

**ANDHRA UNIVERSITY  
DEPARTMENT OF GEOLOGY  
COLLEGE OF SCIENCE AND TECHNOLOGY**



**Scheme of Instruction and Examinations**

**M. Sc. (TECH) APPLIED GEOLOGY**

(Revised Syllabus with effect from the admitted batch 2021-2022)

## **M.Sc (Tech) Applied Geology**

### **Programme Outcomes: (PO)**

- PO<sub>1</sub>** To Impart advanced knowledge on various geological processes and palaeontology.
- PO<sub>2</sub>** To enhance knowledge of geological science with special emphasis on various applied aspects of Geology
- PO<sub>3</sub>** To acquire knowledge about mineral formation processes, distribution, occurrences and water resources
- PO<sub>4</sub>** To get knowledge on minerals, fuels and Groundwater exploration methods and interpretation techniques
- PO<sub>5</sub>** To understand various Metallic and non- Metallic mining Methods.
- PO<sub>6</sub>** To impart skills on ore dressing and Biennial Beneficiation Techniques for various minerals
- PO<sub>7</sub>** To enhance knowledge about various geoenvironments, impacts of mining, civil structures, Environmental Impact Assessment, pollution and Geohazards
- PO<sub>8</sub>** To enhance knowledge to carryout geological mapping, Remote Sensing and GIS on various geological terrains, mineral polices and Mineral industries.

### **Programme Specific Outcomes (PSO)**

- PSO<sub>1</sub>** : Be proficient in identification of minerals, rocks, structures and Stratigraphic units, fossils and Earth processes.
- PSO<sub>2</sub>** : Mapping, characterization of Rocks, exploration and evaluation of minerals deposits using Remote Sensing & GIS, Geological and geophysical techniques.
- PSO<sub>3</sub>** : Mineral policies and Growth of mineral industry, planning, Development of ore dressing, mineral beneficiation and Mining methods with new technology
- PSO<sub>4</sub>** : Applications of geological knowledge in various fields to design and implementation of various petroliferous basins civil engineering and environmental projects

**Laboratory**  
**I-Semester M.Sc (Tech) Applied Geology**  
**MINERALOGY**

**Paper:** I

**Course Objectives:**

- CO<sub>1</sub>** : To introduce structure, chemistry, physical & optical properties of Olivine, garnet, Epidote groups
- CO<sub>2</sub>** : To impart knowledge on Pyroxene, amphiboles, clay and Mica Minerals.
- CO<sub>3</sub>** : To introduce concepts on Isomorphism, Polymorphism and Physical, optical properties of Feldspars
- CO<sub>4</sub>** : To familiarize the studies on Non silicate Groups like Oxides & Sulphides
- CO<sub>5</sub>** : To equip the students on chemistry and paragenesis of carbonates, Phosphates and gemstones etc.

**Course outcomes:**

**At the end of the course student will be able to**

- CO<sub>1</sub>** : Explain the properties of Neso silicates
- CO<sub>2</sub>** : Identify the inosilicates and phyllosilicates
- CO<sub>3</sub>** : Interpret the processes of isomorphism & Polymorphism
- CO<sub>4</sub>** : Identify the Non silicates, native elements, oxides and sulphates
- CO<sub>5</sub>** : Explain the chemistry and paragenesis of Gemstones and Non silicates

**Course Specific Outcomes**

- CSO1** : To understand, structure, genesis, physical, chemical and Optical properties silicate group of minerals
- CSO2** : Imparts knowledge on genesis, physical, chemical and Optical properties of non silicates

**Mapping of Course Outcomes with Program Outcomes:**

CO/PO	P01	P02	P03	P04	P05	P06	P07	P08
<b>C01</b>	<b>x</b>							
<b>C02</b>	<b>x</b>							
<b>C03</b>	<b>x</b>							
<b>C04</b>	<b>x</b>							
<b>C05</b>	<b>x</b>							

**Mapping of Course Outcomes with Program Specific Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
<b>C01</b>	<b>x</b>			
<b>C02</b>	<b>x</b>			
<b>C03</b>	<b>x</b>			
<b>C04</b>	<b>x</b>			
<b>C05</b>	<b>x</b>			

**I - Semester M.Sc (Tech) Applied Geology**  
**IGNEOUS AND METAMORPHIC PETROLOGY**

Paper : II

Course Objectives:

- CO<sub>1</sub> : To introduce the basic concept of Generation of Magmas and its occurrences
- CO<sub>2</sub> : To impart knowledge on Bowen's reaction series, crystallization and classification of magmas.
- CO<sub>3</sub> : To familiarize the descriptive studies of Petrographic province, Mineralogy, Texture and petrogenesis of igneous rocks.
- CO<sub>4</sub> : To introduce the Textures, Structures, Recrystallization differentiation and facies of metamorphic rocks
- CO<sub>5</sub> : To illustrate the metamorphic reactions, Temperature- pressure conditions.

**Course outcomes:**

**At the end of the course student will be able to**

- CO<sub>1</sub> : Explain the basics of magma generation, mixing. Discuss about plate tectonics in relation to petrology.
- CO<sub>2</sub> : Introduce the Basics reaction series, and their classification of igneous rocks.
- CO<sub>3</sub> : Choose the concept of descriptive studies of rocks.
- CO<sub>4</sub> : Illustrate the metamorphic conditions and student can explain phase diagrams.
- CO<sub>5</sub> : Outline of the various metamorphic reaction, such as regional metamorphism and paired metamorphic belts, P-T t paths.

**Course Specific Outcomes**

- CSO1 : To understand Petrography and Petrogenesis of Igneous rocks and forms, structures etc,
- CSO2 : Attains knowledge on Petrography and Petrogenesis of Metamorphic rocks, structures, textures and facies

**Mapping of Course Outcomes with Program Outcomes:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
C01	x							
C02	x							
C03	x							
C04	x							
C05	x							

**Mapping of Course Outcomes with Program Specific Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
C01	x			
C02	x			
C03	x			
C04	x			
C05	x			

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**I-Semester M.Sc Tech Applied Geology  
STRUCTURAL GEOLOGY & TECTONICS**

**Paper:** III

**Course Objectives:**

- CO<sub>1</sub>** : To introduce Mechanical principles and Rock properties
- CO<sub>2</sub>** : To introduce folds and its classification
- CO<sub>3</sub>** : To introduce fractures, Joints and classification of faults
- CO<sub>4</sub>** : To introduce concept of petrofabrics and symmetry Field and lab techniques.
- CO<sub>5</sub>** : To introduce plate tectonics and evolution of continental and oceanic crust and tectonics of orogenic belts of India

**Course outcomes:**

**At the end of the course student will be able to**

- CO<sub>1</sub>** : Explain to mechanical principles, rock properties, concept of stress and strain and composition and resolution of forces.
- CO<sub>2</sub>** : Explain structural features particularly folds mechanics and causes and top bed of primary features
- CO<sub>3</sub>** : Explain origin and classification of Joints and faults.
- CO<sub>4</sub>** : Explain concept of Petrofabrics and Symmetry, types of fabrics and field and lab techniques
- CO<sub>5</sub>** : Explain plate tectonics, continental and Oceanic crust evolution theory and orogenic belts of India and Some case studies.

**Course Specific Outcomes**

- CSO1** : To understand the concept of stress and strain, principles of rupture. Mechanics, and classification of Folds, Faults, Fractures and joints.
- CSO2** : To impart knowledge on concept of plate tectonics, Dynamic evolution of continents and oceanic crust.

**Mapping of Course Outcomes with Program Outcomes:**

CO/PO	P01	P02	P03	P04	P05	P06	P07	P08
<b>CO1</b>	x							
<b>CO2</b>	x							
<b>CO3</b>	x							
<b>CO4</b>	x							
<b>CO5</b>	x							

**Mapping of Course Outcomes with Program Specific Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
<b>CO1</b>	x			
<b>CO2</b>	x			
<b>CO3</b>	x			
<b>CO4</b>	x			
<b>CO5</b>	x			

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**I - Semester M.Sc (Tech) Applied Geology**  
**SEDIMENTOLOGY**

**Paper: IV**

**Course Objectives:**

- CO<sub>1</sub>** : To study the Sedimentology and various types of Sedimentary structures.
- CO<sub>2</sub>** : To study origin and texture of Sedimentology rocks.
- CO<sub>3</sub>** : To introduce the sedimentary environments and facies.
- CO<sub>4</sub>** : To impart knowledge on Clastic, Biogenic, Chemical and volcanogenic sediments and their classifications.
- CO<sub>5</sub>** : To study the provenance of sediments and field and laboratory techniques in Sedimentology.

**Course outcomes:**

**At the end of the course student will be able to**

- CO<sub>1</sub>** : Understand the history and development of Sedimentology, process of transport and sedimentary structures.
- CO<sub>2</sub>** : Explain the origin of sedimentary rocks and grain size parameters.
- CO<sub>3</sub>** : Distinguish the continental and transitional sedimentary environments and their facies.
- CO<sub>4</sub>** : Differentiate the Clastic, Biogenic, Chemical and volcanogenic sediments and also classify the clastic and carbonate rocks.
- CO<sub>5</sub>** : Describe the provenance of sediments, Process of diagenesis of the clastic and carbonate rocks. Field and laboratory techniques in Sedimentology.

**Course Specific Outcomes**

- CSO1** : To Understand Sedimentary Structures, Environments and facies
- CSO2** : To Impart knowledge on classification, provenance and Laboratory Techniques

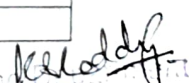
**Mapping of Course Outcomes with Program Outcomes:**

CO/PO	P01	P02	P03	P04	P05	P06	P07	P08
CO1	x							
CO2	x							
CO3	x							
CO4	x							
CO5	x							

**Mapping of Course Outcomes with Program Specific Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
CO1	x			
CO2	x			
CO3	x			
CO4	x			
CO5	x			

  
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## II - Semester M. Sc (Tech) Applied Geology STRATIGRAPHY

**Paper : I**  
**Course objectives**

- CO<sub>1</sub> :** To introduce the principles of stratigraphy controls and development of stratigraphic records.
- CO<sub>2</sub> :** To Impart knowledge on Biostratigraphy
- CO<sub>3</sub> :** To impart knowledge on geochronology and chronostratigraphy of completeness and incompleteness stratigraphic records.
- CO<sub>4</sub> :** To introduce the various seismic methods of seismic stratigraphy.
- CO<sub>5</sub> :** To Seismic stratigraphy the sequence stratigraphy and its applications in explorations.

**Course outcomes:**

**At the end of the course student will be able to**

- CO<sub>1</sub> :** Explain the principles of stratigraphy and controls and development of stratigraphic record.
- CO<sub>2</sub> :** Interpret zonation and time significance, magneto stratigraphy cyclostratigraphy and event stratigraphy.
- CO<sub>3</sub> :** Outline of Geochronology and chronostratigraphy chemostratigraphy etc.
- CO<sub>4</sub> :** Explain the development of seismic methods, and analysis of seismic character sticks.
- CO<sub>5</sub> :** Illustrate historical developments of sequence stratigraphy and Application of sequence stratigraphy in various depositional systems

**Course Specific Outcomes**

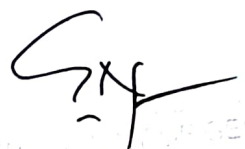
- CSO1 :** Impart knowledge on Principles of Stratigraphy, biostratigraphy and geochronology
- CSO2 :** To understand Seismic Stratigraphy and Sequence Stratigraphy. Applications of sequence Stratigraphy in clastic and carbonate depositional systems

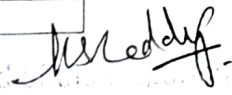
**Mapping of Course Outcomes with Program Outcomes:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x							
CO2	x							
CO3	x							
CO4		x						
CO5		x						

**Mapping of Course Outcomes with Program Specific Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
CO1	x			
CO2	x			
CO3	x			
CO4		x		
CO5		x		

  
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## II - Semester M. Sc (Tech) Applied Geology

### GEOCHEMISTRY AND ISOTOPE GEOLOGY

Paper: II

## Course objectives

- Course objectives**
- CO<sub>1</sub>** : To introduce concept of Geochemistry, cosmic abundance of elements, geochemical evolution of the earth, meteorites, structure, composition of the earth and geochemical classification of elements.
- CO<sub>2</sub>** : To introduce crystal chemistry, trace elements, laws of thermo dynamics, gibbs free energy, ionic substitution in minerals
- CO<sub>3</sub>** : To introduce Geochemical mobility under low and high P-T conditions, Geochemical dispersions and geochemistry of lithosphere, atmosphere, biosphere, and Geochemical cycle.
- CO<sub>4</sub>** : To introduce Geochemistry of water, Mineral stability, water rock interaction.
- CO<sub>5</sub>** : To introduce Radiogenic isotopes, radioactive decay schemes of U-Th- Pb, Rb- Sr, K-Ar, Application of stable isotopes in geology.

**Course outcomes:**

**At the end of the course student will be able to**

- At the end of the course student will be able to**
- |                       |          |   |
|-----------------------|----------|---|
| <b>CO<sub>1</sub></b> | <b>:</b> | Explain the concept of Geochemistry, evolution of the earth composition of meteorites, internal structure and composition of the earth, and geochemical classification of elements. |
| <b>CO<sub>2</sub></b> | <b>:</b> | Explain the crystal chemistry, isomorphism, diadochy camouflage of elements laws of thermo dynamics, Rare earth elements geochemistry.  |
| <b>CO<sub>3</sub></b> | <b>:</b> | Explain the Geochemical mobility under low and high P-T conditions, geochemical dispersions, Geochemistry of lithosphere, Atmosphere, Biosphere and Geochemical cycle.              |
| <b>CO<sub>4</sub></b> | <b>:</b> | Explain the Geochemistry of water, mineral stability, water-rock interaction  |
| <b>CO<sub>5</sub></b> | <b>:</b> | Explain the Radiogenic isotopes Radioactive decay schemes of U-Th- Pb, Rb- Sr, K-Ar, Geochemistry of uranium and thorium.   |

### Course Specific Outcomes

- Course Specific Outcomes**
- CS01 :** To understand concept of Geochemistry, Geochemical classification of elements, Geochemical Mobility etc.
- CS02 :** To Impart knowledge on Radiogenic isotopes, ways of dating, Nuclear reactors and application of stable isotopes in Geology

### Mapping of Course Outcomes with Program Outcomes:

C0/P0	P01	P02	P03	P04	P05	P06	P07	P08
C01	x							
C02	x							
C03	x							
C04		x						
C05		x						

### Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
C01	x			
C02	x			
C03	x			
C04	x			
C05				x

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**II -Semester M. Sc (Tech) Applied Geology**  
**SEDIMENTARY PETROLOGY**

**Paper : III**

**Course objectives**

- CO<sub>1</sub> :** To introduce texture, particle size, shape, roundness etc of sediments.
- CO<sub>2</sub> :** To impart knowledge on internal organization and structure of sedimentary rocks, beds, stromatolites, Biogenic structures etc.
- CO<sub>3</sub> :** To familiarize the student with geometry of sedimentary bodies, classification of gravels, conglomerates and breccias.
- CO<sub>4</sub> :** To impart knowledge on classification of sand stones, shales, siltstones, loess, limestones etc.
- CO<sub>5</sub> :** To familiarize student with non clastic sediments.

**Course outcomes:**

**At the end of the course student will be able to**

- CO<sub>1</sub>:** Explain about the texture, particle size, shape, roundness etc of sediments.
- CO<sub>2</sub>:** Interpret the internal organization and structure of sedimentary rocks, beds, stromatolites, biogenic sediments etc.
- CO<sub>3</sub>:** Illustrate geometry of sedimentary bodies, classification of gravels, conglomerates and breccias.
- CO<sub>4</sub>:** Explain classification of sand stones, shales, siltstones, loess, limestones etc.
- CO<sub>5</sub>:** Illustrate about non clastic sediments.

**Course Specific Outcomes**


- CSO1 :** To understand texture, structure and geometry of sedimentary bodies.
- CSO2 :** Impart knowledge on non clastic sediment rocks

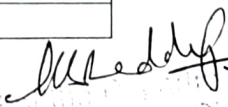
**Mapping of Course Outcomes with Program Outcomes:**

CO/PO	P01	P02	P03	P04	P05	P06	P07	P08
C01	x							
C02	x							
C03	x							
C04	x							
C05	x							

**Mapping of Course Outcomes with Program Specific Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
C01	x			
C02	x			
C03	x			
C04	x			
C05	x			

  
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## II- Semester M. Sc (Tech) Applied Geology MICROPALEONTOLOGY

Paper : IV  
Course objectives

- CO<sub>1</sub> : To introduce advances in micropaleontology kingdoms of life and application of microfossils.
- CO<sub>2</sub> : To explain morphology, ecology distribution and outline classification foraminifera.
- CO<sub>3</sub> : To illustrate the elementary ideas about the major morphological groups of ostracoda, calcareous, Nanno-planckton -coccolithophores etc.
- CO<sub>4</sub> : To introduce morphology, Ecology, Geological history of radio laria diatoms, phosphatic microfossils.
- CO<sub>5</sub> : To explain dinoflagellates, acritarch, Tasmanitds, spores, pollens, morphology etc.

### Course outcomes:

At the end of the course student will be able to

- CO<sub>1</sub> : Explain the advances in micropaleontology, and application of micro fossils etc.
- CO<sub>2</sub> : Outline classification of foraminifera and its uses.
- CO<sub>3</sub> : Explain the elementary ideas about the major morphological groups of ostracoda, calcareous nanno-planton coccolithophores
- CO<sub>4</sub> : Illustrate the morphology, Ecology, Geologic history of radio laria, diatoms, phosphatic microfossils.
- CO<sub>5</sub> : Explain the morphology, Ecology, Geologic history of dinoflagellates, Acritarch, Tasmanitds, spores and pollens.

