

**PASS COURSE AT A GLANCE**

**SUBJECT- GEOLOGY**

**DISCIPLIN SPECIFIC CORE 4 PAPERS**

Number	Semester	Title of the Course	Credit	
			Theory	Practical
DSC-P-GEL-1	1 <sup>ST</sup>	General Geology and Mineralogy	4	2
DSC-P-GEL-2	2 <sup>nd</sup>	Geomorphology, Stratigraphy and Paleontology	4	2
DSC-P-GEL-3	3 <sup>rd</sup>	Petrology, Geochemistry, Ground water & Natural Hazard	4	2
DSC-P-GEL-4	4 <sup>th</sup>	Structural Geology, Engineering Geology, & Economic Geology	4	2

**DISCIPLIN SPECIFIC ELECTIVE 2 PAPERS**

Number	Semester	Title of the Course	Credit	
			Theory	Practical
DSE-P-GEL-1	5 <sup>th</sup>	Exploration Geology	4	2
DSE-P-GEL-2	6 <sup>th</sup>	Fuel Geology	4	2

**SKIL ENHANCEMENT COURSES-LIST-A (Any one Paper)**

Number	Semester	Title of the Course	Credit	
			Theory	
SEC-P-GEL-1	3 <sup>rd</sup> /4 <sup>th</sup> /5 <sup>th</sup>	Field Geology	2	
SEC-P-GEL-2	3 <sup>rd</sup> /4 <sup>th</sup> /5 <sup>th</sup>	Information Technology	2	

**FIRST SEMESTER  
GEOLOGY PASS PAPER-I**

**Theory Paper-I (General Geology, Crystallography and Mineralogy)**

**Objectives of the Course:**

The aim of this course is to study General geology part can give an idea about endogenetic process operating inside the earth. study the crystals through external elements of symmetry, crystal classes and systems, and the relations of symmetry to the internal structure using the chemical and physical properties of the minerals. The course aims also to study the major mineral groups, their occurrences, physical, chemical and crystallographic properties and their possible uses in industry. In these units, the physical, chemical and optical properties of the minerals are described. One should know them to identify the types of rocks.

**Expected outcome:**

The said courses will make the students to understand about the interior of earth. It will help the students to understand about crystal chemistry. The students will be equipped with the knowledge of identifying different minerals with their possible varieties and their occurrence in different types of rocks as a combining unit.

<b>UNIT-I</b>	<b>General Geology:</b> Scope, importance and branches of geology, Age, Origin, and Internal structure of the Earth, Earthquake with its causes, scale, some examples
<b>UNIT-II</b>	<b>Crystallography:</b> Elementary idea about crystal morphology in relation to their internal structure, Crystal parameter and indices, Crystal symmetry and classification of crystal into six normal classes, along with their, axial relationship, symmetry elements, forms present and at least five examples
<b>UNIT-III</b>	<b>Optical Mineralogy:</b> Properties of light, petrological microscope, polarisation, double refraction, R.I, Nicol prism, pleochroism, Isotropism, extinction angle, Birefringence, Interference colour
<b>UNIT-IV</b>	<b>Mineralogy:</b> Silicate structure, physical properties of minerals, Polymorphism, Isomorphism
<b>UNIT-V</b>	<b>Mineral groups:</b> Description of different mineral groups with reference to its mineralogy, chemistry, physical properties, optical properties and uses of Olivine, Pyroxene, Mica, Feldspar, Quartz, Amphibole and Garnet group

**Books Recommended:**

1. W.A DEER, R.A. HOWIE, J. JUSSMAN (1992) Introduction to the rock forming minerals, ELBS (British Govt)
2. William D. Nesse, Introduction to Optical Mineralogy, Page no. 1- 442
3. James D. Dana (Revised by c. Klein & C.S. Hurlbut), Dana's Manual of Mineralogy, Twenty First Edition, Page no. 1-681
4. Dexter Perkins, Mineralogy, Third edition, Page no. 1-388
5. Condie, K. C. (1989) Plate tectonics and Crustal development, Pergamon, 3rd edition, Page no. 1-504.
6. F. Rutley, H. H. Read & G.T. Holoway (1916) Elements of Mineralogy, Nineteenth edition, Page no. 1-388.

