<b>4 Credits</b>
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**Unit 1:** Climate system.

- Forcing and Responses, Components of the climate system.
- Climate controlling factors.

**Unit 2:** Heat budget of Earth.

- Incoming solar radiation and greenhouse effect.
- Heat transformation.
- Earth's heat budget.

**Unit 3:** Atmosphere - Hydrosphere.

- Layers of atmosphere.
- Atmospheric circulation,
- Atmosphere and ocean interaction and its effect on climate.
- Global oceanic conveyor belt. and related control on earth's climate

**Unit 4:** Response of Biosphere to earth's climate.

- Climate change: Natural vs Anthropogenic effects.

**Unit 5:** Orbital cyclicality and climate;

- Milankovitch cycles and variability in the climate.
- The Last Glacial Maximum (LGM).
- Pleistocene Glaciation.

**Unit 6:** Mechanism of monsoon

- Mechanism of Indian Monsoon.

- Factors associated with monsoonal intensity.
- Effects of monsoon.

<b>GEOB5011</b>	<b>Economic Geology Lab</b>	<b>L:0T:4P</b>	<b>2Credits</b>
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- Megascope identification of Ore
- Study of physical properties, chemical composition, mode of occurrence and uses of following ore forming minerals.  
Oxides: Magnetite, Hematite, Martite, Goethite, Limonite, Psilomelane, Pyrolusite, Braunite, Chromite, Ilmenite, Cassiterite.  
Sulphides: Galena, Sphalerite, Pyrite, Pyrrhotite, Chalcopyrite, Bornite, Molybdenite, Realgar, Orpiment, Stibnite .
- Microscopic identification Study of optical properties of common ore forming minerals: Galena, Sphalerite, Pyrite, Pyrrhotite, Chalcopyrite, Magnetite, Hematite, Psilomelane, Pyrolusite.
- Preparation of maps: Distribution of important metallic and non metallic mineral deposits in India

<b>GEOB5021</b>	<b>Geomorphology Lab</b>	<b>L:0T:4P</b>	<b>2 Credits</b>
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- Reading topographic maps, Concept of scale
- Preparation of a topographic profile
- Completion of contour lines and identification of landforms.
- Study of geomorphic models
- Study of different drainage patterns, calculating stream length gradient index, morphometry of a drainage basin

<b>GEOB5031</b>	<b>Exploration Geology Lab</b>	<b>L:0T:4P</b>	<b>2 Credits</b>
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- Identification of anomaly.
- Statistical analysis and graphical representation of data
- Geological cross-section.
- Reserve estimation.
- Problems related with borehole and drilling data

<b>GEOB5041</b>	<b>Earth and Climate Lab</b>	<b>L:0T:4P</b>	<b>2 Credits</b>
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- Study of distribution of major climatic regimes of India on map.
- Distribution of major wind patterns on World map.
- Study of Global oceanic conveyor belt.
- Preparation of paleogeographic maps (distribution of land and sea) of India during specific geological time intervals.

## SEMESTER-VI

Course Type	Course Code	Course Name	L	T	P	IA	UE	Total Marks	Credits
DSC	GEOB6010	Engineering Geology	4	0	0	30	70	100	4
DSC	GEOB6020	Remote Sensing and GIS	4	0	0	30	70	100	4
DSE	GEOB6030	Fuel Geology	4	0	0	30	70	100	4/5
DSE	GEOB6040	Introduction to Geophysics	4	0	0	30	70	100	4
DSC	GEOB6011	Engineering Geology Lab	0	0	4	15	35	50	2
DSC	GEOB6021	Remote Sensing and GIS Lab	0	0	4	15	35	50	2
DSC	GEOB6031	Fuel Geology	0	0/1	4/0	15	35	50	2/1
DSC	GEOB6041	Introduction to Geophysics	0	0	4	15	35	50	2
		<b>Total</b>	<b>16</b>	<b>0</b>	<b>16</b>	<b>180</b>	<b>420</b>	<b>600</b>	<b>24</b>

<b>GEOB6010</b>	<b>Engineering Geology</b>	<b>L4:0T:0P</b>	<b>4Credits</b>
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**Unit 1:**

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

Site investigation and characterization

Foundation treatment: Grouting, Rock Bolting and other support mechanisms

**Unit 2:**

Intact Rock and Rock Mass properties

- Rock Quality Designation (RQD)
- Rock Structure Rating (RSR)
- Rock Mass Rating (RMR)
- Tunneling Quality Index (Q)

