Department of Geology
Faculty of Earth Sciences
Mohanlal Sukhadia University, Udaipur

M. Sc. Tech. (Applied Geology) - Course Structure
Under Choice Based Credit System (CBCS) w. e. f. 2020 – 2021

Core Papers

Paper Code	Paper Name
MT1GEO01-CT01	STRUCTURAL GEOLOGY AND TECTONICS
MT1GEO02-CT02	MICROPALEONTOLOGY
MT1GEO03-CT03	MINERAL EXPLORATION AND MINING GEOLOGY
MT1GEO04-CT04	MINERAL TECHNOLOGY AND MINERAL ECONOMICS
MT2GEO01-CT05	ADVANCED REMOTE SENSING IN GEOSCIENCES
MT2GEO02-CT06	ENGINEERING AND GROUND WATER GEOLOGY
MT2GEO03-CT07	PETROLEUM, COAL AND RADIOACTIVE MINERALS
MT2GEO04-CT08	OCEANOGRAPHY AND CLIMATOLOGY
MT1GEO05-CP01	Practical – I : STRUCTURAL GEOLOGY AND TECTONICS & MICROPALEONTOLOGY
MT1GEO06-CP02	Practical – II : MINERAL EXPLORATION AND MINING GEOLOGY & MINERAL TECHNOLOGY AND MINERAL ECONOMICS
MT2GEO05-CP03	Practical – III : ADVANCED REMOTE SENSING IN GEOSCIENCES & ENGINEERING AND GROUND WATER GEOLOGY
MT2GEO06-CP04	Practical – IV : PETROLEUM, COAL AND RADIOACTIVE MINERALS & OCEANOGRAPHY AND CLIMATOLOGY)

Skill Paper

Paper Code	Paper Name
MT2GEO07-SE01	Geological and Mining Consultancy

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(Dr. Maya Chaudhary)	(Dr. Harish Kapasya)	(Mr. Subhash Chandra Janagal)

M. Sc. Tech. (Applied) Geology - Course structure

Under Choice Based Credit System (CBCS) w. e. f. 2020 – 21

Department of Geology

Faculty of Earth Sciences, M.L. Sukhadia University

M. Sc. Tech. (Semester I)
APPLIED GEOLOGY

Course S.No.	Course Code	Title of Course	L-T-P	No. of Credit	Max. Marks		Total
					Univ. Exam	Inter. Exam	
1	MT1GEO01-CT01	Core Course – I STRUCTURAL GEOLOGY AND TECTONICS	3-1-0	4	80	20	100
2	MT1GEO02-CT02	Core Course – II MICRO-PALEONTOLOGY	3-1-0	4	80	20	100
3	MT1GEO03-CT03	Core Course – III MINERAL EXPLORATION AND MINING GEOLOGY	3-1-0	4	80	20	100
4	MT1GEO04-CT04	Core Course – IV MINERAL TECHNOLOGY AND MINERAL ECONOMICS	3-1-0	4	80	20	100
5	MT1GEO05-CP01	Core Course PR– I **(**STRUCTURAL GEOLOGY AND TECTONICS & MICRO-PALEONTOLOGY **)**	0-0-8	4	80	20	100
6	MT1GEO06-CP02	Core Course PR– II **(**MINERAL EXPLORATION AND MINING GEOLOGY & MINERAL TECHNOLOGY AND MINERAL ECONOMICS **)**	0-0-8	4	80	20	100
	TOTAL			24	480	120	600

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SYLLABUS

M. Sc. Tech (Semester I) 2020-21

APPLIED GEOLOGY

MT1GEO01-CT01 Core Course – I : STRUCTURAL GEOLOGY AND TECTONICS

No. of Credits : 4

UNIT – I

Analysis of deformation. Mechanics of deformation. Strain ellipsoid. Homogeneous and inhomogeneous deformation. Progressive strains, strain paths, deformation paths, determination of strain in deformed rocks.

UNIT- II

Microstructures of deformed rocks and crystallographic preferred orientation in deformed rocks developed by slip, rotation and recrystallization.

UNIT-III

Principles of structural analysis. Structural diagrams- Methods and Interpretations. Criteria of recognition of polyphase deformation. Analysis of areas with simple and complex structures.