### Practical Paper-I

Study of crystal models, Megascopic and Microscopic identification of minerals, Map (Geomorphology), Lab Record, Viva-voce.

### **SECOND SEMESTER GEOLOGY PASS PAPER-2**

#### Theory Paper-II (Geomorphology, Tectonics, Stratigraphy & Palaeontology)

##### **Objectives of the course:**

In this unit, different types of earth features and their causative geological agents have been described. The students can analyse the type of agents that has shapes a particular zone of the earth surface. below units will describe the logical deposition of strata according to geological time. They shall come to know about the distribution of rocks of various time period in different parts of India. It will help the students can know the characteristic properties, origin and classification of fossils.

##### **Expected outcome:**

The students can have the knowledge about the physical features of the surface of the earth and their relation to its geological structures. This knowledge will enable the students to find out the age, lithological constitution and economic importance of various strata. This knowledge will enable the students to find out the age of various strata and also to interpret the paleoenvironments.

<b>UNIT-I</b>	<b>Geomorphology:</b> Weathering and erosion, Geological work of river and landforms developed because of erosion and deposition, Geological work of wind and glacier and landforms developed because of erosion and deposition, Volcano, its type, products
<b>UNIT-II</b>	<b>Tectonics:</b> Continental drift, Concept of plate tectonics, Isostasy, MOR, Island arc, Sea floor spreading
<b>UNIT-III</b>	<b>Stratigraphy (A):</b> Principles of stratigraphy, Stratigraphic correlation, General Stratigraphic timescale, stratigraphy of Cuddapah, Vindhyan, Gondwana and Dharwar along with its Stratigraphic succession, lithology, economic importance, structure and fossil content if any
<b>UNIT-IV</b>	<b>Stratigraphy (B):</b> Stratigraphy of Triassic of Spiti, Jurassic of Kutch, Siwalik and Tertiary of Assam
<b>UNIT-V</b>	<b>Palaeontology:</b> Mode of preservation of fossils, Morphology, geological distribution and evolution of Brachiopods, Cephalopods, Gastropoda, Trilobita, Pelecypoda

##### **Books Recommended:**

1. Amal Dasgupta, An Introduction to Palaeontology, 2<sup>nd</sup> Edition, Page no. 1-543
2. P.C. Jain & M.S. Anantharaman, Palaeontology (Palaeobiology) Evolution and Animal Distribution, Page no. 1-315
3. Wadia. D. N. (1975) Geology of India, McGraw Hill Education India Pvt. Ltd; 4th edition, Page no. 1-560.
4. Ravindra Kumar (1998) Historical Geology and Stratigraphy of India, New Age; 1st edition, Page no. 1-268.
5. Condie, K. C. (1989) Plate tectonics and Crustal development, Pergamon, 3rd edition, Page no. 1-504.
6. P. Kerry, K. Klepeis and F.J. Vine, Global Tectonics, 3rd Edition, Page no. 1-463

## Practical Paper-II

Tectonic zones of india, Plotting of Stratigraphy units in India and Odisha map, Identification of fossils, Lab Record, Viva-voce

## THIRD SEMESTER GEOLOGY PASS PAPER-3

### Theory Paper-III (Petrology, Geochemistry, Hydrology & Natural hazards)

#### Objectives of the course:

In these units, the students can know the characteristic properties of igneous rocks (those formed from molten material) as well as their origin and types. In these units, the students can know the characteristic properties, origin and distribution of ore minerals. The students will be able to know the characteristic properties, origin, movement and types of groundwater

#### Expected outcome:

The students shall have the potential to know the mechanism of formation of different types of igneous rocks. They will be in a position to classify the igneous rocks basing on various parameters. After the study, the student will have the knowledge about Cosmic abundance of elements, Distribution of major and trace elements in the earth crust. This knowledge will enable the students to use groundwater properly and will have the knowledge to install various types of wells.