### Course Specific Outcomes

- CSO1 : To understand calcareous walled microfossils and their applications.
- CSO2 : To impart knowledge on siliceous walled microfossils and their applications.

### Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x	x						
CO2		x						
CO3	x							
CO4	x							
CO5	x							

### Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
CO1	x			x
CO2		x		
CO3		x		
CO4		x		
CO5		x		

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**III-Semester, M.Sc (Tech) Applied Geology  
GEOMORPHOLOGY, REMOTE SENSING and GIS**

**Paper: I**

**Course objectives**

- CO<sub>1</sub>** : To introduce the primitive stages of Remote Sensing
- CO<sub>2</sub>** : To introduce the Principles and Physics of Remote Sensing
- CO<sub>3</sub>** : To familiarise the students with various applications of Remote Sensing, GIS and GPS
- CO<sub>4</sub>** : To introduce the concepts of Drainage basin and Morphometry
- CO<sub>5</sub>** : To introduce the importance of topographical maps and Geomorphology in mineral prospecting, Hydrological studies and Engineering Geological studies

**Course outcomes:**

**At the end of the course student will be able to**

- CO<sub>1</sub>** : learn about primitive stages of remote sensing i.e. various Photogeological studies and interpretation of aerial photographs
- CO<sub>2</sub>** : understand the Principles and physics of Remote Sensing
- CO<sub>3</sub>** : know the importance of Remote Sensing, GIS and GPS in mineral, Hydrogeological and various prospecting studies
- CO<sub>4</sub>** : learn the advanced geomorphology and its importance in various applications
- CO<sub>5</sub>** : Know the importance of Topographical maps and Geomorphology in various geological and terrain evaluation studies.

**Course Specific Outcomes**


- CSO1** : To understand the Principals and applications of Remote Sensing and GIS.
- CSO2** : To impart knowledge on the basic concepts and applications of geomorphology

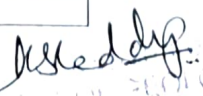
**Mapping of Course Outcomes with Program Outcomes:**

CO/PO	P01	P02	P03	P04	P05	P06	P07	P08
C01		x						
C02	x							
C03		x						
C04	x							
C05				x				

**Mapping of Course Outcomes with Program Specific Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
C01	x			
C02	x			
C03		x		
C04	x			
C05				x

  
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**III-Semester M.Sc (Tech) Applied Geology**  
**GEOPHYSICAL EXPLORATION**

Paper: II

**Course objectives**

- CO<sub>1</sub> : To introduce basics of Gravity methods in Exploration
- CO<sub>2</sub> : To impart knowledge on the Magnetic methods for Exploration.
- CO<sub>3</sub> : To familiarize student in electrical methods of prospecting.
- CO<sub>4</sub> : To impart knowledge on the basics of seismic methods of exploration.
- CO<sub>5</sub> : To familiarize student in geophysical methods in groundwater, mineral and petroleum exploration.

**Course outcomes:**

**At the end of the course student will be able to**

- CO<sub>1</sub> : Explain different Gravity methods for exploration.
- CO<sub>2</sub> : Outline different magnetic methods for exploration.
- CO<sub>3</sub> : Understand the electrical methods in prospecting.
- CO<sub>4</sub> : Explain the basics of seismic methods in exploration
- CO<sub>5</sub> : Outline different Geophysical methods in ground water, mineral and petroleum exploration.

**Course Specific Outcomes**

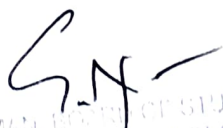
- CSO1 : To understand different Geophysical Exploration methods.
- CSO2 : To familiarize on the applications of different geophysical methods on ground water and petroleum exploration

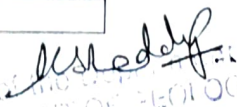
**Mapping of Course Outcomes with Program Outcomes:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1				x				
CO2				x				
CO3				x				
CO4				x				
CO5				x				

**Mapping of Course Outcomes with Program Specific Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
CO1		x		
CO2		x		
CO3		x		
CO4		x		
CO5		x		

  
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**III-Semester M.Sc (Tech) Applied Geology**  
**HYDROGEOLOGY**

**Paper : III**  
**Course objectives**

- CO<sub>1</sub> :** To Introduce concepts on occurrence and distribution of underground water.
- CO<sub>2</sub> :** To familiarize the students with the principles of ground water movement.
- CO<sub>3</sub> :** To impart the techniques of ground water exploration and drilling Methodologies to the students.
- CO<sub>4</sub> :** To Introduce and familiarize the students regarding quality and pollution aspects of Ground water.
- CO<sub>5</sub> :** To explain the concepts Groundwater management.

**Course outcomes:**

**At the end of the course student will be able to**

- CO<sub>1</sub> :** Learn about basic concepts in Ground water occurrence and distribution in different geologic formations.
- CO<sub>2</sub> :** How the ground water moves in different geologic structures and lithologies.
- CO<sub>3</sub> :** Explore and exploit the ground water in different geologic terrains.
- CO<sub>4</sub> :** Independently determine the quality of groundwater and decide upon its uses for domestic, irrigation and irrigation utilities.
- CO<sub>5</sub> :** Learn how to conserve and manage Ground water resources.

**Course Specific Outcomes**


- CSO1 :** To understand occurrence, distribution and dynamis of Ground water.
- CSO2 :** To impart knowledge on the exploration and management of ground water

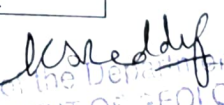
**Mapping of Course Outcomes with Program Outcomes:**

CO/PO	P01	P02	P03	P04	P05	P06	P07	P08
C01			x					
C02	x							
C03				x				
C04							x	
C05				x				

**Mapping of Course Outcomes with Program Specific Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
C01	x			
C02	x			
C03		x		
C04				
C05				x
				x

  
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### III- Semester M.Sc (Tech) Applied Geology SEDIMENTARY BASINS OF INDIA

Paper: IV

#### Course objectives

- CO<sub>1</sub> : To introduce Basin classification and depositional environments Basin evolution and sediments and Remnant and fore land basins and young rift zones.
- CO<sub>2</sub> : To introduce basin mapping methods, depositional systems and sequence Stratigraphy
- CO<sub>3</sub> : To introduce Stratigraphy, structure and tectonics of sedimentary basins of East coast of India K G Basin, Bengal, Mahanadi and Cauvery Basins.
- CO<sub>4</sub> : To introduce Stratigraphy, Structure and tectonics of Sedimentary West Coast of India kutch-Saurashtra-Narmada, Cambay, Bombay high, Kerala-Konkan off shore basins.
- CO<sub>5</sub> : To introduce Stratigraphy, structure and tectonics of some other sedimentary basins of India like Cuddapah, Rajasthan, Assam Shelf and Himalayan Basins.

#### Course outcomes:

**At the end of the course student will be able to**

- CO<sub>1</sub> : Explain Basin classification and depositional environments and evolution and sediments and some examples of rift zones.
- CO<sub>2</sub> : Explain Basin mapping methods, depositional systems and sequence Stratigraphy.
- CO<sub>3</sub> : Explain Stratigraphy, structure and tectonics of Bengal, Mahanadi, Krishna Godavari and Cauvery sedimentary basins.
- CO<sub>4</sub> : Explain Stratigraphy, structure and tectonics of Kutuch, Saurashtra, Narmada, Combay, Bombay High, Kerala and Kankan offshore basins of India.
- CO<sub>5</sub> : Explain Stratigraphy, structure and tectonics of Sedimentary Basins of India like cuddapah, Vindhyan, Rajasthan, Assam shelf and Himalayan basins

#### Course Specific Outcomes

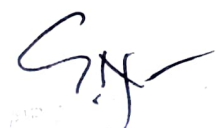
- CSO1 : To understand classification, depositional environments and Evolution of Sedimentary basins
- CSO2 : To impart knowledge on Stratigraphy, structure and tectonics of Sedimentary basins

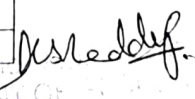
#### Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x							
CO2								x
CO3	x							
CO4	x							
CO5	x							

#### Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
CO1	x			
CO2		x		
CO3				x
CO4				x
CO5				x

  
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**IV- Semester M.Sc (Tech) Geology**  
**MARINE GEOLGOY**

**Paper: I**  
**Course objectives**

- CO<sub>1</sub> : Introduce historical development of marine Geology. Sediment sampling methods, Petrology and source of oceanic crust.
- CO<sub>2</sub> : Illustrate the continental drift, sea floor spreading, plate tectonics divergent - convergent and active margins etc.
- CO<sub>3</sub> : Introduce sea coast classification, sea level changes, law of sea bed causes of sea level changes etc.
- CO<sub>4</sub> : Outline the deep sea sediments and classification, Terrigenous deep sea sediments, Biogenic, authigenic sediments. Marine mineral resources etc.
- CO<sub>5</sub> : Introduce the paleo- oceanography and sediments history of the ocean basins. Oceanic history of CC D. etc.

**Course outcomes:**

**At the end of the course student will be able to**

- CO<sub>1</sub> : Explain historical development of marine geology, sediments sampling methods, Petrology and sources of oceanic crust of changes after formation.
- CO<sub>2</sub> : Illustrate the continental drift, sea floor spreading, Island arcs and back are basins, continental margins types Nearshore geological processes on the continental drifts.
- CO<sub>3</sub> : Illustrate sea-coast classification, sea level changes rate of sedimentation, marine pollution. Causes of sea level changes.
- CO<sub>4</sub> : Explain deep sea sediments and classification, Terrigenous deep sediments. Biogenic and authigenic sediments etc.
- CO<sub>5</sub> : Illustrate the Palaeo-oceanography and sediment history of ocean basins. History of calcium compensation. Depth (CCD)- critical events in ocean history.

**Course Specific Outcomes**

- CSO1 : To understand sampling methods, morphology, structure, Petrology and Sources of ocean crust.
- CSO2 : To impart knowledge on deep sea sediments and paleo oceanography.

**Mapping of Course Outcomes with Program Outcomes:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x							
CO2		x						
CO3		x						
CO4			x					
CO5	x							

**Mapping of Course Outcomes with Program Specific Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
CO1	x			
CO2	x			
CO3	x			
CO4		x		
CO5	x			

*G.N.*

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**IV-Semester M.Sc (Tech) Applied Geology  
GEOLOGICAL AND GEOCHEMICAL EXPLORATION**

Paper: **II**

**Course objectives**

- CO<sub>1</sub> : To impart knowledge on Geological mapping, sampling and exploration.
- CO<sub>2</sub> : To familiarize student with knowledge on guides to ore search.
- CO<sub>3</sub> : To impart knowledge on regional exploration- different stages etc.
- CO<sub>4</sub> : To familiarize students with geochemical cycle and Geochemical mobility, dispersion patterns etc.
- CO<sub>5</sub> : To impart knowledge on the methods of Geochemical Exploration.

**Course outcomes:**

**At the end of the course student will be able to**

- CO<sub>1</sub> : Understand Geological Mapping, sampling methods and exploration.
- CO<sub>2</sub> : Outline various guides to ore search.
- CO<sub>3</sub> : Explain regional exploration – Different stages of exploration, etc.
- CO<sub>4</sub> : Understand Geochemical cycle, Geochemical mobility, dispersion patterns etc.
- CO<sub>5</sub> : Explain various methods of Geochemical Exploration.

**Course Specific Outcomes**

- CSO1 : To understand Geological exploration methods, like magnetic, electric, Seismic etc.
- CSO2 : To impart knowledge on geochemical exploration, Geochemical cycle primary and secondary dispersion patterns.

**Mapping of Course Outcomes with Program Outcomes:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1								x
CO2				x				
CO3				x				
CO4	x							
CO5				x				

**Mapping of Course Outcomes with Program Specific Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
CO1		x		
CO2		x		
CO3		x		
CO4	x			
CO5		x		

S.N.

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# IV- Semester M.Sc (Tech) Applied Geology ENGINEERING GEOLOGY

Paper : III

## Course objectives

- CO<sub>1</sub> : To introduce site investigations for dam construction and Design and case history of dams in India
- CO<sub>2</sub> : To impart knowledge on reservoir site investigations and problems related to reservoirs
- CO<sub>3</sub> : To familiarize tunnelling methods in different rock types
- CO<sub>4</sub> : To introduce concepts of land slides, mechanics of soils
- CO<sub>5</sub> : To illustrate engineering properties of rocks.

## Course outcomes:

At the end of the course student will be able to

- CO<sub>1</sub> : Explain geological, geomorphological and geological investigations
- CO<sub>2</sub> : Outline investigation methods and desiltation methods for dams for reservoirs
- CO<sub>3</sub> : Choose the methods of tunnelling in different rocks types.
- CO<sub>4</sub> : Illustrate the impacts of land slides
- CO<sub>5</sub> : Determine the engineering properties of various rocks.

## Course Specific Outcomes

- CSO1 : To understand Role of geologist in civil Engineering, classification of Dams, Design of Dams, Reservoirs, Tunnels.
- CSO2 : To impart knowledge on landslides and their remedies. Understands about building stones and soils

## Mapping of Course Outcomes with Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1							x	
CO2							x	
CO3		x						
CO4		x						
CO5	x							

## Mapping of Course Outcomes with Program Specific Outcomes:

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
CO1				x
CO2	x			
CO3		x		
CO4		x		
CO5	x			

**IV-Semester M.Sc (Tech) Applied Geology  
(ECONOMIC GEOLOGY & INDIAN MINERAL DEPOSITS)**

Paper : IV

**Course objectives**

- CO<sub>1</sub> : To introduce processes of formation of mineral deposits, ore bearing fluids, metallogenic epochs etc.
- COB<sub>2</sub> : To impart knowledge on preparation of polished sections and physical properties of Ore minerals.
- CO<sub>3</sub> : To familiarize student with structures and textures of ore minerals. Applications of ore microscopic studies in ore dressing.
- CO<sub>4</sub> : To impart knowledge on chromite, manganese, copper-lead-zinc deposits etc.
- CO<sub>5</sub> : To familiarize student on coal, barites, clays, limestone etc.

**Course outcomes:**

**At the end of the course student will be able to**

- CO<sub>1</sub> : Explain the processes of formation of mineral deposits, able to understand ore bearing fluids, metallogenic epochs etc.
- CO<sub>2</sub> : Understand the procedure of preparation of polished sections and physical properties of ore minerals.
- CO<sub>3</sub> : Outline various structures and textures of ore minerals and applications of ore microscopic studies in ore dressing.
- CO<sub>4</sub> : Explain occurrence, genesis, distribution and Uses of chromate, manganese, copper-lead-zinc deposits etc.
- CO<sub>5</sub> : Understand the occurrence, genesis, distribution and uses of coal, barites, clays, limestone etc.

**Course Specific Outcomes**

- CSO1 : To impart knowledge on mineral formation processes.
- CSO2 : To understand the distribution of various Indian mineral deposits.

**Mapping of Course Outcomes with Program Outcomes:**

CO/PO	P01	P02	P03	P04	P05	P06	P07	P08
CO1	x							
CO2		x						
CO3			x					
CO4			x					
CO5			x					

**Mapping of Course Outcomes with Program Specific Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
CO1	x			
CO2			x	
CO3			x	
CO4	x			
CO5	x			

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STUDENT  
ECONOMIC GEOLOGY  
APPLIED GEOLOGY

**V-Semester M.Sc Tech Applied Geology  
SURFACE AND UNDERGROUND MINING**

Paper: 1

**Course Objectives:**

- CO<sub>1</sub>** : To introduce basic concepts of mining, Mine development and waste disposal methods
- CO<sub>2</sub>** : To impart knowledge on alluvial mining methods and underground mining methods
- CO<sub>3</sub>** : To equip coal mining methods, mine transportation methods types of supports, Mine drainage
- CO<sub>4</sub>** : To introduce explosives, methods of charging, mine ventilation
- CO<sub>5</sub>** : To understand management principles, mine safety.

**Course outcomes:**

**At the end of the course student will be able to**

- CO<sub>1</sub>** : Outline the development of mines, and various mine waste disposal methods
- CO<sub>2</sub>** : Choose underground metallic and non-metallic mining methods
- CO<sub>3</sub>** : Select the coal mining methods and methods of transportation in different coal fields.
- CO<sub>4</sub>** : Understand effects of various explosives mine ventilation methods
- CO<sub>5</sub>** : Estimate value of mineral properties and mines safety principles

**Course Specific Outcomes**

- CS01** : To understand terminology, basic concepts different mining methods, their development and transportation
- CS02** : To impart knowledge on Explosives, mine ventilation mine rescue operations, mine legislation, mine plans, ventilation and safety.

**Mapping of Course Outcomes with Program Outcomes:**

CO/PO	P01	P02	P03	P04	P05	P06	P07	P08
CO1	x							
CO2		x						
CO3		x						
CO4		x						
CO5						x		

**Mapping of Course Outcomes with Program Specific Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
CO1	x			
CO2			x	
CO3			x	
CO4			x	
CO5			x	

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**V -Semester M.Sc (Tech) Applied Geology-  
FUEL GEOLOGY**

**Paper: II**

**Course Objectives:**

- CO<sub>1</sub>** : To introduce the petroliferous rocks, origin and occurrence of petroleum
- CO<sub>2</sub>** : To study the migration and accumulation of petroleum
- CO<sub>3</sub>** : To classify the hydrocarbon traps and study the physical and chemical properties of reservoir fluids.
- CO<sub>4</sub>** : To study the geological conditions of coal formation origin of coal and development of coal facies, classification, ranking and grading of coal.
- CO<sub>5</sub>** : To introduce the principles and applications of coal petrology and origin of coal macerals, classification of Gondwana coals.