UNIT-IV

Ductile Shear zones- geometry and Fabric development. Thrusts tectonic mélange.

UNIT- V

Major Earth Structures, plate tectonics, Geological structures and plate tectonics.

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M. Sc. Tech. (Semester I) 2020-21

APPLIED GEOLOGY

MT1GEO02-CT02 **Core Course – II :** MICRO-PALEONTOLOGY

No. of Credits : 4

UNIT-I

Introduction and Historical account of development of subject. Classification of microfossils. Techniques of collection and preparation of microfossils. Application of Micropalaeontology in petroleum, Exploration in determination of age of the stratum, local and regional correlation of subsurface succession of Oil Wells, palaeofacies and Tectonic history of the basin, Procedure in classification.

UNIT-II

Foraminifera : The living animal, Alternation of generations, Morphology of the test, Classification and Systematic of Super-families, Families and more important Genera (with particular phylogenetic relationship), Ecology & Palaeoecology, and Geological History.

UNIT-III

Ostracode: Morphology; Classification, Systematic of important genera, Ecology and Palaeoecology and geological history.

Condonts: Morphology; Classification, Zoological affinity and geological history.

UNIT-IV

Pollen, Spore and Seeds: Morphology; Classification, and geological history. Application of Palynology with reference to Petroleum and Coal exploration.

UNIT-V

Introducation to Morphology, Classification and geological History of the microfossils viz. Acritarchs, Calcareous algae, Calpionellids, Chitinozoans, Coccoliths, Diatoms, Dinoflagellates, and Radiolarians.

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M. Sc. Tech. (Semester I) 2020-21
APPLIED GEOLOGY

MT1GEO03-CT03 Core Course – III : MINERAL EXPLORATION AND MINING GEOLOGY

No. of Credits : 4

UNIT-I

Exploration and Mining Geology: Outline of Growth and Development of Mining Geology. Gathering and presenting geological data including geologic mapping in underground mines. Ore search and guides. Drilling for geologic information,Plannig of drill holes and logging of drill hole data.

UNIT- II

Sampling ore bodies and Estimation of ore reserves. Examination and evaluation of Prospect and mines. Role of Geologist in exploration and mining. Consulting Geologists.

UNIT-III

Exploration Geophysics: Fundamentals of geophysical prospecting, Methods and Application. Air borne and Ground geophysical surveys, Planning and coordinating geophysical work.

UNIT-IV

Exploration Geochemistry: Principles of geochemical prospecting. Exploration geochemistry sequence, Methods and application. Field and Laboratory analytical methods (Assaying methods.) Treatment of geochemical data.

UNIT-V

Ore Microscopy: Principles of Ore-Microscopy. Procedures of preparing polished sections, Etching. Scientific and industrial application of ore microscopy. Textures of ore minerals and paragenesis.

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M. Sc. Tech. (Semester I) 2020-21
APPLIED GEOLOGY

MT1GEO04-CT04 Core Course – IV: MINERAL TECHNOLOGY AND MINERAL TECONOMICS

No. of Credits : 4

UNIT – I

Principles of ore dressing. Comminution-breaking, crushing and grinding. Principles and methods of screening and classification. Filtration. Methods of Concentration - Hand sorting, Washing, Gravity concentration, Heavy media separation, Flotation, Magnetic, Electrostatic and other methods. Study of mineral dressing processes of important ores and Industrial minerals in India.

UNIT - II

Non-Metallic minerals: State-wise distribution of the resources, production, exports and imports, industrial uses and specifications of the important non- metallic minerals of India and their world scenario.

UNIT – III

Metallic minerals: State-wise distribution of the resources, production, consumption and uses, exports and imports of the important metallic minerals of India and their world scenario.

UNIT – IV

Energy and fuel minerals: State-wise distribution, production, consumption, exports and imports of the important energy and fuel minerals of India and their world scenario.

UNIT –V

Peculiarities of mineral deposits. Conservation and substitution of minerals. Mineral concession rules of India. National mineral policy. Mineral policy of Rajasthan: Granite and Marble policy. Strategic, critical and essential minerals.