<b>UNIT-I</b>	<b>Igneous and Metamorphic Petrology:</b> Forms, structure, texture and classification of igneous rocks, Bowen's reaction series Agents and type of metamorphism, structure, texture of metamorphic rocks
<b>UNIT-II</b>	<b>Sedimentary Petrology:</b> Process of formation of sedimentary rock, texture, structure and Classification of sedimentary rock, Individual classification of Sandstone and Limestone
<b>UNIT-III</b>	<b>Geochemistry:</b> Cosmic abundance elements, Rock cycle, Composition of Meteorites, Geo-chemical classification of elements
<b>UNIT-IV</b>	<b>Ground Water/Hydrogeology:</b> Vertical zonation of ground water, Types of Aquifer, Hydro geological properties of rock like Porosity, permeability, specific retention, specific yield
<b>UNIT-V</b>	<b>Natural hazards:</b> The causes, effects and mitigation measures for flood and cyclone, Landslide, Tsunamis and Marine transgression and regression

#### Books Recommended:

1. Mason, B. (1968) Principles of Geochemistry, John Wiley & Sons; 3rd International edition, Page no. 1-330.
2. Best. (2002) Igneous and Metamorphic Petrology, Wiley-Blackwell, 2nd edition, Page no. 1-752.
3. John D. Winter, Principles of Igneous and Metamorphic Petrology, 2nd Edition, page no. 1-443
4. Pettijohn, F. J. (1983) Sedimentary rocks, HarperCollins, 3rd edition, Page no. 1-526.
5. Todd, D. K. (2015) Ground water Hydrology, Page no. 1- 656
6. Savindra Singh (1998) Geomorphology, Prabalika Publication, Page no. 1- 552

### Practical Paper-III

Megascope identification of igneous, metamorphic and sedimentary rocks, Microscopic identification of igneous, metamorphic and sedimentary rocks, Study of ground water conditions in a given map, Lab Record, Viva-voce

### **FOURTH SEMESTER GEOLOGY PASS PAPER-4**

#### **Theory Paper-IV (Structural Geology, Engineering Geology & Economic Geology)**

**Objectives of the course:** In these units, the students can know the characteristic properties, origin and types of various structural features found in rocks. The students can know the characteristic properties, origin and distribution of coal, petroleum and nuclear minerals. After the study, the student will have the knowledge of their conservation and management.

**Expected outcome:**

The above knowledge will enable the students to study the history of mechanism of formation and structure of rocks. The students can have the knowledge of various environmental laws related to mining of minerals.

<b>UNIT-I</b>	<b>Structural Geology(A):</b> Concept of dip and strike, Determination of top and bottom of beds, Definition and classification of folds.
<b>UNIT-II</b>	<b>Structural Geology(B):</b> Definition and classification of faults and its recognition in the field, Origin, types of unconformity and its recognition in the field. Definition and classification of joints
<b>UNIT-III</b>	<b>Engineering Geology:</b> Description, site selection and effect of Dam, Bridge, Tunnel Engineering properties of rock
<b>UNIT-IV</b>	<b>Economic Geology (A):</b> Process of formation of Ore deposits, Mode of occurrence, genesis, mineralogy, Indian distribution and uses of metallic ores of Iron, Manganese, Copper, Aluminium
<b>UNIT-V</b>	<b>Economic Geology (B):</b> Mode of occurrence, genesis, mineralogy, Indian distribution and uses of Nonmetallic ores Mica, Limestone, Gypsum, Asbestos, Mode of occurrence, genesis, Indian distribution and uses of Coal and Petroleum.

**Books Recommended:**

1. Billings, M. P. (1972) Structural Geology, Pearson College Div., 3rd editions, Page no. 1-606.
2. Ghosh, S. K. (1993) Structural Geology, Pergamon, Page no. 1-598.
3. Krishnaswamy, S.: (1988) Mineral Resources of India, Oxford & IBH, Page no. 1- 613
4. N Chenna Kesavulu, Textbook of Engineering Geology, 2nd edition, Page no. 331-441
5. Ries and Watson: (1914) Engineering Geology, New York, J. Wiley & sons, Page no. 1- 142
6. B.S. Satya Narayanswami, Structural Geology, Page no. 1-191

### Practical Paper-IV

Structural map, Megascope identification of ores, Ore reserve calculation, Field Report, Lab Record, Viva-voce

**DISCIPLINE SPECIFIC ELECTIVE (Pass)**

**(SEMESTER-V)**

**PAPER-I (EXPLORATION GEOLOGY)**

**(Credits: Theory-4, Practical-2)**

**(Credits: Theory-4, Practical-2)**

**Objectives of the course:** In these units, the students can know the characteristic properties, origin and distribution of ore minerals.

**Expected outcome:**

After the study, the student will have the knowledge of exploring them by sampling and geophysical methods.