**Course outcomes:**

**At the end of the course student will be able to**

- CO<sub>1</sub>** : Understand the petroliferous rocks viz, source, reservoir and cap rocks. Discuss the origin and occurrence of petroleum.
- CO<sub>2</sub>** : Explain the primary and secondary migration, classification of hydrocarbon traps and reservoir fluid characters.
- CO<sub>3</sub>** : Describe the different types of well logs and their uses. Classification of sedimentary basins of India.
- CO<sub>4</sub>** : Understand the geological conditions of coal formation describe the origin, classification, ranking and grading of coal.
- CO<sub>5</sub>** : Explain the origin of coal macerals and coal petrology Classification of Gondwana coals and coal bed methane.

**Course Specific Outcomes**


- CSO1** : To understand occurrence, seepages, provinces, reservoir rocks and cap rocks, of oil and gas different structural and Stratigraphic traps. Knowledge on Petroleferous basins of India
- CSO2** : To impart knowledge on classification, origin, Physical and chemical properties of coal. Macerals of coal, Coal bed methane and different coal fields of India

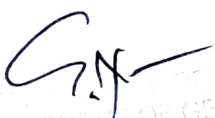
**Mapping of Course Outcomes with Program Outcomes:**

CO/PO	P01	P02	P03	P04	P05	P06	P07	P08
C01				x				
C02				x				
C03				x				
C04				x				
C05				x				

**Mapping of Course Outcomes with Program Specific Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
C01	x			
C02	x			
C03	x			
C04	x			
C05	x			

  
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**V- Semester M.Sc (Tech) Applied Geology  
GEO INFORMATICS**

**Paper : III**

**Course Objectives:**

- CO<sub>1</sub> :** Introduce the art of map making and types of maps their numbering system.
- CO<sub>2</sub> :** Illustrate Geographical information systems and hardware and software requirements of GIS
- CO<sub>3</sub> :** Interpret the Data base structures and data formats in GIS methods of data capturing, editing and topology creation.
- CO<sub>4</sub> :** Introduce map projections and spatial analysis in GIS Remote Sensing & GIS data integration.
- CO<sub>5</sub> :** Illustrate application and uses of GIS particularly in geological studies

**Course outcomes:**

**At the end of the course student will be able to**

- CO<sub>1</sub> :** Explain of the art of map making, different types of maps world and India topographical maps and their numbering system.
- CO<sub>2</sub> :** Illustrate the geographical systems. Definition and introduction of GIS. Hardware and software requirement of GIS.
- CO<sub>3</sub> :** Explain database structures and data formats in GIS, methods of data capturing, editing and topology creation
- CO<sub>4</sub> :** Explain map projection and spatial analysis in GIS Remote sensing GIS data intension.
- CO<sub>5</sub> :** Illustrate and applications and uses of GIS particularly in geological studies.

**Course Specific Outcomes**

- CSO1 :** To impart concept of GIS different types of maps and map projections and different methods of data capturing, editing, integration of spatial and non spatial data using Geographic information systems.
- CSO2 :** Impart knowledge on Integration of Remote Sensing and GIS data with emphasis on recent GIS packages, their importance and their applications in Geological studies

**Mapping of Course Outcomes with Program Outcomes:**

CO/PO	P01	P02	P03	P04	P05	P06	P07	P08
C01								x
C02								x
C03								x
C04								x
C05								x

**Mapping of Course Outcomes with Program Specific Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
C01		x		
C02		x		
C03		x		
C04		x		
C05		x		

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V Semester M.Sc (Tech) Applied Geology  
**MINE LEGISLATION & MINE PLANNING**

Paper : IV  
Course Objectives:

- CO<sub>1</sub> : To introduce mineral concession rules and licensing policy  
CO<sub>2</sub> : To impart knowledge on Andhra Pradesh minor mineral concession rules.  
CO<sub>3</sub> : To familiarize open cast mine planning including Environment management plan.  
CO<sub>4</sub> : To introduce mining plan-waste disposal.  
CO<sub>5</sub> : To introduce underground mine planning including operational planning

**Course outcomes:**

**At the end of the course student will be able to**

- CO<sub>1</sub> : Understand licensing policy for minerals.  
CO<sub>2</sub> : Outline minor mineral concession rules.  
CO<sub>3</sub> : Explain Open cast Mine planning and Environment management.  
CO<sub>4</sub> : Choose various mine plan and waste disposal methods  
CO<sub>5</sub> : Outline underground Mining planning and Environment management.

**Course Specific Outcomes**

- CS01 : To understand different legislative acts like Mines and Minerals act 1957, Mineral concession rules (1960), Minor Mineral concession rules (1966), Forest conservation Act (1980) etc.  
CS02 : To impart knowledge on mine plan, mineral beneficiation, employment potential, Environmental management plan, Mine development sequence etc.

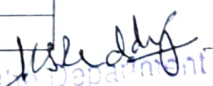
**Mapping of Course Outcomes with Program Outcomes:**

CO/PO	P01	P02	P03	P04	P05	P06	P07	P08
CO1								x
CO2								x
CO3					x			
CO4							x	
CO5							x	

**Mapping of Course Outcomes with Program Specific Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
CO1			x	
CO2			x	
CO3				x
CO4			x	
CO5			x	



  
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**VI-Semester M.Sc (Tech) Applied Geology**  
**MINERAL ECONOMICS**

**Paper :** I

**Course objectives**

- CO<sub>1</sub>** : To impart knowledge on concept of mineral economics, Mines and mineral legislation in India, Mineral taxation-National Mineral policy.
- CO<sub>2</sub>** : To familiarize student with major, minor minerals, strategic, critical, essential minerals etc.
- CO<sub>3</sub>** : To introduce Reserves, production and distribution of various minerals in the world-Tenor, grade and specifications.
- CO<sub>4</sub>** : To familiarize student in conservation of minerals, changing patterns in mineral consumption.
- CO<sub>5</sub>** : To impart knowledge on the Growth of mineral industry and economy in India, economic minerals of Andhra Pradesh etc.

**Course outcomes:**

**At the end of the course student will be able to**

- CO<sub>1</sub>** : Explain the concept of mineral economics – Mines and mineral legislation in India, National Mineral Policy.
- CO<sub>2</sub>** : Understand major minerals, minor minerals, strategic, critical and essential minerals etc.
- CO<sub>3</sub>** : Outline Reserves, production and distribution of various minerals in the world – Tenor, grade and specifications.
- CO<sub>4</sub>** : Explain the conservation and substitution of minerals, changing patterns in mineral consumption etc.
- CO<sub>5</sub>** : Understand the growth of mineral industry and economy in India, economic minerals of Andhra Pradesh etc.

**Course Specific Outcomes**

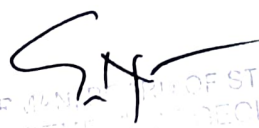
- CS01** : To understand concept of mineral economics, mineral legislation taxation and National mineral policy, war and war supporting minerals
- CS02** : To understand conservation of minerals changing patterns and mineral consumption, growth of mineral industry.

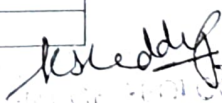
**Mapping of Course Outcomes with Program Outcomes:**

CO/PO	P01	P02	P03	P04	P05	P06	P07	P08
<b>C01</b>								<b>x</b>
<b>C02</b>	<b>x</b>							
<b>C03</b>								<b>x</b>
<b>C04</b>								<b>x</b>
<b>C05</b>								<b>x</b>

**Mapping of Course Outcomes with Program Specific Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
<b>C01</b>			<b>x</b>	
<b>C02</b>	<b>x</b>			
<b>C03</b>			<b>x</b>	
<b>C04</b>			<b>x</b>	
<b>C05</b>			<b>x</b>	

  
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**VI-Semester M.Sc (Tech) Applied Geology  
ENVIRONMENTAL GEOLOGY**

**Paper: II**  
**Course objectives**

- CO<sub>1</sub>** : To introduce the basic concept of Environmental Geology, land use, degradation, desertification, Water resources – causes and Control.
- CO<sub>2</sub>** : To impart knowledge on Geo –environmental hazards –causes and Control.
- CO<sub>3</sub>** : To illustrate the impact of mining activities on various environments
- CO<sub>4</sub>** : To illustrate the causes for pollution and energy resources and remedial methods.
- CO<sub>5</sub>** : To illustrate the environmental impact assessment structures, Rehabilitation programme for various disasters.

**Course outcomes:**

**At the end of the course student will be able to**

- CO<sub>1</sub>** : Explain the basics principles of environmental geology
- CO<sub>2</sub>** : Choose the means of preparedness measures against geological hazards.
- CO<sub>3</sub>** : Causes and Controlling methods of Global warming, pollution and student can aware alternative energy resources.
- CO<sub>4</sub>** : Illustrate the impacts of mining activities on various environments
- CO<sub>5</sub>** : Outline the various rehabilitation programme for various environments.

**Course Specific Outcomes**

- CSO1** : To understand basic concepts of environmental geology, land use, degradation, desertification, causes and control, environmental hazards –causes, mining activities on various environments.
- CSO2** : To understand causes for pollution and controlling methods. Alternative Energy resources and environmental impact assessment structures and Rehabilitation programme for various disasters

**Mapping of Course Outcomes with Program Outcomes:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
<b>CO1</b>							<b>x</b>	
<b>CO2</b>							<b>x</b>	
<b>CO3</b>							<b>x</b>	
<b>CO4</b>							<b>x</b>	
<b>CO5</b>							<b>x</b>	

**Mapping of Course Outcomes with Program Specific Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
<b>CO1</b>	<b>x</b>			
<b>CO2</b>				<b>x</b>
<b>CO3</b>				<b>x</b>
<b>CO4</b>				<b>x</b>
<b>CO5</b>				<b>x</b>

*S. N.*  
CHAIRMAN OF STUDENT  
DEPARTMENT OF GEOLOGY  
ANDHRA UNIVERSITY  
VISAKHAPATNAM

*K. N. Reddy*  
Head of the Department  
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**VI- Semester M.Sc Tech Applied Geology  
MINERAL PROCESSING ENGINEERING**

**Paper: III**

**Course outcomes:**

- CO<sub>1</sub> : To introduce fundamentals and importance of mineral processing, Nature and occurrence of Ores, and Role of geologist in mineral processing.
- CO<sub>2</sub> : To introduce concept of crushing type of crushers and principles of grinding, types of ball mills.
- CO<sub>3</sub> : To introduce classification in mineral processing, types of classifiers, screening, types of screenings.
- CO<sub>4</sub> : To introduce Hydro cyclones and types dense media separation, flocculation and flotation jigging, tabling, Magnetic separation.
- CO<sub>5</sub> : To introduce Flow sheet design, hydro metallurgy, heap leaching, hot water drying of coals, radiometric methods of coal separation. Flow sheets of beach sand separation,

**Learning outcomes:**

**At the end of the course student will be able to**

- CO<sub>1</sub> : Explain the fundamentals and Economic importance of mineral processing, nature and occurrence of ores and role of geologist in mineral processing.
- CO<sub>2</sub> : Explain the concept of crushing, type of crushers, principles of grinding, types of mills.
- CO<sub>3</sub> : Explain the classification in mineral processing, types of classifiers, screening, wet and dry screening.
- CO<sub>4</sub> : Explain the hydro cyclones ,and its types dense media separation Flotation jigging, types Magnetic separation, Magnetic separators.
- CO<sub>5</sub> : Explain the flow sheet design, hydro metallurgy, heap leaching, hot water drying of coals, radiometric methods of coal separation. Flow sheets of beach sand separation, copper, lead, zinc ores.

**Course Specific Outcomes**

- CSO1 : To understand fundamentals of mineral processing, Concept of crushing, types of crushers, principles of grinding, types of ball mills, classification of mineral processing, types of classifiers and screenings.
- CSO2 : To understand Hydro cyclones and types, dense media Separation, flocculation, flotation, jigging, tabling magnetic Separation, flow sheet design, radiometric methods of coal separation, flow sheet of beach sand separation.

**Mapping of Course Outcomes with Program Outcomes:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	x							
CO2						x		
CO3						x		
CO4						x		
CO5						x		

**Mapping of Course Outcomes with Program Specific Outcomes:**

CO/PSO	PSO 1	PSO 2	PSO 3	PSO 4
CO1	x			
CO2			x	
CO3			x	
CO4			x	
CO5			x	

*[Signature]*  
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**M.Sc. (TECH) APPLIED GEOLOGY**  
**Scheme of Instruction and Examinations**  
**(With effect from the admitted batch of 2021-2022)**

S. No	Course	Teaching/Lab Hours Per week	Duration of Examination hours	Allotment of Marks		Total Marks	Subject Credits
				Final	Mid-Exam		
<b><u>I – SEMESTER (With effect from the admitted batch of 2021-2022)</u></b>							
01.	Paper - I Mineralogy AG -101	4	3	80	20	100	4
02.	Paper - II Igneous and Metamorphic Petrology AG -102	4	3	80	20	100	4
03.	Paper - III Structural Geology & Tectonics AG -103	4	3	80	20	100	4
04.	Paper – IV Sedimentology AG -104	4	3	80	20	100	4
05.	Paper - I Mineralogy ( <i>Practical</i> ) AG -105	3	3	50		50	2
06.	Paper - II Igneous and Metamorphic Petrology ( <i>Practical</i> ) AG -106	3	3	50		50	2
07.	Paper - III Structural Geology & Tectonics ( <i>Practical</i> ) AG -107	3	3	50		50	2
08.	Paper – IV Sedimentology ( <i>Practical</i> ) AG -108	3	3	50		50	2
09.	Field Work AG -109	6	-	50		50	2
10.	Viva-Voce AG -110	-	-	50		50	2
<b>TOTAL</b>						<b>700</b>	<b>28</b>



S. No	Course	Teaching/Lab Hours Per week	Duration of Examination hours	Allotment of Marks		Total Marks	Subject Credits
				Final	Mid-Exam		
<b>II – SEMESTER (With effect from the admitted batch of 2021-2022)</b>							
01.	Paper - I Stratigraphy AG-201	4	3	80	20	100	4
02.	Paper - II Geochemistry & Isotope Geology AG -202	4	3	80	20	100	4
03.	Paper – III Sedimentary petrology AG -203	4	3	80	20	100	4
04.	Paper – IV Micropaleontology AG -204	4	3	80	20	100	4
05.	Paper - I Stratigraphy (Practical) AG -205	3	3	50		50	2
06.	Paper - II Geochemistry & Isotope Geology (Practical) AG -206	3	3	50		50	2
07.	Paper - III Sedimentary petrology (Practical) AG -207	3	3	50		50	2
08.	Paper – IV Micropaleontology (Practical) AG -208	3	3	50		50	2
09.	Surveying AG -209	6	3	50		50	2
10.	Viva-Voice AG -210	-	-	50		50	2
TOTAL						700	28

S. No	Course	Teaching/Lab Hours Per week	Duration of Examination hours	Allotment of Marks		Total Marks	Subject Credits
				Final	Mid-Exam		
III – SEMESTER (With effect from the admitted batch of 2021-2022)							
01.	Paper - I Geomorphology, Remote Sensing & GIS AG -301	4	3	80	20	100	4
02.	Paper – II Geophysical Exploration AG -302	4	3	80	20	100	4
03.	Paper – III Hydrogeology AG -303	4	3	80	20	100	4
04.	Paper – IV Sedimentary Basin of India AG -304	4	3	80	20	100	4
05.	Paper - I Geomorphology, Remote Sensing & GIS (Practical) AG -305	3	3	50		50	2
06.	Paper – II Geophysical Exploration (Practical) AG -306	3	3	50		50	2
07.	Paper – III Hydrogeology (Practical) AG -307	3	3	50		50	2
08.	Geological Mapping (Two Weeks) AG -308	-	-	75		75	3
09.	Viva-Voice AG -309	-	-	25		25	1
TOTAL						650	26



S. No	Course	Teaching/Lab Hours Per week	Duration of Examination hours	Allotment of Marks		Total Marks	Subject Credits
				Final	Mid-Exam		
IV – SEMESTER (With effect from the admitted batch of 2021-22)							
01.	Paper - I Marine Geology AG -401	4	3	80	20	100	4
02.	Paper – II Geological & Geochemical Exploration AG -402	4	3	80	20	100	4
03.	Paper – III Engineering Geology AG -403	4	3	80	20	100	4
04.	Paper – IV Economic Geology & Indian Mineral Deposits AG -404	4	3	80	20	100	4
05.	Paper - I Marine Geology (Practical) AG -405	3	3	50		50	2
06.	Paper – II Geological & Geochemical Exploration (Practical) AG -406	3	3	50		50	2
07.	Paper – III Engineering Geology (Practical) AG -407	3	3	50		50	2
08.	Paper – IV Economic Geology & Indian Mineral Deposits (Practical) AG -408	3	3	50		50	2
09.	Mining Training Programme AG -409	-	-	75		75	3
10.	Viva-Voce AG -410	-	-	25		25	1
TOTAL						700	28

S. No	Course	Teaching/Lab Hours Per week	Duration of Examination hours	Allotment of Marks		Total Marks	Subject Credits
				Final	Mid-Exam		
V- SEMESTER (With effect from the admitted batch of 2021-2022)							
01.	Paper - I Surface and Underground Mining AG -501	4	3	80	20	100	4
02.	Paper – II Fuel Geology AG -502	4	3	80	20	100	4
03.	Paper – III Geo-Informatics AG -503	4	3	80	20	100	4
04.	Paper – IV Mine legislation & Mine Planning AG -504	4	3	80	20	100	4
05.	Paper – II Fuel Geology (Practical) AG -505	4	3	50		50	2
06.	Paper – III Geo Informatics (Practical) AG -506	4	3	50		50	2
07.	Intellectual Property Rights (IPR) AG -507	-	-	-		50	2
08.	MOOCs AG -508	-	-	-		100	4
09.	Viva-Voice AG -509	-	-	50		50	2
TOTAL						700	28

S. No.	Course	Teaching / Lab Hours Per week	Duration of Examination hours	Allotment of Marks		Total Marks	Subjects Credits
				Final			
<b><u>VI – SEMESTER</u> (With effect from the admitted batch of 2021-2022)</b>							
01.	Paper - I Mineral Economics AG -601	4	3	80	20	100	4
02.	Paper - II Environmental Geology AG -602	4	3	80	20	100	4
03.	Paper - III Mineral processing Engineering AG -603	4	3	80	20	100	4
04.	Paper - IV Project Oriented Dissertation AG -604	-	-	100		100	4
05.	Paper - I Mineral Economics (Practical) AG -605	4	3	50		50	2
06.	Paper - II Environmental Geology (Practical) AG -606	4	3	50		50	2
07.	Paper - III Mineral processing Engineering (Practical) AG -607	4	3	50		50	2
08.	Project Oriented Dissertation Viva Voce AG -608	-	-	50		50	2
09.	Research Methodology AG -609	2	-	-		50	2
10.	MOOCs AG -610	-	-	-		100	4
09.	Viva Voce AG -611	-	-	50		50	2
Total:						800	32

# **SYLLABUS**

## **I – SEMESTER, M.Sc. (TECH) APPLIED GEOLOGY**

### **PAPER- I, MINERALOGY**

**(With effect from the admitted batch of 2021-2022)**

#### **UNIT –I**

Introduction to Minerals. Classification of silicate minerals. Structure, chemistry, physical and optical properties of (a) Olivine Group (b) Garnet Group (c) Epidote Group (d) Aluminosilicate Group

#### **UNIT –II**

Structure, chemistry, physical and optical properties of (a) Pyroxene Group (b) Amphiboles Group (c) Clay minerals (d). Mica Group.