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M. Sc. Tech. (Semester I) 2020-21
APPLED GEOLOGY

MT1GEO05-CP01 **Core Course PRACTICAL – I** **No. of Credits : 4**

(STRUCTURAL GEOLOGY AND TECTONICS & MICRO-PALEONTOLOGY**)**

Structural Geology and Tectonics:

1. Identification of structural elements and their chronology in hand specimen.
2. Solution of structural problems by stereo-graphic projection, single and double rotation problems.
3. Structural analysis with stereonet: s-pole, B-pole diagram, methodology and interpretation of patterns.
4. Drill hole problems.

Micropaleontology

1. Identification and morphological study of following microfossil genera under stereozoom microscope: Ostracodes, Foraminifera, Conodonts and Charophytes.
2. Morphological features of Pollens & spores, Acritarchs, Diatoms and Radiolaria.

Viva Voice

Field Training

Record

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M. Sc. Tech. (Semester I) 2020-21
APPLED GEOLOGY

MT1GEO06-CP02 **Core Course PRACTICAL – II** **No. of Credits : 4**

(MINERAL EXPLORATION AND MINING GEOLOGY & MINERAL TECHNOLOGY AND MINERAL ECONOMICS**)**

Mineral Technology and Mineral Economics

1. Flow sheets of beneficiation of important ore minerals.
2. Industrial specification of important industrial minerals.
3. Study of important metallic and non-metallic minerals in hand specimen.

Mineral Exploration and Mining Geology

1. Survey and leveling by Theodolite and related problems.
2. Estimation of ore reserves.
3. Site selection for bore-holes.
4. Basic knowledge and handling of GPS.

Viva Voice

Record

Compulsory Field Training Program : Geological Field Training mainly based on Structural Mapping. – 10 days duration

Note: **Field Training is Compulsory, Student not taking part in the field training shall not be allowed to appear in the examination**

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M. Sc. Tech. (Semester II) 2020-21
APPLIED GEOLOGY

Course S.No.	Course Code	Title of Course	L-T-P	No. of Credit	Max. Marks		Total
					Univ. Exam	Inter. Exam	
1	MT2GEO01-CT05	Core Course – V ADVANCED REMOTE SENSING IN GEOSCIENCES	3-1-0	4	80	20	100
2	MT2GEO02-CT06	Core Course – VI ENGINEERING AND GROUND WATER GEOLOGY	3-1-0	4	80	20	100
3	MT2GEO03-CT07	Core Course – VII PETROLEUM, COAL AND RADIOACTIVE MINERALS	3-1-0	4	80	20	100
4	MT2GEO04-CT08	Core Course – VIII OCEANOGRAPHY AND CLIMATOLOGY	3-1-0	4	80	20	100
5	MT2GEO05-CP03	Core Course PR– III **(**ADVANCED REMOTE SENSING IN GEOSCIENCES & ENGINEERING AND GROUND WATER GEOLOGY**)**	0-0-8	4	80	20	100
6	MT2GEO06-CP04	Core Course PR– IV **(**PETROLEUM, COAL AND RADIOACTIVE MINERALS & OCEANOGRAPHY AND CLIMATOLOGY**)**	0-0-8	4	80	20	100
7	MT2GEO07-SE01	Skill Course Elective **Geological & Mining Consultancy**	0-0-4	2	80	20	100
	TOTAL			26	560	140	700

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(Dr. Harish Kapasya)

Checked and pproved
(-sd)

(Mr. Subhash Chandra Janagal)

M. Sc. Tech. (Semester II) 2020-21
APPLIED GEOLOGY

MT2GEO01-CT05 Core Course – V : ADVANCED REMOTE SENSING IN GEOSCIENCES
No. of Credits : 4

UNIT-I

Types and geometry of aerial photography, tilt and relief distortion. Elements of photogrammetry, stereoscopy, stereovision, flight planning. Height and slope rectification of aerial photo-interpretation techniques. Recognition of photo- elements and terrain elements like drainage pattern, density, type, landform behavior of rocks and soil material, vegetation characteristics, and use and associations.

UNIT-II

Electromagnetic energy, electromagnetic spectrum, image characteristics. Physics of remote sensing, black body radiation, laws of radiation, atmospheric interaction. Scattering, reflection, absorption, transmission. Remote Sensing data products, geometric and radiometric correction, thermal and microwave remote sensing. Digital Image processing Space missions, Indian Remote Sensing Satellites. Remote Sensing: data source, platforms and sensors Acquisition of remotes sensing data. Remote Sensing techniques in Geosciences: Visual Interpretation of satellite image: Techniques of image interpretation using spectral, spatial and temporal information. Signature of the nature objects.