Unit-I	Resource reserve definition, A brief overview of classification of mineral deposit with respect to process of formation and in relation to exploration strategies.
Unit-II	Principles of mineral exploration, geological, geochemical and geophysical exploration.
Unit-III	Drilling & logging, core & non-core drilling, planning of bore holes & location of bore holes on ground, core logging.
Unit-IV	Reserve estimations & errors: Principles of reserve estimation, density & bulk density, factors affecting reliability of reserve estimation. reserve estimation based on geometrical methods (polygon, square, rectangular, triangular).
Unit-V	Mining terminology, Classification of mining methods, Open cast mining, Underground mining methods (Stopping methods- Board and pillar, Long wall, Cut and fill, Shrinkage stopping), chain and compass survey.

**Books Recommended:**

1. Arogyaswamy, R. H. P (1973) Courses in Mining Geology, Oxford & IBH Pub. Co., Page no. 1- 916
2. Emmons, W. H. (1918) Principles of Economic Geology, New York, McGraw-Hill, Page no. 1-140
3. Bateman, A. M. (1981) Economic Mineral deposits, John Wiley & Sons Inc, 3rd edition, Page no. 1- 604
4. Park. C. F. (Jr) & Mac Diarmid, M. A. (1986) Ore Deposits, Page no. 1- 525
5. Mukharjee, A. (2007) Ore Genesis, Waveland Press, Page no.1- 985
6. Stanton (1972) Ore Petrology, McGraw-Hill, 1972, Page no.1- 713

**PRACTICAL**

Problems related to exploration, Reserve estimation, Chain and Compass survey, Preparation of sub-surface lithologs.

**DISCIPLINE SPECIFIC ELECTIVE (Pass)**  
**(SEMESTER-VI)**  
**PAPER-II (FUEL GEOLOGY)**  
**(Credits: Theory-4, Practical-2)**

**Objectives of the course:** In this course, the students can know the characteristic properties, origin and distribution of coal, petroleum and nuclear minerals. After the study, the student will have the knowledge of their conservation and management.

**Expected outcome:**

The students can have the knowledge of various environmental laws related to mining of minerals.

- Unit-I** Coal: definition, origin, classification of coal, fundamental of coal petrology: lithotype, microlithotypes & maserals in coal proximate & ultimate analysis.
- Unit-II** Coal as fuel: coal bed methane (CBM) global & Indian scenario underground coal gasification, coal liquefaction. Distribution of coal in India.
- Unit-III** Petroleum: chemical composition and physical properties of crudes in nature. Origin of petroleum, Distribution of petroleum in India.
- Unit-IV** Petroleum reservoirs & traps  
Reservoir rocks, classification of reservoir rocks, hydrocarbon traps (defn, anticlinal theory) classification of hydrocarbon traps- structural, stratigraphic & combination. Cap rocks – definition and properties.
- Unit-V Other fuels – Gas hydrate, Nuclear fuel.

**Books Recommended:**

1. Francis, W.: (1961) Coal-its formation and composition, Edward Arnold, Page no. 1- 806
2. Levorsen. A, I. (2004) Geology of Petroleum, CBS Publishers & Distributors Pvt. Ltd., second edition.
3. Hobson, G. D. and Tiratsoo, E. N. Introduction to Petroleum Geology, Beaconsfield, Eng., Scientific Press, 1975, Page no. 1- 300
4. Deb, S. (1980) Industrial Minerals and Rocks of India, Allied Publishers, page no. 1-603.
5. Chandra, D., Singh, R. M. and Singh, M. P. (2000) Textbook of Coal (Indian context), Tara Book Agency
6. Francis, W. (1961) Coal-its formation and composition, Edward Arnold, page no. 1-806.

**PRACTICAL**

Plotting of coal, petroleum and radioactive mineral deposits in the map of India and Odisha, Study of hand specimens of coal, Reserve estimation of coal, Correlation of bore-logs of coal deposits.

**SKILL ENHANCEMENT COURSE**

**Project work**

**(2 credit)**

1. Geological Mapping
2. Remotesensing and GIS
3. Ground Water Studies
4. Engineering Geology
5. Economic Geology
6. Fossil Studies
7. Environmental Geology
8. Applied Geology
9. Geological Resource Management
10. Natural Disaster Management