#### **UNIT –III**

Isomorphism, Polymorphism. Structure, chemistry, physical and optical properties of (a) Feldspathoids Group (b) Feldspars and (c) silica minerals

#### **UNIT – IV**

Classification of nonsilicates; chemistry and paragenesis of Native elements, Oxides and Sulphides.

#### **UNIT –V**

Chemistry and paragenesis of Carbonates, phosphates, Halides, Sulphates, Gemstones and Semi precious stones.

#### **PRACTICALS:**

- a) Megascopic and microscopic identification of important silicate and nonsilicate minerals.
- b) Calculation of Mineral formula
- c) Interpretation of X-ray diffractograms of common minerals and D.T.A curves.
- d) SEM photographs

**(P.T.O)**



**TEXT BOOKS:**

An Introduction to the rock forming minerals by **W.A. Deer, R.A. Howie and J. Zussman**

Dana's Text book of Mineralogy by **W.E. Ford**

Manual of Mineralogy by **Klein, C. and Hurlbut, Jr.C.S**

Descriptive Mineralogy by **L.G. Berry and Mason.**

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**MODEL QUESTION PAPER**

**I – SEMESTER, M.Sc. (TECH) APPLIED GEOLOGY**

**PAPER – I, MINERALOGY**

**(With effect from the admitted batch of 2021-2022)**

**Time: 3Hrs**

**Max. Marks: 80**

**Answer FIVE questions, choosing ONE from each Unit.**

**All questions carry equal marks.**

**UNIT-I**

1. Write in detail about the classification of silicate minerals with neat sketches?

**OR**

2. Answer any **TWO** of the following:

- a) Structure of olivine group of minerals
- b) Chemistry of garnet group of minerals
- c) Optical properties of kyanite and sillimanite

**UNIT-II**

3. Describe the structure, chemistry and optical properties of pyroxene group of minerals

**OR**

4. Answer any **TWO** of the following:

- a) Di-Octahedral micas
- b) Smectite group
- c) Chemistry of amphiboles

**UNIT-III**

5. Write the classification of the feldspar group of minerals and add a note on its twinning?

**OR**

6. Answer any **TWO** of the following:

- a) Classification of Feldspathoids
- b) Structure of quartz, trydamite and cristobalite.
- c) Isomorphism

**UNIT-IV**

7. Write in detail about chemistry and paragenesis of the Sulphide group of minerals?

**OR**

8. Answer any **TWO** of the following:

- a) Classification of non-silicates
- b) Physical properties of Native metallic elements
- c) Spinel group of minerals

**UNIT-V**

9. Describe the phosphate minerals in terms of its chemistry and paragenesis.

**OR**

10. Answer any **TWO** of the following:

- a) Gemstone varieties of Quartz and their properties.
- b) Halide group of minerals
- c) Chemistry of carbonate minerals

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# **SYLLABUS**

## **I – SEMESTER, M.Sc. (TECH) APPLIED GEOLOGY**

### **PAPER – II, IGNEOUS AND METAMORPHIC PETROLOGY**

**(With effect from the admitted batch of 2021-2022)**

#### **UNIT – I**

Magma generation, Primary and modified magmas. Mantle Xenoliths.. Differentiation and assimilation of magmas, Magma mixing. Plate tectonics in relation to petrology.

#### **UNIT – II**

Bowen's reaction series, phase equilibrium of single, binary and ternary silicate systems and crystallisation in the light of experimental works and petrogenetic importance. Criteria for classification of igneous rocks. Textural, mineralogical and chemical classification. Norm (CIPW) and Niggli values. Classification using multiple criteria, IUGS classifications.

#### **UNIT – III**

Petrographic provinces and associations. Mineralogy, texture and petrogenesis of major igneous rock types such as granites, Basalts, ultramafic rocks, carbonatites, Lamprophyres syenites, & Nepheline syenites.

#### **UNIT – IV**

Metamorphic textures and structures. Recrystallisation, metamorphic differentiation, metamorphic condition, mineralogies and protoliths. Metamorphic phase diagrams – ACF, AKF and AFM, metamorphic facies with special reference to Indian Examples.

#### **UNIT – V**

Nature of metamorphic reactions. Pressure – temperature conditions of metamorphism. Anatexis and origin of migmatites. Regional metamorphism and paired metamorphic belts. P-T-t paths.

#### **PRACTICALS:**

- a) Megascopic and microscopic study of igneous rocks.
- b) Calculation of CIPW norms. Preparation of variation diagrams.
- c) Megascopic and microscopic study of metamorphic rocks.
- d) Construction of ACF – AKF – AFM diagrams.
- e) Geothermobarometric calculations.

**(P.T.O)**

**TEXT BOOKS:**

Philpots A., 1992. Igneous and metamorphic petrology.

Best, M.G., 1986. Igneous and metamorphic petrology.

Yardley, B.W., 1989. An introduction to metamorphic petrology.

Raymond, L.A., 1995. Petrology.

Middlemost – Magmas and Magmatic rocks.

Turner & Verhoogom – Igneous & Metamorphic petrology.

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# **MODEL QUESTION PAPER**

## **I- SEMESTER, M.Sc. (TECH) APPLIED GEOLOGY**

### **PAPER – II, IGNEOUS AND METAMORPHIC PETROLOGY**

**(With effect from the admitted batch of 2021-2022)**

**Time: 3Hrs**

**Max. Marks: 80**

**Answer FIVE questions, choosing ONE from each Unit.**

**All questions carry equal marks.**

#### **UNIT-I**

1. Discuss about differentiation and Assimilation of Magmas.

**OR**

2. Write notes on any **THREE** of the following:

- a) Mantle xenoliths.
- b) Primary and modified magmas.
- c) Lithosphere and Asthenosphere.
- d) Magma mixing.

#### **UNIT-II**

3. Write on phase equilibrium of single, binary and ternary systems crystallisation.

**OR**

4. Write notes on any **THREE** of the following:

- a) Textural classification of igneous rocks.
- b) Mineralogical classification of igneous rocks.
- c) Role of volatiles in Crystallisation.
- d) Norm – CIPW.

#### **UNIT-III**

5. Describe the mineralogy, texture and petrogenesis of ultramafic rocks.

**OR**

6. Answer any **THREE** of the following:

- a) Petrographic provinces and associations.
- b) Basalts.
- c) Granites.
- d) Alkaline rocks.

#### **UNIT-IV**

7. Write an essay on metamorphic facies concept. Give in detail about different metamorphic facies with examples.

**OR**

8. Answer any **THREE** of the following:

- a) Metamorphic structures.
- b) ACF – AFM diagrams.
- c) Recrystallisation.
- d) Protoliths.

#### **UNIT-V**

9. Write about migmatites and their origin.

**OR**

10. Answer any **THREE** of the following:

- a) Metasomatism.
- b) Regional metamorphism.
- c) Petrogenetic aspects of metamorphic rocks of India.
- d) Anatexis.

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## **SYLLABUS**

### **I – SEMESTER, M.Sc. (TECH) APPLIED GEOLOGY**

### **PAPER- III, STRUCTURAL GEOLOGY AND TECTONICS**

**(With effect from the admitted batch of 2021-2022)**

#### **UNIT – I**

Mechanical principles and properties of rocks and their controlling forces. Concept of stress and strain. Composition and resolution of forces. Principles of failure by rupture relation of rupture to strain. Two dimensional strain and stress analysis. Types of strain ellipses and ellipsoids, their properties and geological significance.

#### **UNIT – II**

Folds and their classification. Mechanics and causes of folding. Determination of top of beds by primary features.

#### **UNIT – III**

Fractures and Joints. Nomenclature, origin, significance and classification of faults. Causes and dynamics of faulting, strike slip faults, normal faults, overthrust and nappe etc.

#### **UNIT – IV**

Concept of petrofabrics and symmetry. Field and laboratory techniques. Stereographic treatment, Types of fabrics, fabric elements.

#### **UNIT – V**

Plate tectonics, Dynamic evolution of continental and oceanic crust, Tectonics of Precambrian Orogenic Belts of India. Formation of Mountain roots. Anatomy of orogenic belts with case examples such as Apline Himalayan, the Andes etc.

#### **PRACTICALS:**

- a) Preparation and interpretation of geological maps and sections.
- b) Structural problems concerning to economic mineral deposits.
- c) Recording and plotting of field data.
- d) Plotting and interpretation of petrofabric data on the stereographic nets.

#### **TEXT BOOKS:**

- 1) Structural Geology by M.P. Billings.
- 2) Structural Geology and Tectonic Principles by P.C. Badgley.
- 3) Principles of Physical Geology by A. Holmes and D. L. Holmes.
- 4) Aspects of Tectonics focus on South Central India by K.S. Validya.
- 5) An outline of structural Geology by Bruce E. Hobbs.

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# **MODEL QUESTION PAPER**

## **I – SEMESTER, M.Sc. (TECH) APPLIED GEOLOGY**

### **PAPER – III, STRUCTURAL GEOLOGY & TECTONICS**

**((With effect from the admitted batch of 2021-2022))**

**Time: 3Hrs**

**Max. Marks: 80**

**Answer FIVE questions, choosing ONE from each Unit.**

**All questions carry equal marks.**

#### **UNIT-I**

1. Define stress and strain. Explain how rocks behave under these conditions.

**OR**

2. Answer any **TWO** of the following:

a) Boudinage structures

b) Deformation mechanisms

c) Mechanical properties of rocks

#### **UNIT-II**

3. Describe the different types of fold

**OR**

4. Answer any **TWO** of the following:

a) Dome

b) Basins

c) Mechanics of folding

#### **UNIT-III**

5. Describe the criteria by which faults are recognized.

**OR**

6. Answer any **TWO** of the following:

a) Slickenside

b) Columnar Joints

c) Nappe

#### **UNIT-IV**

7. Discuss the concept of petrofabrics and symmetry.

**OR**

8. Answer any **TWO** of the following:

a) Tectonite

b) Equal area net

c) Planar and linear structures

#### **UNIT-V**

9. Explain the tectonics of the Precambrian orogenic belts of India.

**OR**

10. Answer any **TWO** of the following:

a) Wilson cycle

b) Back-arc margins

c) Continental platforms

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# **SYLLABUS**

## **I – SEMESTER, M.Sc. (TECH) APPLIED GEOLOGY**

### **PAPER- IV. SEDIMENTOLOGY**

**(With effect from the admitted batch of 2021-2022)**

#### **UNIT - I**

Earth surface system: History and development of sedimentology. Liberation and flows of sediments, processes of transport and generation of mechanical, chemical and biogenic sedimentary structures and controls on the sedimentary rock record.

#### **UNIT -II**

Origin of sedimentary rocks. Sedimentary textures, frame work matrix and cement of terrigenous sediments. Definition, measurement and interpretation of grain size -Wentworth scale, sieving and grain size parameters.

#### **UNIT – III**

Sedimentary environments and facies. Characteristics of continental: desert, fluvial, glacial, lacustrine, deltaic and transitional- lagoonal, littoral and barrier complex environments.

#### **UNIT- IV**

Clastic sediments- gravel, sand and mud. Biogenic, chemical and volcanogenic sediments. Classification of conglomerates, sandstones and mudstones, and carbonate rocks.

#### **UNIT-V**

Provenance of sediments. Diagenesis and fluid flow. Diagenesis of mudstone, sand stone, limestone and Dolomites: Changes in mineralogy, fabric and chemistry. Field and laboratory techniques in sedimentology: recording of sedimentary structures, preparation of litho logs, rock and thin section staining.

**(P.T.O)**



### **PRACTICALS:**

- 1) Study of primary, secondary and biogenic sedimentary structures in hand specimens, of photographic atlases, field photographs and wherever possible on the outcrops.
- 2) Pipette analysis – sand, silt and clay separation and estimation of percentages.
- 3) Size analysis – (sieving), calculation of grain size parameters.
- 4) Heavy mineral- liquid separation-Bromoform method
- 5) Graphical representation of data-Preparation of histograms, triangular coordinate diagrams and Shepard classification chart.
- 6) Microscopic study of heavy minerals and sedimentary rocks.

### **TEXT BOOKS:**

- Allen, J.R.L., 1985: Principles of Physical Sedimentation. George Allen & Unwin.
- Allen, P., 1997: Earth surface Processes. Blackwell.
- Nicholas,G.,1999: Sedimentology and Stratigraphy. Blackwell.
- Davis, R.A.Jr., 1992: Depositional Systems. Prentice Hall.
- Einesele,G., 1992:Sedimentary basins. Springer Verlag.
- Friedman G.M.,and J.E Sanders: Principles of Sedimentology
- Prothero, D.R. and Schwab, F., 1996: Sedimentary Geology, Freeman
- Potter P.E & Pettijohn, F.J: Paleocurrents and Basin Analysis by
- Pettijohn F.J : Sedimentary rocks
- Reineck,H.E and Singh,I.B 1980: Depositional Sedimentary Environments.
- Springer-Verlag.
- Miall,A.D.,2000: Principles of sedimentary Basin Analysis. Springer-Verlag
- Milner, H.B: Sedimentary Petrology
- Blatt H, Murray, G,V and Middleton,R.C.,1980: Origin and sedimentaryRocks.
- Bhattacharya,a and Chakraborti,C.,2000: Analyses of sedimentary successions.
- Oxford-IBH
- Boggs Sam Jr.m1995: Principles of Sedimentology and Stratigraphy, Prentice Hall.
- Sengupta S., 1997: Introduction to Sedimentology. Oxford-IBH

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# **MODEL QUESTION PAPER**

## **I – SEMESTER, M.Sc. (TECH) APPLIED GEOLOGY**

### **PAPER – IV, SEDIMENTOLOGY**

**(With effect from the admitted batch of 2021-2022)**

**Time: 3Hrs**

**Max. Marks: 80**

**Answer FIVE questions, choosing ONE from each Unit.**

**All questions carry equal marks.**

#### **UNIT-I**

1. Write an essay on different sedimentary structures generated by mechanical and chemical process. Illustrate with neat sketches.

**OR**

2. Write notes on any **THREE** of the following:
- a) Sedimentary rock record.
  - b) Biogenic sedimentary structures.
  - c) Processes of transport.
  - d) Stylolite.

#### **UNIT-II**

3. What are grain size parameters? Explain their importance in the interpretation of deposition of sediments.

**OR**

4. Answer any **TWO** of the following:
- a) Sedimentary texture.
  - b) Wentworth grade scale .
  - c) Origin of sedimentary rocks

#### **UNIT-III**

5. What is delta? Explain the detailed notes of various deposits formed in the deltaic environment.

**OR**

6. Answer any **THREE** of the following:
- a) Glacial environment.
  - b) Desert environment.
  - c) Littoral and barrier complex.
  - d) Lacustrine environment.

#### **UNIT-IV**

7. Write an essay on the classification on the carbonate rocks.,

**OR**

8. Answer any **TWO** of the following:
- a) Classification of sandstones.
  - b) Chemical and volcanogenic sediments.
  - c) Clastic sediments

#### **UNIT-V**

9. Write and essay on diagenesis of sandstones

**OR**

10. Answer any **TWO** of the following:
- a) Field and laboratory techniques in Sedimentology.
  - b) Diagenesis of mudstone
  - c) Rock and thin section staining.