UNIT-III

Interpretation of lithology: rock types, discrimination of igneous, sedimentary and metamorphic terrain under different climate condition. Photo-interpretation of structural and landform elements. Geomorphic features of glacial, fluvial, costal, eolian and denudation landforms. Geomorphologic mapping and terrain evaluation.

UNIT-IV

Terrain Analysis for Engineering projects: principles, terrain classification, terrain mapping, properties of martial and masses. Application of Remote Sensing techniques in site selection of dams, bridges, air strips, road, tunnels, canals. Studies in slope failure, rock failure and soil relationship of rock types and geomorphology to various soil types, Soil mapping and land cover mapping. Forest types, their distribution and relationship of vegetation to rock types. Relationship between vegetation and geomorphic parameters.

UNIT-V

Geographic Information System: components, data presentational, vector and raster methods, input are and definition of equipment. Database design and structure. Data analysis and cartographic modeling. Digital elevation model. Data representation and techniques.

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M. Sc. Tech. (Semester II) 2020-21
APPLIED GEOLOGY

MT2GEO02-CT06 Core Course – VI : ENGINEERING AND GROUND WATER GEOLOGY

No. of Credits : 4

UNIT-I

Engineering Geology: Dams and Reservoirs – Types of dams and reservoirs and their salient features, selection of sites, geological investigation for dams and reservoirs, examples of some major dams, causes of dam failure, geological problems after dam construction. Tunnels – Types, geological investigations, soft ground tunneling. Roads & Highways – Geological investigations for roads and highways, Roads and highways in hilly, marshy and permafrost regions, geological problems after road and highways construction. Land-Slides – causes, effects and mitigation.

UNIT-II

Foundation of bridges and pavements and their geological considerations. Building site exploration and foundation and its geo-engineering aspects. Earth work. For various civil engineering projects. Engineering properties of rocks. Elements of Soil and Soil mechanics, Engineering use of soils.

UNIT-III

Ground water Geology: Elements of ground water hydrology. Source of ground water and origin. Hydrologic cycle. Occurrence and distribution of ground water. Hydrological properties of water bearing materials. Different types of openings in rocks. Porosity, Permeability, Transmissibility, Storage coefficient, Specific yield, Specific retention, Laws governing them and methods of their determination.

UNIT-IV

Occurrence of ground water in different types of rocks-igneous, metamorphic and sedimentary (Soluble, Non-soluble and Non- indurated sedimentary). Water table; Important causes of fluctuation. Water table and pressure surface maps, methods of their construction and their interpretation. Fresh and Salt water relationship in coastal areas.

UNIT-V

Exploration of ground water by various methods: Geological methods, Hydrological methods, Geophysical methods. Wells –Different types of wells and equipments of their construction. Use of well hydraulics; Well characteristics and their determination. Use and conservation of ground water. Artificial recharge of ground water. Basin-wise development of groundwater in Indian subcontinent. Groundwater provinces of India and Rajasthan.

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M. Sc. Tech First Year (Semester II) 2020-21
GEOLOGY

MT2GEO03-CT07 Core Course – VII : PETROLEUM, COAL AND RADIOACTIVE MINERALS

No. of Credits : 4

UNIT-I

Petroleum: Nature, characteristics, origin, entrapment and migration of Petroleum. Properties of source and reservoir rocks. Structural, stratigraphic and combination traps.

UNIT-II

Study of petroliferous basins of India and important basins of world, Exploration techniques of petroleum.

UNIT-III

Coal: Nature, Characteristic, Classification and petrography of coal. Rank, grading conservation and commercial uses.

UNIT-IV

Study of coal fields of India and important world deposits. Exploration, exploitation and beneficiation of with special reference to India.

UNIT-V

Radioactive minerals : nature, Characteristic, distribution, classification, potentialities, conservation and utilization of important radioactive minerals. Geological study and origin of important radioactive minerals deposits of India and world.