**Unit 3:** Geological considerations in construction of Dams and Reservoirs

**Unit 4:** Geological considerations in construction of Tunnels

**Unit 5:** Landslides Causes and corrective/Preventive measures.

<b>GEOB6020</b>	<b>Remote Sensing and GIS</b>	<b>L4:0T:0P</b>	<b>4Credits</b>
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**Unit 1:** Photogeology

- Types and acquisition of aerial photograph.
- Scale and resolution.
- Elements of air photo interpretation.
- Identification of sedimentary, igneous and metamorphic rocks and various aeolian, glacial, fluvial and marine landforms,

**Unit 2:** Remote Sensing

- Concepts in remote sensing
- Sensors and scanners
- Satellites and their characteristics
- Data formats- Raster and Vector.

**Unit 3:** Digital Image Processing

- Fundamentals of Image processing, Image Correction, Image enhancement, Image classification, FCC and image Ratioing,

**Unit 4:**GIS

- Datum, Coordinate systems and Projection systems.
- Introduction to DEM analysis.

**Unit 5:** GPS

- Concepts of GPS and DGPS
- Applications in earth system sciences.

<b>GEOB6030</b>	<b>Fuel Geology</b>	<b>L4:0T:0P</b>	<b>4Credits</b>
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**Unit 1:** Coal

- Definition and origin of coal.
- Classification of coal.
- Fundamentals of Coal Petrology.
- Basic concepts of Proximate and Ultimate analysis.

**Unit 2:** Coal as a fuel

- Coal Bed Methane (CBM) in Indian scenario
- Underground coal gasification
- Coalfields of India

**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: clastic and chemical.
- Hydrocarbon trap: definition, classification: structural, stratigraphic and combination
- Migration and hydrocarbon accumulation.
- Cap rocks - definition and general properties.
- Distribution of hydrocarbon reserves in India

<b>GEOB6040</b>	<b>Introduction to Geophysics</b>	<b>L4:0T:0P</b>	<b>4Credits</b>
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**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, Seismic- their principles and applications.
- Concepts and usage of corrections in geophysical data.

**Unit 3:** Geophysical field operations

- Different types of survey: grid and route surveys.
- Profiling and sounding techniques,
- Scales of survey.
- Presentation of geophysical data.

**Unit 4:** Application of Geophysical methods

- Regional geophysics, ore geophysics and groundwater geophysics.

**Unit 5:** Geophysical anomalies

- Correction to measured quantities: geophysical anomaly, regional and residual'(local) anomalies.
- Factors controlling anomaly

<b>GEOB6020</b>	<b>Engineering Geology Lab</b>	<b>L:0T:4P</b>	<b>4Credits</b>
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- Computation of reservoir area, catchment area, reservoir capacity and reservoir life.
- Merits, demerits & remedial measures based upon geological cross sections of project sites.
- Computation of index properties of rocks.
- Computation of RQD, RSR, RMR and 'Q'
- Plotting of Major Dams/ Tunnels on the outline map of India.
- Study of Seismic / landslide zones of India.

<b>GEOB6021</b>	<b>Remote Sensing and GIS Lab</b>	<b>L0:0T:4P</b>	<b>2Credits</b>
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- Aerial Photo/ imagery interpretation, identification of sedimentary, igneous and metamorphic rocks and various surface features.
- Introduction to DIP and GIS softwares. Digital Image Processing .exercises including analysis of satellite data in different bands and interpret various objects on the base of their spectral signatures. Creating a FCC from raw data, Registration of satellite data with a toposheet of the area

- Enhancing the satellite images; Generating NDVI images and other image ratio and its interpretation. Classification of images. DEM analysis: generating slope map, aspect map and drainage network map and its applications

<b>GEOB6031</b>	<b>Fuel Geology Lab</b>	<b>L0:0T:4P</b>	<b>2Credits</b>
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- Study of hand specimens of coal
- Plotting of major coalfields / oilfields of India in map.
- Reserve estimation of coal.
- Three point problems to calculate Dip and Strike of coal seams.
- Calculation of fixed carbon, volatile matter and calorific value of coal from given data.
- Section correlation and identification of hydrocarbon prospect

<b>GEOB6041</b>	<b>Introduction to Geophysics Lab</b>	<b>L0:0T:4P</b>	<b>2Credits</b>
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- Identification of anomalies by Graphical methods : Data obtained from equipotential method, Data obtained from self potential method
- Geophysical calculation based on seismic method: refraction, reflection
- Problems based on electrical resistivity methods: Wenner's array, Schlumberger's array