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**Syllabus**  
**II – Semester, M.Sc. (Tech), Applied Geology**  
**Paper -I STRATIGRAPHY**  
**(Effective from the Admitted Batch of 2021-2022)**

**UNIT-1**

Importance and principles of stratigraphy, Geological Time Scale, Hutton's uniformitarianism- controls and development of stratigraphic record, Lithostratigraphy, correlation and stratigraphic code.

**UNIT-II**

Bio-stratigraphy: Review of current trends, Zonation and time significance. Magneto stratigraphy, Cyclostratigraphy and Event stratigraphy.

**UNIT-III**

Geochronology and Chronostratigraphy, Chemostratigraphy, Completeness and incompleteness of stratigraphic records.

**UNIT-IV**

**Seismic stratigraphy:** Early Development of Seismic Methods, Principles of Reflection Seismic Methods, Principles of Refraction Seismic Methods and Analysis reflection characteristics, Identification of major depositional units Integration of well and seismic Predict environmental setting, lithology Determination of age model.

**UNIT-V**

**Sequence Stratigraphy:** Historical developments of sequence Stratigraphy, key concepts, transgressions and regressions. Sequence Stratigraphic surfaces, types of stratal terminations, Systems tract: Low stand systems tract, High stand systems tract, Falling stage systems tract, Regressive systems tract. Hierarchy of sequences and sequence boundaries; Sequence stratigraphy of hydrocarbon reservoirs; Applications to source rocks exploration. Application of sequence stratigraphy in clastic and carbonate depositional systems.

**Practicals:**

Construction of Biostratigraphic range charts and paleoenvironmental analysis of well sections. Preparation of different stratigraphic distribution maps of India. Study of paleogeographic Maps. Interpretation of Seismic sections, Seismic Sequence Analysis.

**Text Books:**

- 1) Doyle, P and Bennet, M.R., 1996; Unlocking the stratigraphic Record. John Wiley.
- 2) Boggs, Sam JR; 1995; Principles of sedimentology and stratigraphy Prentice Hall.
- 3) Brenner, R.E and MC Hargue, T.R; 1988; Integrative Stratigraphy Concepts and applications Prentice Hall.
- 4) Sam Bogs, Jr. (2006) Principles of Sedimentology and Stratigraphy,
- 5) Octavian Catuneanu (2006 Ed.) Principles of Sequence Stratigraphy, Elsevier B.V.
- 6) Wolfgang Schlager, Carbonate Sedimentology and Sequence Stratigraphy , SEPM (Society for Sedimentary Geology), USA

# **MODEL QUESTION PAPER**

## **II – SEMESTER, M.Sc. (TECH) APPLIED GEOLOGY**

### **PAPER – I. STRATIGRAPHY**

**(Effective from the Admitted Batch of 2021-2022)**

**Time: 3Hrs**

**Max. Marks: 80**

**Answer FIVE questions, choosing ONE from each Unit.**

**All questions carry equal marks.**

#### **UNIT-I**

1. Write an essay on principle of correlation.

**OR**

2. Answer any **TWO** of the following

- a) Uniformitarianism.   b) Geologic time scale.   c) Lithostratigraphy.

#### **UNIT-II**

3. Write an essay on cyclostratigraphy and event Stratigraphy.

**OR**

4. Answer any **TWO** of the following

- a) Zonation.   b) Magnetostratigraphy.   c) Biostratigraphy.

#### **UNIT-III**

5. Discuss about seismic Stratigraphy and sequence Stratigraphy.

**OR**

6. Answer any **TWO** of the following:

- a) Completeness of stratigraphic records.   b) Geochronology.  
c) Chemostratigraphic correlation.

#### **UNIT-IV**

7. Identification major depositional unit integration of Well and Seismic

**OR**

8. Answer any **TWO** of the following:

- a) Principles of reflection seismic methods  
b) Principles of refraction seismic methods  
c) Lithology, determine an age model

#### **UNIT-V**

9. Describe the historical development of sequence Stratigraphy

**OR**

10. Answer any **TWO** of the following:

- a) High stand systems tract  
b) Falling stage systems tract  
c) Application of sequence Stratigraphy in clastic depositional systems

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## **SYLLABUS**

### **II – SEMESTER, M.Sc. (TECH) APPLIED GEOLOGY**

### **PAPER – II, GEOCHEMISTRY & ISOTOPE GEOLOGY**

**(Effective from the Admitted Batch of 2021-2022)**

#### **UNIT-I**

Concept of Geochemistry, Cosmic abundance of elements, geochemical evolution of the earth, Composition of meteorites, Structure and composition of the earth, primary differentiation of elements and Geochemical classification of elements.

#### **UNIT-II**

Significance of Crystal chemistry in Geochemistry, isomorphism and diadochy camouflage, computing and admission of trace elements, Laws of thermodynamic, Gibbs free energy, Principles of Ionic substitution in minerals, Rare earth geochemistry and their abundance and mobility in crust.

#### **UNIT-III**

Geochemical mobility under low and high P-T conditions; Geochemical Dispersion, Primary and Secondary dispersion patterns and their classification; Geochemistry of Lithosphere, Atmosphere, Biosphere; Geochemical cycle.

#### **UNIT-IV**

Geochemistry of Water – Mineral Stability; Water – rock interaction, Migration of elements in endogenic environment. Eh-pH – diagram and natural water environment.

#### **UNIT-V**

Radiogenic isotopes, Radioactive decay and growth; Basic ways of dating, Isochrons, Radiometric dating of single mineral and whole rock; Radioactive Decay schemes of U-Th-Pb, Rb-Sr, K-Ar; Geochemistry of Uranium ;and Thorium – Nuclear Reactors, Neutron activation analysis. Application of stable isotopes in Geology.

#### **PRACTICALS:**

Sampling and sample preparation – Methods of Preparation 'B' solution (Dissolution procedures) Determination of elemental concentration on Atomic absorption spectrometer. Calculation of radio metric dating of minerals.

#### **TEXT BOOKS:**

Principles of Geochemistry – Brian Mason & C.B. Moore Geochemistry – Gold Schmidt.

Introduction to Geochemistry – Krawskop, K.B., M.C. Graw Hill Applied Geochemistry – F.R. Siegel.

Stable Isotope Geochemistry – Springer verlag Principles of Isotope Geology – John Wiley Publication Faure, G; 1986.

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# **MODEL QUESTION PAPER**

## **II – SEMESTER, M.Sc. (TECH) APPLIED GEOLOGY**

### **PAPER – II, GEOCHEMISTRY & ISOTOPE GEOLOGY**

**(Effective from the Admitted Batch of 2021-2022)**

**Time: 3Hrs**

**Max. Marks: 80**

**Answer FIVE questions, choosing ONE from each Unit.**

**All questions carry equal marks.**

#### **UNIT-I**

1. Write an essay on Primary Differentiation of elements in the earth

**OR**

2. Write short notes on any **THREE** of the following:

- a) Cosmic abundance of elements
- b) The Composition of the earth crust
- c) Geochemical Classification of the elements
- d) Composition of the meteorites

#### **UNIT-II**

3. Describe Rare earth geochemistry and their abundance and mobility in crust level

**OR**

4. Write short notes on any **THREE** of the following:

- a) Significance of crystal chemistry
- b) Distribution coefficient of trace elements
- c) Laws of the thermodynamics
- d) Ionic substitution in minerals

#### **UNIT-III**

5. Explain briefly the geochemical mobility under low and high Pressure – STemperature conditions

**OR**

6. Write short notes on any **THREE** of the following:

- a) Primary dispersion patterns.
- b) Geochemistry of Lithosphere.
- c) Geochemistry of atmosphere.
- d) Geochemical cycle.

#### **UNIT-IV**

7. Describe the Process of water – rock interaction

**OR**

8. Write short notes on any **THREE** of the following:

- a) Migration of elements in endogenic environment
- b) Mineral stability
- c) Eh-pH diagram
- d) Natural water environment

#### **UNIT-V**

9. Write an essay on Radiometric dating of minerals

**OR**

10. Write short notes on any **THREE** of the following:

- a) Radiogenic Isotopes
- b) Geochemistry of uranium
- c) Nuclear Reactors
- d) Decay scheme of K- Ar

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# **SYLLABUS**

## **II – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**

### **PAPER- III, SEDIMENTARY PETROLOGY**

**(With effect from the admitted batch of 2021-2022)**

#### **UNIT – I**

Introduction, Texture of Sediments: Particle Size of detrital rocks, shape and roundness, surface textures, fabric and frame work geometry, crystalline and other endogenetic fabrics, Biogenic Fabrics

#### **UNIT –II**

Internal organization and structure of sedimentary rocks: Internal organization and structure of beds. Bedding plane markings and structures, Deformed and disturbed bedding. Stromatolites and other biogenic structures. Diagenic Structures

#### **UNIT – III**

Geometry of Sedimentary bodies: Sand Stone bodies. Sand stone dikes, sills and Auto intrusions, carbonate rock geometry. Gravels, Conglomerates. Basic differences between gravels and sands. Classification of gravels and conglomerates. Breccias

#### **UNIT- IV**

Sands and Sand stones: Classification of sand stones. Petrography of Sand stones Diagenesis of sand stones. Petrogenesis of sand stones. Classification and petrology of shales. Siltstones and loess. Limestone and Dolomites: textures and structures of lime stones. Classification of limestones, Diagenesis of limestones.

#### **UNIT-V**

Nonclastic Sediments (Excluding lime stones): Phosphorites and other phosphatic sediments. Salines and other evaporates (Excluding carbonates). Glauconites, Iron bearing sediments.

#### **PRACTICALS:**

- 1) Megascopic Identification of sedimentary rocks: varieties of sandstones, limestones, conglomerates, shales.
- 2) Microscopic Identification of sedimentary rocks: limestone, Dolomite, Phosphorite, Sandstones and Shales.

#### **TEXT BOOKS:**

- 1) Sedimentary rocks by F.J.Pettijohn.
- 2) Petrology of Sedimentary rocks- J.T. Greensmith 1988
- 3) Sedimentary petrology : An Introduction to the origin of Sedimentary rocks, 3<sup>rd</sup> edition – Maurice.E.Tucker

# **MODEL QUESTION PAPER**

## **II – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**

### **PAPER - III, SEDIMENTARY PETROLOGY**

**(Effective from the Admitted Batch of 2021-2022)**

**Time: 3Hrs**

**Max. Marks: 80**

**Answer FIVE questions, choosing ONE from each Unit.**

**All questions carry equal marks.**

#### **UNIT-I**

1. Write a descriptive note on the Sedimentary textures.

**OR**

2. Write short notes on any **TWO** of the following:
  - a) Biogenic fabrics.
  - b) Frame work geometry.
  - c) Endogenetic fabrics.

#### **UNIT-II**

3. Describe in detail about stromatolites and other biogenic structures.

**OR**

4. Write short notes on any **TWO** of the following:
  - a) Structure of beds
  - b) Deformed bedding
  - c) Diagenic structures.

#### **UNIT-III**

5. Write an essay on sand stone bodies.

**OR**

6. Write short notes on any **TWO** of the following:
  - a) Gravel
  - b) Conglomerate
  - c) Breccia

#### **UNIT-IV**

7. Describe in detail about the textures and structures of limestones.

**OR**

- 8) Write short notes on any **TWO** of the following:
  - a) Shales
  - b) Siltstones
  - c) Loess

#### **UNIT-V**

- 9) Write an essay on salines and evaporates.

**OR**

- 10) Write short notes on any **TWO** of the following:
  - A) Phosphorites
  - B) Glauconites
  - C) 0
  - D) Iron bearing Sediments

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## **Syllabus**

### **II – Semester, M.Sc. (Tech) Applied Geology**

#### **Paper -IV MICROPALAEONTOLOGY**

**(Effective from the Admitted Batch of 2021-2022)**

##### **UNIT-1**

Introduction and advances in Micropaleontology. Kingdoms of life. Stratigraphic distribution of major microfossil groups. Collection, separation and mounting of microfossils from surface and sub-surface sediments. Applications of Microfossils - Biostratigraphy, Paleoenvironmental and Paleoclimate, Basin Analysis and Hydrocarbon Exploration, Paleooceanography

##### **UNIT-II**

**Calcareous-Walled Microfossils:** Morphology, Ecology distribution and outline classification of foraminifera. Role of Foraminifera in hydrocarbon exploration and Monitoring Coastal Pollution.

##### **UNIT-III**

**Calcareous-Walled Microfossils:** Elementary ideas about the major morphological groups of Ostracoda, Calcareous Nannoplankton-Coccolithophores, Pteropods and their stratigraphic and paleontological significance. Stable Isotopes and paleoclimates. Taphonomy and paleobiogeography

##### **UNIT-IV**

**Siliceous -Walled Microfossils:** Radiolaria: Morphology, Ecology, Geologic History. Diatoms: Morphology, Ecology, Geologic History. Silicoflagellates: Morphology, Ecology, Geologic History. **Phosphatic Microfossils:** Conodonts- Morphology, Paleocology, Geologic History and other Phosphatic Microfossils.

##### **UNIT-V**

**Organic-Walled Microfossils:** Dinoflagellates, Acritarch, Tasmanitids, Chitinozoa, Spores and Pollens-Morphology, Ecology and Geologic History.

##### **Practicals:**

Processing and preparation of samples for Microscopic study. Identification of selected species of Foraminifera, Ostracoda Radiolaria, and Diatoms, under stereo binocular Microscope with CCTV. Study of Important microfossils from stratigraphic distributions of India. Study of SEM photographs of microfossils.

##### **Text Books:**

Pratul Kumar Saraswati and M.S. Srinivasan (2016 Ed.). Micropaleontology Principles and Applications. Springer International Publishing Switzerland.

Bilal U.Haq and Anne Boersma (1998 Ed.) Introduction to marine micropalaeontology. Elsevier, New York



**MODEL QUESTION PAPER**  
**II – SEMESTER, M.Sc. (TECH) APPLIED GEOLOGY**  
**PAPER – IV, MICROPALAEONTOLOGY**  
**(Effective from the Admitted Batch of 2021-2022)**

Time: 3Hrs

Max. Marks: 80

**Answer FIVE questions, choosing ONE from each Unit.**

**All questions carry equal marks.**

**UNIT-I**

1. Describe advances in Micropaleontology

**OR**

2. Answer any **TWO** of the following:

- A. Kingdom of life
- B. Biostratigraphy
- C. Paleoclimate

**UNIT-II**

3. Write about morphology, distribution and classification of Foraminifera

**OR**

4. Answer any **TWO** of the following:

- a. Role of Foraminifera in Hydrocarbon Exploration.
- b. Role of Foraminifera in monitoring coastal pollution
- c. Ecology of Foraminifera

**UNIT-III**

5. Write about the major morphological characters of ostracoda

**OR**

6. Answer any **TWO** of the following:

- a. Calcareous Nanno Plankton
- b. Coccolithophores
- c. Pteropods

**UNIT-IV**

7. Write Morphology, Ecology and Geological history of Radiolaria

**OR**

8. Answer any **TWO** of the following:

- a. Silicoflagellates
- b. Paleoecology
- c. Diatoms

**UNIT-V**

9. Write an essay on Dinoflagellates

**OR**

10. Answer any **TWO** of the following:

- a. Spores and Pollens
- b. Tasmanitids
- c. Acritarch

## **SYLLABUS**

### **III – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**

#### **PAPER- I, GEOMORPHOLOGY REMOTE SENSING & GIS**

**(Effective from the Admitted Batch of 2021-2022)**

#### **UNIT-I**

Photo geology: Introduction. Aerial Photographs: types of Aerial Photographs, classification and geometry. Photogrammetry. Stereo grams, stereo scopes. Stereo scopy and scale in aerial photographs. Aerial mosaics. Aerial mosaics vs toposheet. Principles and fundamentals of aerial photo interpretation and Basic recognition elements in aerial photographs.

#### **UNIT-II**

Principles of Remote Sensing: Electromagnetic spectrum. Interaction of EMR with atmosphere and earth surface features. Spectral characteristics of vegetation, water and soil. Remote sensing observation flat forms, resolutions and orbits. Global and Indian space missions i.e. LANDSAT, METEOSAT, SEASAT, SPOT, RADARSAT & IRS Series of satellites.

#### **UNIT-III**

Image interpretation: Introduction to Digital Image Processing. Fundamentals of image interpretation. Basic recognition elements in satellite image interpretation. False colour composite (FCC), Aerial photo vs. satellite image. Application of remote sensing in geology, geomorphology, mineral exploration and hydro geological studies. Fundamentals of Geographic information system (GIS), Global positioning system (GPS) and their applications.

#### **UNIT-IV**

Basic concepts of geomorphology, weathering, mass wasting and soils. Geomorphic cycle. Geomorphic process and resulting land forms. Concept of drainage basin, drainage patterns and slopes.

#### **UNIT-V**

Topographical maps. Geomorphology of India. Morphology and it's relation to structure and lithology. Application of geomorphology in mineral prospecting, civil engineering studies, hydrogeological studies.

**(P.T.O)**

**PRACTICALS:**

Study of Topographical maps. Stereo tests and study of different types of aerial photographs. Identification of land forms on oblique/ vertical aerial photographs using stereo scopes. Interpretation of satellite images for lithology, geomorphology and structural features.

**TEXT BOOKS:**

1. Miller, V.C., 1961: Photogeolgy, Mc Graw H, 11.
2. Sabins F.F., 1985: Remote Sensing – Principles and applications, Freeman.
3. Ray R.G., 1969: Aerial photographs in Geologic interpretations. USGS Prof. Paper 373.
4. Thornbury, W.S.: Principles of Geomorphology, Wiley Eastern New Delhi.
5. Garner H.F., 1974: Origin of Landscapes, oxford University Press.
6. Leopold L.B., 1964: Fluvial processes in geomorphology, Euresia Publishing House.