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M. Sc. Tech. (Semester II) 2020-21
APPLIED GEOLOGY

MT2GEO04-CT08 Core Course – VIII: OCEANOGRAPHY AND CLIMATOLOGY

No. of Credits : 4

UNIT-I

Hypsography of the continents and ocean floor –continental shelf, slope, rise and abyssal plains. Physical and chemical properties of sea water and their spatial variations. Residence times of elements in sea water. Ocean currents, waves and tides, important current systems.

UNIT-II

Oceanic sediments: Factors controlling the deposition and distribution of oceanic sediments. Thermohaline circulation and the oceanic conveyor belt. Major water masses of the world's oceans. Biological productivity in the oceans.

UNIT-III

Joint Global Ocean Flux Study (JGOFS) and its applications in Paleoceanography. Ocean Drilling Programme and its major accomplishments in paleoceanography. Approached to paleo oceanographic reconstructions; various proxy indicators for paleo ocenographic interpretations. Opening and closing of ocean gateways and their effect on circulation and climate during the Cenozoic. Sea level processes and Sea level changes.

UNIT-IV

Fundamental principles of climatology. Insolation and heat budget, radiation balance, general circulation of the atmosphere. Latitudinal and seasonal variation of insolation, temperature, pressure, wind belts, humidity and precipitation, water balance. Air masses, monsoon, Jet streams, tropical cyclones, and El Nino Southern Oscillation (ENSO).. Classification of climates – Koppen's and Thornthwaite's scheme of classification.

UNIT-V

Structure and chemical composition of the atmosphere, lapse rate and stability, greenhouse gases and global warming. Cloud types, formation and precipitation processes, air- sea interactions on different space and time scales. Climatic and sea level changes on different time scales. Coupled ocean-atmosphere system, General weather systems of India, - Monsoon system.

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M. Sc. Tech. (Semester II) 2020-21
APPLIED GEOLOGY

MT2GEO05-CP03 **Core Course PRACTICAL – III** **No. of Credits : 4**

(ADVANCED REMOTE SENSING IN GEOSCIENCES &
ENGINEERING AND GROUND WATER GEOLOGY**)**

Advanced Remote Sensing in Geosciences

Photo based, air-based calculations; Analysis of the drainage system using aerial photographs; Geomorphic mapping on aerial photographs; Geological and structural mapping using aerial photographs.; Lineament analysis on satellite images; Geological and structural studies using imageries.

Engineering and Ground Water Geology

Problems related to aggregate impact values of rock samples, moisture content and dry density in rocks; Exercises based on physico-mechnical properties of rock samples; Preparation of iso-hyetal maps; Groundwater contouring; Rainfall frequency analysis; Calculation of porosity, permeability, yield; Pumping test exercises; Problems related to chemical quality of groundwater.

Viva Voice

Field Training

Record

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M. Sc. Tech. (Semester II) 2020-21
APPLIED GEOLOGY

MT2GEO06-CP04 **Core Course PRACTICAL – IV** **No. of Credits : 4**

(PETROLEUM, COAL AND RADIOACTIVE MINERALS & OCEANOGRAPHY AND CLIMATOLOGY**)**

Petroleum, Coal and Radioactive Minerals

Distribution of petroleum, coal and radioactive minerals in World, India and Rajasthan; Identification of coal and radioactive minerals in hand specimen; Exercise on reservoir volume and yield calculation; Coal petrography

Oceanography and Climatology

Study of distribution of major climatic regimes of India on map; Distribution of major wind patterns on World map; Preparation of paleogeographic maps (distribution of land and sea) of India during specific geological time intervals; Numerical exercises on interpretation of proxy records for paleoclimate; Exercises on establishing chronology

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Viva- Voice

Record

Compulsory Field Training Program : Geological Field Training mainly based on Engineering Geology, Groundwater and Ore Dressing. – 10 days duration

Note: **Field Training is Compulsory, Student not taking part in the field training shall not be allowed to appear in the examination**

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M. Sc. Tech. (Semester II) 2020-21
APPLIED GEOLOGY

MT2GEO07-SE01 Skill Course Elective – Geological & Mining Consultancy No. of Credits : 2

Elements of Geological and Structural Mapping

Surveying Techniques

Rules and Regulation related to granting of P.L./M.L

Procedure to obtain mining lease and NOCs from related organizations

Preparation of Mine Plan / Environmental Clearance Report (EC)

Procedure of Public Hearing

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