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## **MODEL QUESTION PAPER**

### **III – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**

#### **PAPER- I, GEOMORPHOLOGY REMOTE SENSING & GIS**

**(Effective from the Admitted Batch of 2021-2022)**

**Time: 3Hrs**

**Max. Marks: 80**

**Answer FIVE questions, choosing ONE from each Unit.**

**All questions carry equal marks.**

#### **UNIT-I**

- 1) What are different types of aerial photographs? Add a note on their geometry.

**OR**

- 2) Write short notes on any **THREE** of the following:
- |                                      |                       |
|--------------------------------------|-----------------------|
| a) Controlled mosaic.                | b) Nadir point.       |
| c) Vertical and inclined photograph. | d) Stereoscope usage. |

#### **UNIT-II**

- 3) What is electromagnetic spectrum? Discuss its interaction with earth surface features.

**OR**

- 4) Briefly write about the Indian space programmes.

#### **UNIT-III**

- 5) Describe in detail the elements of visual image interpretation for geology.

**OR**

- 6) Write short notes on any **THREE** of the following:
- |                                     |                              |
|-------------------------------------|------------------------------|
| a) Global resource satellites.      | b) Remote sensing Platforms. |
| c) Aerial photo Vs Satellite image. | d) Elements of GIS.          |

#### **UNIT-IV**

- 7) Write essay on Fundamental concepts in Geomorphology.

**OR**

- 8) Write short notes on any **THREE** of the following:
- |                       |                                   |
|-----------------------|-----------------------------------|
| a) Weathering agents. | b) Explain the drainage patterns. |
| c) Types of soils.    | d) Geomorphic cycle.              |

#### **UNIT-V**

- 9) Discuss about the relation between the morphology and Structure and lithology.

**OR**

- 10) Write short notes on any **THREE** of the following:
- |                     |  |
|---------------------|--|
| a) Relief & slope.  | b) Topographical maps                    |
| c) Karst topography | d) Pediment and residual hill – explain. |

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**SYLLABUS**  
**III – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**  
**PAPER- II, GEOPHYSICAL EXPLORATION**  
**(Effective from the Admitted Batch of 2021-2022)**

**UNIT – I**

The Earth's gravity field, the force of gravity on the surface of the Earth, the figure of the earth, geoid, spheroid and international Gravity formula, establishment of gravity bases, drift correction, principles of Gravity instruments, Reduction of gravity data, free air and Bouguer anomalies, preparation of gravity anomaly maps and their interpretation in terms of shape, size and depth.

**UNIT –II**

Earth's main magnetic field, Origin and temporal variations, Geomagnetic elements, magnetic moments, intensity of magnetization and induction, magnetic potential and its relation to field, Principle of magnetic prospecting instruments, field surveys and data reduction, preparation of magnetic anomaly maps and their quantitative interpretation. Magnetic anomalies due to simple pole and dipole, introduction to aeromagnetic surveys.

**UNIT – III**

Principle of electrical Methods of prospecting, Different types of electrode arrays, field procedure, profiling and sounding application in ground water prospecting and civil Engineering.

**UNIT- IV**

Fundamental principles of wave propagation, stress, strain and Hook's law, Elastic Module, wave equations, reflection, refraction, Critical refraction, diffraction, reflection and transmission coefficients. P & S wave velocities, Geophone and its performance, reflection and refraction surveys for single interface, concept of seismic channel and multichannel recording of seismic data, CDP method of data acquisition, interpretation of seismic data.

**UNIT-V**

Gravity anomalies of Sphere, Horizontal circular cylinder, Fault. magnetic anomalies of dyke, sphere and fault. Application of geophysical methods in Ground water, mineral and petroleum exploration.

**PRACTICALS:**

- 1) Interpretation of gravity anomalies over simple Geometrical models like sphere, Horizontal circular cylinder and Fault models.
- 2) Interpretation of Magnetic anomalies over simple Geometrical medals like dyke, Fault etc.
- 3) Resistivity surveys with different arrays.

**TEXT BOOKS:**

- 1) Gravity and Magnetic Methods, Rao, B.S.R & Murthy, I.V.R.
- 2) Gravity and Magnetics in oil prospecting, L.L. Nettleton.
- 3) Geophysical Methods in Geology, (Second Edition) P.V. Sharma.
- 4) Applied Geophysics, W.M. Telford et. al.
- 5) Introduction to Geophysical Prospecting M.B. Dobrin.

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**MODEL QUESTION PAPER**  
**III – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**  
**PAPER - II, GEOPHYSICAL EXPLORATION**  
**(Effective from the Admitted Batch of 2021-2022)**

**Time: 3Hrs**

**Max. Marks: 80**

**Answer FIVE questions, choosing ONE from each Unit.**  
**All questions carry equal marks.**

**UNIT-I**

8. Write an essay on the preparation of gravity anomaly maps and their interpretation.

**OR**

9. Write short notes on any **THREE** of the following:
- d) Geoid, spheroid and international gravity formula.
  - e) Drift correction.
  - f) Free air and Bouguer.
  - g) Qualitative and Quantitative interpretation of gravity data.

**UNIT-II**

10. Define geomagnetic elements and draw neatly their vectorial representation. Give the mathematical relationships between different geomagnetic elements. Also discuss the origin of magnetic anomalies.

**OR**

11. Write short notes on any **THREE** of the following:
- d) Magnetic anomaly maps.
  - e) Aeromagnetic surveys.
  - f) Working principle of magnetometers.
  - g) Magnetic properties of rocks.

**UNIT-III**

12. Describe the basic principles of resistivity method and write in detail about ground water prospecting using resistivity methods.

**OR**

13. Explain the difference between the Apparent Resistivity and true Resistivity. Derive an expression for resistivity of any four – Electrode set – up.

**UNIT-IV**

14. a) What is Geophone, Draw a neat sketch and explain.  
b) Explain the seismic incident, reflection, refraction and diffraction waves.

**OR**

15. Write notes on any **THREE** of the following:
- a) CDP method of data acquisition.
  - b) Principles of wave propagation.
  - c) Recording of seismic data.
  - d) Seismic Velocity and interrelation.

**UNIT-V**

16. Write in detail the application of geophysical methods in mineral exploration.

**OR**

17. Describe the gravity anomaly expressions of sphere and fault.

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## **SYLLABUS**

### **III – SEMESTER, M.Sc. (TECH) APPLIED GEOLOGY**

#### **PAPER- III, HYDROGEOLOGY**

**(Effective from the Admitted Batch of 2021-2022)**

##### **UNIT-I**

**Occurrence and distribution of Ground Water:** Origin of Water; Hydrologic cycle; Hydrological properties of rocks – Porosity, Specific yield, Specific Retention, Hydraulic Conductivity, Storativity, and Transmissivity; Vertical Distribution of Ground Water; Types of Aquifers- Unconfined, Confined, Semi - Confined & Perched; Springs; Hydrothermal phenomena.

##### **UNIT-II**

**Ground Water Mechanics:** Darcy's law and its Application ; Determination of Permeability in laboratory and in field; Steady State, Unsteady State and Radial Flow equations; Tracer Studies; Pumping Tests- Methods, Estimation of T & S by Theis, Jacob and Theis Recovery Methods, Specific Capacity Method by Slither's Method.

##### **UNIT-III**

**Exploration and Water Wells:** Ground Water Exploration- Remote Sensing. Hydrogeological and Surface Geophysical Methods; Types of wells, Drilling Methods, Construction, Design and Maintenance of Shallow Wells, Deep Wells in Hard rocks, Soft rocks and in Unconsolidated Sediments; Well Development; Well Rehabilitation; Pumping equipment.

##### **UNIT-IV**

**Ground Water Chemistry:** Quality of Ground Water, Physical and Chemical properties; Quality criteria for domestic, irrigation and industrial uses; Graphical presentation of Water quality data; Sources of pollution; Sea water intrusion and its controls; Problems of Arsenic, Fluoride and Nitrate; Radioisotopes to Ground Water Studies.

##### **UNIT-V**

**Ground Water Management:** Water Table Contour maps; Water Table fluctuations and causative factors; Overexploitation and Ground Water Mining ; Ground Water Development in Urban areas and Rain water Harvesting; Renewable and Non-renewable Ground Water resources; Concept of Basin Management, Watershed Basin Management; Artificial Recharge methods; Land subsidence; Modelling Techniques; Ground Water Provinces of India; Ground Water Legislation.

**(P.T.O)**

**PRACTICALS:**

Hydro geological surveys around Visakhapatnam. Problems on well hydraulics, vertical electrical sounding and interpretation of the data. Pumping test. Processing of data for T & S by Theis. Jacob and Theis recovery methods. Specific capacity of wells by Slichter's method. Well loss estimation from stop drawdown test and graphical presentation of chemical data.

**TEXT BOOKS:**

Ground water Hydrology by Todd. D.K. John Wiley & Sons. New York.

Hydrogeology by Karanth. K.R. Tata Mc Graw Hill Publ Co New Delhi.

Ground water assessment. Development and Management by Karanth K.R. Tata Mc.  
Graw Hill Publ. Co. New Delhi.

Hydro Geology by Davis S.N. and Dewiest, R.J.M. John wiley & Son New York.

Ground Water by Raghunath. H.M. Wiley Eastern Ltd. New Delhi.

Ground water Resources evaluation by Walton. W.C. Mc Graw Hill Publ. Co. New Delhi.

Ground water Hydrology by Bouwer H. Mc Graw Hill Book Co. New Delhi.

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# **MODEL QUESTION PAPER**

## **III - SEMESTER M.Sc. (TECH) APPLIED GEOLOGY**

### **PAPER – III. HYDROGEOLOGY**

**(Effective from the Admitted Batch of 2021-2022)**

**Time: 3Hrs**

**Max. Marks: 80**

**Answer FIVE questions, choosing ONE from each Unit.**

**All questions carry equal marks.**

#### **UNIT-I**

1. What are aquifers? Bring out their salient features along with their classification. Explain the geological framework of an artesian aquifer.

**OR**

2. Write short notes on any **THREE** of the following:

- |   |                                   |
|---|-----------------------------------|
| a) Precipitation.                         | b) Evaporation and transpiration. |
| c) Vertical distribution of ground water. | d) Infiltration.                  |
| e) Coastal aquifer system.                |                                   |

#### **UNIT-II**

3. Describe the occurrence of groundwater in sedimentary formations,

**OR**

4. Write short notes on any **THREE** of the following:

- |                                       |                         |
|---------------------------------------|-------------------------|
| a) Hydraulic conductivity.            | b) Storage coefficient. |
| c) Specific yield.                    | d) Tidal efficiencies.  |
| e) Groundwater in Basaltic formation. |                         |

#### **UNIT-III**

5. State Darcy's law. Describe differential equations governing steady and unsteady state of groundwater flow.

**OR**

6. Write short notes on any **THREE** of the following:

- |                           |                                  |
|---------------------------|----------------------------------|
| a) Boundary conditions.   | b) This method of pumping tests. |
| c) Flow net analysis.     | d) Cone of depression.           |
| e) Construction of wells. |                                  |

#### **UNIT-IV**

7. Explain in detail the different drilling methods.

**OR**

8. Write short notes on any **THREE** of the following:

- |                           |                      |
|---------------------------|----------------------|
| a) Well maintenance.      | b) Well development. |
| c) Tube wells.            | d) Design of wells.  |
| e) Construction of wells. |                      |

#### **UNIT-V**

9. Give a brief account of ground water pollution.

**OR**

10. Write short notes on any **THREE** of the following:

- |  |   |
|--|---|
| a) Diagrammatic representation of chemical data. | c) Classification of irrigation waters. |
| b) Bacteriological parameters.                   | d) Hardness of water.                   |
|  | e) Fluorosis.                           |

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## **SYLLABUS**

### **III – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**

#### **PAPER- IV, SEDIMENTARY BASINS OF INDIA**

**(Effective from the Admitted Batch of 2021-2022)**

#### **UNIT-I**

**Basins Classification and Depositional Environments:** Tectonic Basin Classification, Tectonics and Basin Filling, Basin Morphology and Depositional Environments.

**Basin Evolution and Sediments:** Rift basins, Continental Margin and Slope Basins, Intracontinental Sag Basins. Deep-Sea Trenches, Foreland, Back arc and Retro arc Basins, Remnant and Foreland Basins, Collision – Related Basins, Pull-Apart Basins, Basin- Type Transitions (Polyphase Basins)

#### **UNIT-II**

**Basin mapping methods:** Structure and isopach contouring, Lithofacies maps, Geophysical techniques, Clastic petrographic data, Computer mapping methods, Stratigraphic cross sections, Paleocurrent analysis, Remote sensing.

**Depositional systems and sequence stratigraphy:** Stratigraphic architecture, Nonmarine depositional systems, Coastal depositional system. Clastic shelves and associated depositional systems, Carbonate and evaporate depositional systems, Clastic depositional systems of the continental slope, rise and basin plain, Sequence stratigraphy.

#### **UNIT-III**

Stratigraphy, Structure and Tectonics of Onshore and Offshore Sedimentary basins of East Coast of India with special reference to – Bengal Basin – Mahanadi - Krishna - Godavari and Cauvery Basins.

#### **UNIT-IV**

Stratigraphy, Structure and Tectonics of Onshore and Offshore Sedimentary basins of West Coast of India with special reference to Kutch – Saurashtra – Narmada – Cambay Bombay high, Kerala – Konkan Offshore Basins.

#### **UNIT-V**

Stratigraphy, Structure and Tectonics of other Sedimentary basins of India with special reference to Cuddapah - Vindhyan – Rajasthan - Assam shelf – and Himalayan foot hill Basins.

#### **TEXT BOOKS:**

- 1) Einsele G 1992 Sedimentary Basins. Springer Verlag.
- 2) Miall A 2000 Principles of Sedimentary Basin analysis.
- 3) Sengupta S 1997. Introduction to Sedimentology oxford – IBH.
- 4) Petrol ferrous Basins of India, ONGC, Petroleum Asia Journal.

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# **MODEL QUESTION PAPER**

## **III SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**

### **PAPER – IV, SEDIMENTARY BASINS OF INDIA**

**(Effective from the Admitted Batch of 2021-2022)**

**Time: 3Hrs**

**Max. Marks: 80**

**Answer one question from each Unit**

**All questions carry equal marks.**

#### **UNIT – I**

- 1) Write in detail the Tectonic classification of Sedimentary Basins.

**OR**

- 2) Write short notes on any **TWO** of the following:
- a) Rift basins
  - b) Intercontinental Sag Basins
  - c) Foreland Basins.

#### **UNIT – II**

- 3) Explain different mapping methods of Sedimentary Basins.

**OR**

- 4) Write short notes on any **TWO** of the following:
- a) Sequence stratigraphy.
  - b) Carbonate and evaporate depositional systems.
  - c) Nonmarine depositional systems.

#### **UNIT – III**

- 5) Write on the Stratigraphy, Structure and Tectonics of Krishna -Godavari Basin.

**OR**

- 6) Write short notes on any **TWO** of the following:
- a) Mahanadi Basin.
  - b) Bengal Basin.
  - c) Cauvery Basin.

#### **UNIT – IV**

- 7) Write on the Stratigraphy, Structure and Tectonics of Bombay high Offshore Basin.

**OR**

- 8) Write short notes on any **TWO** of the following:
- a) Cambay Basin.
  - b) Narmada Basin.
  - c) Konkan Offshore Basin.

#### **UNIT – V**

- 9) Write on the Stratigraphy, Structure and Tectonics of Assam Basin.

**OR**

- 10) Write short notes on any **TWO** of the following:
- a) Cuddapah Basin.
  - b) Rajasthan Basin.
  - c) Himalayan foot hill Basin.

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## **SYLLABUS**

### **IV – SEMESTER, M.Sc. (TECH) APPLIED GEOLOGY**

#### **PAPER- I, MARINE GEOLOGY**

**(Effective from the Admitted Batch of 2021-2022)**

##### **UNIT-I**

Introduction and Historical development of Marine Geology. Sediment sampling methods; morphology of the ocean; oceanic crust structure, petrology and sources of oceanic crust; and changes after formation.

##### **UNIT-II**

Continental drift; sea floor spreading; Plate tectonics – concept and geometry of plate tectonics; driving mechanism of plates, Island Arcs and back arc basins; Continental margin types: Divergent – convergent and active margins; collision processes on convergent margins. Nearshore geological processes on the continental shelf.

##### **UNIT-III**

Sea-Coast-Classification, Sea-level changes, Rate of sedimentation. Marine pollution. Law of the Sea.

##### **UNIT-IV**

Deep sea sediments and classification; Terrigenous deep sea sediments; Biogenic and Authigenic sediments. The geologic record of bottom currents – Method of study; erosion, transportation and deposition of bottom currents. Marine Mineral Resources.

##### **UNIT-V**

Palaeo-oceanography and sediment history of the ocean basins – Pacific, Atlantic and Indian. Oceanic history of Calcium Carbonate Compensation Depth (CCD), Global palaeo-oceanography and evolution – Critical events in ocean history.

**(P.T.O)**

### **PRACTICALS:**

**Beach Profile studies:** Estimation of deposition and erosion.  
**Interpretation of Echo-profiles** – Continental Shelf, Slope, rise and Abyssal Plains.  
**Coarse fraction studies:** Oolites, Glauconite and Phosphorite etc. **Clay mineral analysis** – X-ray diffraction charts.

Estimation of calcium carbonate and Organic matter percentage in the sediments.

### **TEXT BOOKS:**

1. James P. Kennett 1982, Marine Geology, Prentice Hall.
2. Shepard, F.P. 1948, Sub Marine Geology, Harper and Row.
3. Seibold, E and Berger, W.H. 1982 The Sea Floor, Springer-Verlag.
4. William W.A. Nikoebach and R.W. Strenburg The World Ocean.
5. Pipkin, B.N., Gorsline, D.S., Cassey, R.E. & Hammond, D.E., 1972. Laboratory Exercises in oceanography, Freeman.

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# **MODEL QUESTION PAPER**

## **IV – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**

### **PAPER – I. MARINE GEOLOGY**

**(Effective from the Admitted Batch of 2021-2022)**

**Time: 3Hrs**

**Max. Marks: 80**

**Answer FIVE questions, choosing ONE from each Unit.**

**All questions carry equal marks.**

#### **UNIT – I**

1. Discuss the history and development of marine Geology in the world.

**OR**

2. Write short notes on any **TWO** of the following.
  - a) Sources of oceanic crust.
  - b) Core samplers.
  - c) Morphology of the oceans.

#### **UNIT – II**

3. What is continental drift? Explain the mechanism of plate tectonics.

**OR**

4. Write short notes on any **TWO** of the following.
  - a) Island Arcs.
  - b) Sea floor spreading.
  - c) Nearshore geological processes.

#### **UNIT – III**

5. Write detailed notes on classification of sea coasts.

**OR**

6. Write short notes on any **TWO** of the following.
  - a) Rate of Sedimentation.
  - b) Marine pollution.
  - c) Law of the sea bed.

#### **UNIT – IV**

7. Write detail notes on classification of Deep sea sediments.

**OR**

8. Write short notes on any **TWO** of the following.
  - a) Beach placers.
  - b) Carbonate sediments.
  - c) Occurrence of hydrocarbons in the sea.

#### **UNIT-V**

9. Write an essay on the palaeo-oceanography and sediment history of Indian Ocean.

**OR**

10. Write short notes on any **TWO** of the following.
  - a) Calcium Carbonate Compensation Depth (CCD).
  - b) Critical events in ocean history.
  - c) Sediment history of Pacific Ocean.

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## **SYLLABUS**

### **IV – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**

### **PAPER – II, GEOLOGICAL & GEOCHEMICAL EXPLORATION**

**(Effective from the Admitted Batch of 2021-2022)**

#### **UNIT – I**

Introduction –Parameters for exploration, Ore genesis in relation to mineral exploration - Geological mapping: Surface and sub surface mapping, Methods of sampling –Drilling techniques –Controls of mineralization.

#### **UNIT –II**

Guides to ore search –Physiographic, Mineralogical, Stratigraphic, Lithological and Structural guides.

#### **UNIT – III**

Regional exploration – Different stages. Planning and operation, mineral reserves estimation, calculation of average of grades. Documentation of exploration data.

#### **UNIT- IV**

Geochemical cycle, mobility and association of elements, primary and secondary dispersion patterns and their classification.

#### **UNIT-V**

Methods of Geochemical Exploration: Lithogeochemical, Pedogeochemical, Biogeochemical, Atmogeochemical and Geobotanical surveys.

**(P.T.O)**



**PRACTICALS:**

1. Measures of reserves estimation
2. Average grade calculation
3. Preparation of geochemical maps
4. Interpretation of Geochemical data

**TEXT BOOKS:**

1. Mining Geology, H. E. McKnistry, Asia Publishing House.
2. An Introduction to Mineral Economics, Kaulir Kisor Chatterjee, Publishing for one world.
3. Principles of Geochemistry, Brian Mason & Carleton B. Moore, Willey Eastern Limited.
4. Applied Geochemistry, Frederic R. Siegel, A wiley - Interscience Publication.

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## **MODEL QUESTION PAPER**

### **IV – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**

### **PAPER – II, GEOLOGICAL & GEOCHEMICAL EXPLORATION**

**(Effective from the Admitted Batch of 2021-2022)**

**Time: 3Hrs**

**Max. Marks: 80**

**Answer FIVE questions, choosing ONE from each Unit.**

**All questions carry equal marks.**

#### **UNIT-I**

1. Describe in detail about Geological mapping?

**OR**

2. Answer any **TWO** of the following:
- a) Channel Sampling.
  - b) Core drilling.
  - c) Parameters for exploration.

#### **UNIT-II**

3. What are different structural guiders for mineral search?

**OR**

4. Answer any **TWO** of the following:
- a) Physiographic guides – for placer minerals.
  - b) Stretigraphic guides – Coal.
  - c) Oxidation products – guiders.

#### **UNIT-III**

5. Write an essay on different stages of Mineral exploration.

**OR**

6. Answer any **TWO** of the following:
- a) Weighted average Grade.
  - b) Geometrical Methods of Mineral reserves estimation.
  - c) Documentation of exploration data.

#### **UNIT-IV**

7. Give detail classification on secondary dispersal patterns of geochemical elements.

**OR**

8. Answer any **TWO** of the following:
- a) Geochemical cycle.
  - b) Mobility of elements.
  - c) Association of elements.

#### **UNIT-V**

9. Write in detail about lethogeochemical Method of exploration.

**OR**

10. Answer any **TWO** of the following:
- a) Universal indicators.
  - b) Sample collection for Biogeochemical survey.
  - c) Principle in Atmogechemical Method.

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**SYLLABUS**  
**IV – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**  
**PAPER – III, ENGINEERING GEOLOGY**  
**(Effective from the Admitted Batch of 2021-2022)**

**UNIT – I**

Role of geologist in civil Engineering. Dams: classification of dams, parts of dams, Dam site investigations: Geological, Geomorphological and Geophysical. Foundation studies. Design of dams case Histories in India.

**UNIT –II**

Reservoirs: Types of reservoir, leakage and sedimentation problems in reservoir Investigations for reservoir sites.

**UNIT – III**

Tunnels, Tunnelling in various types of rocks and soils and problem. Tunnelling method.

**UNIT- IV**

Landshales defination, types, causes, stability analysis, remedies for landslides. Soils: classification of Soils Mechanic of soils. Soil problem

**UNIT-V**

Building stones: Engineering properties of various building stones & Testing Methods. Distribution and occurrence of Building stone in India

**PRACTICALS:**

- a) Physical properties of Rocks & Soils
- b) Mechanical properties of Rocks & Soils
- c) Geo technical properties of Soils & Rocks

**TEXT BOOKS:**

1. Fundamentals of Engineering Geology by Khumi (R.S. Dhanapat Rai & Sons, New Delhi).
2. Principles of Engineering Geology and Geotectonics by Krynine, D.P. and Judd, W.R. (Mc-Graw- Hill, New York)
3. Text book of Engineering Geology by Chenne Kesavulu, N (Mc-Millan India Ltd., New Delhi).
4. Engineering Geology for Civil Engineering, By Venkata Reddy, D (Oxford & IBH Publ. Co. Pvt., Lt., New Delhi).

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# **MODEL QUESTION PAPER**

## **IV – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**

### **PAPER – III, ENGINEERING GEOLOGY**

**(Effective from the Admitted Batch of 2021-2022)**

**Time: 3Hrs**

**Max. Marks: 80**

**Answer FIVE questions, choosing ONE from each Unit.**

**All questions carry equal marks.**

#### **UNIT-I**

1. Write an essay role of Geologist in civil Engineering

**OR**

2. Write short notes on any **TWO** of the following:
- a) Nagarjuna Sagar Dam
  - b) Arch Dam.
  - c) Jack Test

#### **UNIT-II**

3. What are geological factors to be considered for reservoir site selection?

**OR**

4. Write short notes on any **TWO** of the following:
- a) Life of Reservoir.
  - b) Desiltation Methods in Reservoir.
  - c) Leakages Averting Methods in Reservoir .

#### **UNIT-III~`**

5. Write an essay on Tunnelling in various rock types.

**OR**

6. Write short notes on any **TWO** of the following:
- a) Tunnel Alignment.
  - b) Water problems in Tunnels.
  - c) Supports in Tunnels.

#### **UNIT-IV**

7. Give a detail account on classification of Soils.

**OR**

8. Write short notes on any **TWO** of the following:
- a) Causes for landslides.
  - b) Stability of Slopes.
  - c) Soil Mechanics.

#### **UNIT-V**

9. Write an essay on distribution of building stones in India.

**OR**

10. Write short notes on any **TWO** of the following:
- a) Crushing strength.
  - b) Attrition test.
  - c) Permeability.

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**SYLLABUS**  
**IV – SEMESTER, M.Sc. (TECH) APPLIED GEOLOGY**  
**PAPER – IV, ECONOMIC GEOLOGY & INDIAN MINERAL DEPOSITS**  
**(Effective from the Admitted Batch of 2021-2022)**

**UNIT – I**

Nature of ore bearing fluids Principles of formation of mineral deposits – Role of pressure and temperature in ore-bearing fluids – Metallogenic epochs and provinces – geological thermometers. Process of formation of mineral deposits.

**UNIT –II**

Ore microscope – preparation of polished section – physical properties of ore minerals under reflecting microscope – form, colour, hardness, reflectivity – reflection pleochroism, etch test etc.

**UNIT – III**

Structures and textures of ore minerals – Application of ore microscopic studies in ore dressing.

**UNIT – IV**

Geological setting mode of occurrence, genesis, distribution and uses of chromite, manganese, iron, copper- lead- zinc, bauxite and placers.

**UNIT – V**

Geological setting mode of occurrence, genesis, distribution and uses of coal, barites, clays, limestones, mica, phosphates, precious and semi-precious stones.

**PRACTICALS:**

- II. Megascope identification of ore minerals.
- III. Identification of ore minerals under ore microscope.

**TEXT BOOKS:**

- 1. Economic Minerals Deposits – Bateman, A.M. and Jenson, M.L.
- 2. Ore Deposits – Park Jr. C.F. and MacDiarmid, R.A.
- 3. Ore Deposits in India – Gokhale, K.V.G.K. and Rao, T.C.
- 4. Industrial Minerals and rocks in India – Deb, S.
- 5. Ore Deposits – Lindgren, W.
- 6. Ore Petrology – Stanton, R.L.
- 7. Ore Microscopy – Cameron, E.C.
- 8. Ore texture and their intergrowths – Ramdohr, P.

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## **MODEL QUESTION PAPER**

### **IV – SEMESTER, M.Sc. (TECH) APPLIED GEOLOGY**

### **PAPER – IV, ECONOMIC GEOLOGY & INDIAN MINERAL DEPOSITS**

**(Effective from the Admitted Batch of 2021-2022)**

**Time: 3Hrs**

**Max. Marks: 80**

**Answer FIVE questions, choosing ONE from each Unit.**

**All questions carry equal marks.**

#### **UNIT-I**

1. Discuss the role of pressures and temperatures in ore-bearing fluids.

**OR**

2. Write short notes on any **THREE** of the following:

- a) Metallogenic epochs.
- b) Metallogenic provinces.
- c) Geological thermometers.

#### **UNIT-II**

3. Describe the Physical properties of ore minerals under reflecting microscope.

**OR**

4. Write short notes on any **THREE** of the following:

- a) Supergene Enrichment.
- b) Preparation of polished section.
- c) Metasomatism.
- d) Placer deposits.
- e) Groundwater in Basaltic formation.

#### **UNIT-III**

5. Describe the structures and textures of ore minerals.

**OR**

6. Write short notes on any **THREE** of the following:

- a) Characteristics of metamorphic paragenesis.
- b) Ore microscopic studies in ore dressing.
- c) Zoning.
- d) Characteristics of sedimentary paragenesis.

#### **UNIT-IV**

7. Describe the geological setting, mode of occurrence, genesis, distribution and uses of Bauxite deposits.

**OR**

8. Write short notes on any **TWO** of the following:

- a) Manganese ore.
- b) Chromite deposits.
- c) Placer deposits.

#### **UNIT-V**

9. Give the geological setting, mode of occurrence, genesis, distribution characteristics and uses of coal with reference to India.

**OR**

10. Write short notes on any **THREE** of the following:

- a) Diamond.
- b) Glass.
- c) Phosphates.
- d) Semiprecious stones.

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## **SYLLABUS**

### **V – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**

#### **PAPER- I, SURFACE & UNDERGROUND MINING**

**(Effective from the Admitted Batch of 2021-2022)**

#### **UNIT – I**

Introduction – Terminology – Basic Concepts, Factors influencing for selection of Surface/Underground Mining. Development of Benches, Disposal of waste Mine Development– Choice of site for shaft development.

#### **UNIT –II**

Alluvial mining methods, Development of tunnels, Adits, levels etc. Open cast and Underground Mining methods.

#### **UNIT – III**

Coal Mining Methods. Mine transportation, Mine drainage, Mine Supports.

#### **UNIT- IV**

Explosives, - Classification, Methods of charging explosives effects of blasting – Mine – Ventilation – Mine rescue operations.

#### **UNIT-V**

Mining legislation, Mining Plans, - Mining Organisation management principles – Writing reports, Mine valuation, Mine safety.

#### **TEXT BOOKS:**

1. Shevyako, 1 – Mining of mineral deposits. Foreignanwages publishing.
2. Boky, B-Mining MIR publishers, Moscw.
3. Mc Kinstry, H.E – Mining geology, Prentic Hall.
4. Arogyaswamy, R.N.P. – Courses in mining geology. Exford & IBH, Delhi.
5. Young – Mining.
6. Hooven- Practicals of Mining.



## **MODEL QUESTION PAPER**

**V – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**

**PAPER – I, SURFACE & UNDER GROUND MINING**

**(Effective from the Admitted Batch of 2021-2022)**

**Time: 3Hrs**

**Max. Marks: 80**

**Answer FIVE questions, choosing ONE from each Unit.**

**All questions carry equal marks.**

### **UNIT-I**

1. What are different advantages and disadvantages of open cast Mining.

**OR**

2. Answer any **TWO** of the following:

- |   |                  |
|---|------------------|
| a) Dumping of Mine waste.<br>Methods.         | b) Shaft sinking |
| c) Factors influencing for bench development. |                  |

### **UNIT-II**

3. Write an essay on alluvial Mining methods.

**OR**

4. Answer any **TWO** of the following:

- |                   |              |
|-------------------|--------------|
| a) Kaolin mining  | b) Dragline. |
| c) Direct haulage |              |

### **UNIT-III**

5. Write an essay on Mine supports.

**OR**

6. Answer any **TWO** of the following:

- |                                   |                     |
|-----------------------------------|---------------------|
| a) Acid mine drainage.<br>method. | b) Board and Pillar |
| c) Mine transportation.           |                     |

### **UNIT-IV**

7. Write an essay on various types of explosives.

**OR**

8. Answer any **TWO** of the following:

- |   |                |
|---|----------------|
| a) Efficiency of blasting.<br>blasting. | b) Problems in |
| c) Mine lighting.                       |                |

### **UNIT-V**

9. Write an essay on Mine legislation in India.

**OR**

10. Answer any **TWO** of the following:

- |                                      |                 |
|--------------------------------------|-----------------|
| a) Flow Chart for Mine organisation. | b) Mine Safety. |
| b) Importance of Mine valuation.     |                 |

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## **SYLLABUS**

### **V – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**

#### **PAPER- II, FUEL GEOLOGY**

**(Effective from the Admitted Batch of 2021-2022)**

#### **UNIT – I**

Introduction; Occurrence of petroleum – surface occurrences: seepages, mud volcanoes and mud flows, occurrence of solid petroleum, kerogen shale; subsurface occurrences; minor showings pools, and provinces; Reservoir rocks – origin and classification; Reservoir pore space – origin and measurement of porosity and permeability.

#### **UNIT –II**

Reservoir traps – Structural, stratigraphic and miscellaneous traps; salt domes; Reservoir fluids – physical and chemical properties of oilfield water, oil and gas; Origin of petroleum – Inorganic and organic origin, organic source material and transformation of organic matter into petroleum.

#### **UNIT – III**

Migration and accumulation of petroleum – Primary migration and secondary migration; Exploration and exploitation of petroleum; Principles of well logging, various types of well logs; Evaluation of reserves and resources; Important petroliferous basins of India – K-G Basin, Cauvery basin Mahanadi basin, and Bombay High.

#### **UNIT- IV**

Introduction; Classification of coal; Physical and chemical properties of coal; Proximate and ultimate analysis of coal; Origin of coal; Peatification and coalification; Origin of peat swamps; Development of coal facies – type of deposition; Peat- forming plant communities; Depositional milieux; Nutrient supply;  $p^H$  value, Bacterial activity, Sulfur; Temperature of the peat; Redox potential.

#### **UNIT-V**

Macerals of coal – Vitrinite group, Exinite group, and Inertinite group; Microlithotypes of coal; Coal preparation; Coal- bed methane; Application of coal petrography; Important coalfields of India – Gondwana group, Jharia coalfields, Raniganj coalfields and coalfields of Andhra Pradesh.

**(P.T.O)**

**PRACTICALS:**

Preparation of structural, Isopach and Isochore maps(contour maps), Facies maps, Fence diagrams, Isometric projections, Paleontologic range chart, Sediment maps, Cross sections; Computation of stratigraphic thickness; Drafting of columnar section in graphic symbols; Correlation of electric logs; Study of hand-specimens of different reservoir rocks and coal; Problems related to proximate analysis of coal; Study of thin sections of coal for macerals.

**TEXT BOOKS:**

1. Geology of Petroleum by A.I. LEVORSEN.
2. Petroleum Geology by F.K. NORTH.
3. Petroleum Geology by KENNETH K. LANDES.
4. Principles of Petroleum Geology by WILLIAM L. RUSSEL.
5. Petroleum Geology by RICHARD E. CHAPMAN.
6. Structural Geology for Petroleum Geologists by WILLIAM L. RUSSEL.
7. Important Journals related to Petroleum Geology.
8. Coal Petrology by Prof. E. STACH et al.

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# **MODEL QUESTION PAPER**

**V – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**

**PAPER – II, FUEL GEOLOGY**

**(Effective from the Admitted Batch of 2021-2022)**

**Time: 3Hrs**

**Max. Marks: 80**

**Answer FIVE questions, choosing ONE from each Unit.**

**All questions carry equal marks.**

## **UNIT-I**

1. Describe the various surface occurrences of petroleum drawing neat sketches wherever necessary.

**OR**

2. Write short notes on any **TWO** of the following:  
a) Reservoir rocks. b) Porosity and permeability.  
c) Kerogen shale.

## **UNIT-II**

3. Describe the various types of structural traps with neat sketches.

**OR**

4. Write short notes on any **TWO** of the following:  
a) Primary stratigraphic traps. b) Secondary stratigraphic traps.  
c) Salt domes.

## **UNIT-III**

5. Write an essay on the secondary migration of petroleum.

**OR**

6. Write short notes on any **TWO** of the following:  
a) Primary migration of petroleum. b) Tectonics of Cauvery Basin.  
c) Tectonic of K-G Basin.

## **UNIT-IV**

7. Write an essay on the origin of coal.

**OR**

8. Write short notes on any **TWO** of the following:  
a) Origin of peat swamps. b) Peat – forming plant communities.  
c) Redox potential.

## **UNIT-V**

9. Describe the Exinite group of macerals.

**OR**

10. Write short notes on any **TWO** of the following:  
a) Microlithotypes of coal. b) Coal – bed methane.  
c) Raniganj coal fields.

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# **SYLLABUS**

## **V – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**

### **PAPER- III, GEOINFORMATICS**

**(Effective from the Admitted Batch of 2021-2022)**

#### **UNIT – I**

History of the art of map-marking. Different types of maps. Thematic map, Bathymetric, Oceanographic map. Topographical maps, Geological and Geographical maps. Different scales of maps. Projection of maps. World and India topographical maps and their numbering system. Representation of natural and manmade features on maps.

#### **UNIT –II**

Geographical information systems: Definition and introduction to GIS, Hardware and software requirements for GIS.

#### **UNIT – III**

Data base structures and data formats in GIS, Spatial data mode is (Raster and Vector). Methods of Data capturing, editing and topology creation and integration of spatial and non-spatial data.

#### **UNIT- IV**

Map projections and spatial analysis in GIS. Remote sensing and GIS data integration. Overview of recent GIS packages and their importance.

#### **UNIT-V**

Applications and uses of GIS particularly in geological studies.

#### **PRACTICALS:**

Scanning and Digitization, data export, import and data conversions. Geo-referencing. Overlay analysis and map display.

#### **TEXT BOOKS:**

1. Principals of Geographical Information Systems for Land Resources Assessment by P.A. Burrough, Clarendon Press, Oxford.
2. Geographic Information systems for Geoscientists; Mapping with GIS by Graem f. Bonham – carter, pergemon publisher.
3. Understanding GIS, the ARC / INFO METHOD ESRI Inc. USA.

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### **MODEL QUESTION PAPER**

## **V – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**

### **PAPER- III, GEOINFORMATICS**

**(Effective from the Admitted Batch of 2021-2022)**

**Time: 3Hrs**

**Max. Marks: 80**

**Answer FIVE questions, choosing ONE from each Unit.**

**All questions carry equal marks.**

## UNIT-I

1. Write notes on World and Indian Topographical maps and their numbering system.

**OR**

2. Write notes on different types of Maps, their similarities and differences?

## UNIT-II

3. Answer any **TWO** of the following:
- a) Elements of GIS.
  - b) Data models in GIS.
  - c) Concepts in GIS.

**OR**

4. Define GIS? Explain its role in decision makings?

## UNIT-III

5. Write an essay on Database structures and Data formats in GIS?

**OR**

6. Explain in detail Editing (Error detection and correction) and Topology creation in GIS?

## UNIT-IV

7. Write an essay on integration of Remote Sensing and GIS data?

**OR**

8. Write an essay on current GIS packages and their importance?

## UNIT-V

9. Explain in detail the application of GIS in Environmental Geology?

**OR**

10. Explain in detail the application of GIS in the Earth Sciences?

[illegible]

**SYLLABUS**  
**V – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**  
**PAPER- IV, MINE LEGISLATION & MINE PLANNING**  
**(Effective from the Admitted Batch of 2021-2022)**

**UNIT – I**

Mines and minerals (regulation and development) Act, 1957 – Introduction – Scope – Application – Mining lease – Minor minerals – Prospecting license – Renewal – Royalty and dead rent – Preferential rights – Powers of government. The mineral concession rules (1960) – Introduction – Preliminary – Certification of approval – Grant of prospecting / Mining license for scheduled minerals – Prospecting license – Mining license – Dead rent of review – Statutory time limits.

**UNIT –II**

The Andhra Pradesh minor minerals concession Rules, 1966 – Introduction – Powers – Seizure of minerals – Leases – Quarrying – Grant of quarry lease – Period of lease – Renewal – Auction system – Sand Policy.

**UNIT- III**

The forest conservation Act (1980) and rules (1981). Environmental impact assessment and environmental management planning – Experimentation – Report preparation – National standards.

**UNIT – IV**

Outline of mining plan – General – Geology and resources – Mining – Blasting – Mine drainage – Disposal of waste – Use of mineral – Mineral beneficiation – Surface transport – Site services – Employment potential – Environment management plan.

**UNIT-V**

Conceptual mine planning / Pre feasibility various steps in design opencast and underground mine plans. Geotechnical, groundwater and surface hydrogeological data utilization for mine plan development. Mine development sequence. Design of access Ramp and Haul Roads. Pit design

**TEXT BOOKS:**

1. P. Seshagiri Rao's Law of Mines and Minerals – N. Hunaimy, Asia Law House, Hyderabad.
2. Indian bureau of Mines, Nagpur guidelines for mining plan preparation 1994.
3. Comprehensive guidelines on prospecting requirements. Published by Indian Bureau of Mines, Nagpur 1994.
4. Granite conservation and development rules, 1999. Published by Indian Bureau of Mines, Nagpur, 1999.
5. Indian Minerals year books, Published by Indian Bureau Mines, Nagpur.

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# MODEL QUESTION PAPER

**V – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**

## **PAPER – IV, MINE LEGISLATION & MINE PLANNING**

**(Effective from the Admitted Batch of 2021-2022)**

**Time: 3Hrs****Max. Marks: 80**

**Answer FIVE questions, choosing ONE from each Unit.**

**All questions carry equal marks.**

## UNIT-I

1. Write essay on applications of Mining Lease, Mineral prospecting and royalty.

**OR**

2. Write short notes on any **TWO** of the following:
- a) Preferential rights.
- b) The mineral concession rules.
- c) Statutory time limits.

## UNIT-II

3. Briefly explain the Leases of quarrying grants and renewal process.

**OR**

4. Write short notes on any **TWO** of the following:
- a) Sand policy.
  - b) Seizure of minerals.
  - c) Auction systems.

## UNIT-III

5. Briefly explain the Forest conservation rules.

**OR**

6. Write short notes on any **TWO** of the following:
- a) Environmental impact assessment.
  - b) Environmental management planning.
  - c) Report preparation – National standards.

## UNIT-IV

7. Briefly explain the Outlines of mine planning.

**OR**

8. Write short notes on any **TWO** of the following:
- a) Mineral Beneficiation.
  - b) Site services.
  - c) Environmental impact.

## UNIT-V

9. Briefly explain the Conceptual mine planning..

**OR**

10. Write short notes on any **TWO** of the following:
- a) Opencast mine plan.
  - b) Underground mine plan.
  - c) Haul Road desing

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## **SYLLABUS**

### **VI – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**

#### **PAPER – I, MINERAL ECONOMICS**

**(Effective from the Admitted Batch of 2021 – 2022)**

#### **UNIT – I**

Concept of mineral economics – Significance of minerals in the nation's economy – Identification of the problems – Peculiarities inherent in mineral industry – International aspects of mineral industry and geopolitics – Mines and mineral legislation in India – Mineral taxation – National Mineral Policy.

#### **UNIT –II**

Classification of minerals – major, minor and fuels, Industrial – Strategic, critical and essential minerals – Present and future mineral supplies of the world.

#### **UNIT – III**

Reserves, production and distribution of various minerals in the world – Indian position in the reserves, production and consumption of various minerals – Exports and imports of minerals – Tenor, grade and specification of important minerals with examples.

#### **UNIT- IV**

Conservation and substitution of minerals – Low grade ores – Use of scrap – New technologies, synthetics, Changing pattern of mineral consumption.

#### **UNIT-V**

Growth of mineral industry and economy in India– Minerals and mineral based industries in Andhra Pradesh. Economic minerals of Andhra Pradesh, Captive mining.

#### **PRACTICALS:**

Problems of ore Economic calculations.

#### **TEXT BOOKS:**

1. An introduction to mineral economics by K.K. Chatterjee, Wiley Eastern Ltd.
2. Mineral economics by R.K. Sinha and N.S. Sharma.
3. Minerals in the World Industry by Vosknil, W.H.

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**MODEL QUESTION PAPER**  
**VI – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**  
**PAPER – I, MINERAL ECONOMICS**  
**(Effective from the Admitted Batch of 2021-2022)**

**Time: 3Hrs**

**Max. Marks: 80**

**Answer FIVE questions, choosing ONE from each Unit.**

**All questions carry equal marks.**

**UNIT-I**

2. Concept and scope of mineral economics.

**OR**

11. Write short notes on any **TWO** of the following:
- b) Mineral legislation in India.
  - b) National mineral policy.
  - c) Geopolitics.

**UNIT-II**

12. Write on classification of minerals in economic point of View.

**OR**

13. Write short notes on any **TWO** of the following:
- b) Strategic minerals.
  - b) Industrial minerals.
  - c) Future mineral supplies of the world.

**UNIT-III**

14. Write on India's various mineral positions in the world.

**OR**

15. Write short notes on any **TWO** of the following:
- d) Tenor.
  - e) Specification of important minerals for various industries.
  - f) Export and Import of minerals.

**UNIT-IV**

16. Write a detailed account on conservation and substitution for various minerals.

**OR**

17. Write short notes on any **TWO** of the following:
- d) Changing pattern of mineral consumption in India.
  - e) Low grade ores.
  - f) Use of scraps.

**UNIT-V**

18. Write a detailed account on mineral based industries in Andhra Pradesh.

**OR**

19. Write short notes on any **TWO** of the following:
- d) Growth of mineral industry.
  - e) Mineral based economy in India.
  - f) Economic minerals of Andhra Pradesh.

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## **SYLLABUS**

### **VI – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**

#### **PAPER- II, ENVIRONMENTAL GEOLOGY**

**(Effective from the Admitted Batch of 2021 - 2022)**

##### **UNIT-I**

Principles of Environmental geology; Land and its use and management; Desertification and degradation of land; Water resources – Hydrogeological considerations and management; Soil profile, degradation, conservation; Erosion – causes and control.

##### **UNIT-II**

Geo-environmental hazards – Volcanoes, Earthquakes, Dams and reservoirs Landslides, Tunnels, Floods, Cyclones and Tsunamis, Subsidence, Avalanches.

##### **UNIT-III**

Pollution and Energy – types of pollution: Water Pollution; Air pollution; Noise pollution; Land Pollution, Global Warming; Alternative Sources of Energy.

##### **UNIT-IV**

Impact of Mining activities on environments: Soils, water resources, Mine dump Problems and Management.

##### **UNIT-V**

Environmental Impact assessment structures for various disasters like volcanoes, Floods, Tsunamis, Landslides, surface and underground mining

#### **PRACTICALS:**

1. Landslide Prone areas
2. Land subsidence studies
3. Coastal studies
4. Water pollution studies

#### **TEXT BOOKS:**

5. India's Environmental problems and perspective by Radhakrishna, K.K. Geological Society of India, Bangalore.
6. Environmental Geology – Indian context by Valdiya, K.S. (Tata\_Mc-Graw Hill Publ. Co., New Delhi).
7. The Dynamic Earth System by Patwardhan, A M (Prentice Hall of India Pvt. Ltd., New Delhi).
8. Engineering and General Geology, by Parbin Singh (Katson Publ House, Ludiana).
9. Soil erosion and conservation by Tripathi, R.P. and Singh, H.P (Wiley Eastern Limited, New Delhi).
10. Environmental Hazards, Smith, K. 1992, Routledge, London.

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## **MODEL QUESTION PAPER**

### **VI – SEMESTER, M.Sc. (TECH) APPLIED GEOLOGY**

#### **PAPER- II, ENVIRONMENTAL GEOLOGY**

**(Effective from the Admitted Batch of 2021-2022)**

**Time: 3Hrs**

**Max. Marks: 80**

**Answer FIVE questions, choosing ONE from each Unit.**

**All questions carry equal marks.**

#### **UNIT-I**

1. Explain the land management methods.

**OR**

2. Write short notes on any **TWO** of the following

- a) Environmental Geology   b) Land Desertification.   c) Soil Profile.

#### **UNIT-II**

3. What is an earthquake, Explain the geo-environmental effects due to earthquakes.

**OR**

4. Write short notes on any **TWO** of the following

- a) Cyclones and coastal areas.   b) Volcanoes   c) Tunnels

#### **UNIT-III**

5. What is a global warming? Discuss the problems from global warming.

**OR**

6. Write short notes on any **TWO** of the following

- a) Water pollution.   b) Alternate sources of Energy  
c) Land Pollution.

#### **UNIT-IV**

7. Discuss the impact of mining activities on the environmental on soils.

**OR**

8. Write short notes on any **TWO** of the following

- a) Acid mine drainage  
b) Mine dumps managements  
c) Systematic disposal Mine waste .

#### **UNIT-V**

9. Write briefly about various stages of Environmental impact assessment studies for

Underground mines.

**OR**

10. Write short notes on any **TWO** of the following

- a) Tsunamics  
b) Landslides.  
c) Floods.

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## **SYLLABUS**

### **VI – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**

#### **PAPER- III, MINERAL PORCESSING ENGINEEING**

#### **(Effective from the Admitted Batch of 2021-2022)**

##### **UNIT – I**

Introduction fundamentals of mineral processing. Importance of mineral processing, economics of mineral processing, occurrence of ores in nature, justification for mineral processing, Role of geologist in mineral processing.

##### **UNIT –II**

Crushing, type of crushers, cone crushers, Hammer mill, stamp mill, recent advances in crushing, principles of grinding, dry and wet grinding, trembling mills – Ball mill, types of ball mills, rod mill, types of rod mills.

##### **UNIT – III**

Classification in mineral processing. types of classifiers, screening, types of screening, statitionary screens, vibrating screens, laboratory screens, wet and dry screening.

##### **UNIT- IV**

Hydrocyclones, types of hydrocyclones, densemedia separation, flocculation and dispersion application, Floatation and agglomeration application, Jigging, types of Jigging, tabling, types of tables, application. Magnetic separation, types of magnetic separators.

##### **UNIT-V**

Flow sheet design, miscellaneous processes – hydro metallurgy, heap leaching, hot water drying of coals, radiometric methods of coal separation. Flow sheets of beach sand separation, copper, lead, zinc separation of Khetri and Jawar mines, coal washery design.

#### **PRACTICALS:**

1. Horse power (HP) calculation.
2. Mass balance of a flow sheet.
3. Flow sheet design.
4. Performance of a jaw crusher.
5. Performance of a hand jig.
6. Assignment on a topic of mineral processing design and presentation.
7. Visit to a mineral processing industry.

#### **TEXT BOOKS:**

1. Principles of mineral dressing – A.M. Gaudin.
2. Elements of ore dressing – A.F. Taggart.
3. Course in mining geology – R.N.P. Araogyaswamy.
4. Mineral processing – E.J. Pryor.
5. Ore Processing – S.K. Jain.
6. Ore deposits of India – Their distribution and processing – K.V.G.K. Gokhale and T.C. Rao.

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## **MODEL QUESTION PAPER**

**VI – SEMESTER, M. Sc. (TECH) APPLIED GEOLOGY**

**PAPER – III, MINERAL PROCESSING ENGINEERING**

**(Effective from the Admitted Batch of 2021-2022)**

**Time: 3Hrs**

**Max. Marks: 80**

**Answer FIVE questions, choosing ONE from each Unit.**

**All questions carry equal marks.**

### **UNIT-I**

1. Write about operations involved in mining and mineral processing.

**OR**

2. Answer any **TWO** of the following:
- a) Occurrence of ores.
  - b) Role of geologist in mineral processing.
  - c) Economics of mineral processing.

### **UNIT-II**

3. Write about different types of crushers and their operation.

**OR**

4. Write notes on any **TWO** of the following:
- a) Ball mill.
  - b) Rod mill.
  - c) Hammer mill

### **UNIT-III**

5. Write in detail about different types of classifiers.

**OR**

6. How the sizing operation takes place by using screening operations.

### **UNIT-IV**

7. Describe the method of Flotation.

**OR**

8. Write short notes on any **TWO** of the following:
- a) Jigging.
  - b) Tabling.
  - c) Flocculation and agglomerates.

### **UNIT-V**

9. Write about the miscellaneous processes of mineral processing.

**OR**

10. Write short notes on the following:
- a) Lead and Zinc concentration.
  - b) Case study of beach sand processing.

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