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

## Outcome of M. Sc. Geology Programme

After getting M.Sc. degree students get jobs in Central Government Department like Geological survey of India, Indian Bureau of Mines, Central Groundwater Board etc. Public enterprises and MNC like ONGC, Oil India, Cairn Energy etc. They also get jobs in state Government Department like Department of Mines and Geology, Groundwater Department, state government enterprises like RSMM. All mineral, cement and building stone industries employ them as geologist. Also working as private consultants.

| **Course/Paper Code** | **Course/Paper Name** | **Objective of Course** | **Outcome of Course** |
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| M1GEO01-CT01 | Tectonics and Geomorphology | It is aimed to learn about the role of tectonics in landscape evolution, the coupling of tectonics and climate, tools and methods used in the investigation of landforms and landscape responses to deformation in different timescales | Outcomes are expected in terms of coupled knowledge of tectonics and geomorphology. It is expected that the students bear the knowledge to understand the processes of geomorphology with the role of tectonics. |
| M1GEO02-CT02 | Mineralogy | The objective of the course is to understand the distribution of minerals in different Earth's spheres and evaluate different processes of the Physico-chemical environment of their formation. The course also includes minerals, which are of economic significance and learn the basic principles to identify them. | At the end of the course the successful students able to identify and characterize the common minerals based on their physical, chemical and optical properties. The students will also get the idea of preliminary knowledge on instrumentation techniques used for mineralogical studies. |

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| M1GEO03-CT03 | Palaeontology -I | To explain the origin and evolution of life is intricately linked with the geological history of the Earth. Students explore knowledge about the evolutionary history of organism. | Through the fossil records students will explore topics such as evolutionary diversity, exceptional preservation and palaeoclimates. Through the key groups of invertebrate fossils students will come to know about the major concepts such as the origin of life, patterns of evolution and extinction, the importance of exceptional fossil assemblages, and the relationship between ecology and evolution. |
| M1GEO04-CT04 | Precambrian Stratigraphy | It is aimed to make understand almost 90% of Earth's geological history through this paper by pertaining knowledge of lithology, crustal evolution and geochronology. | Students are expected to carry with them knowledge based upon geochronological sequence of rock layers formed in India and World all over during Precambrian time. The knowledge imparted will bear characterization of Precambrian rocks with respect to lithology, structure, extension, location, age & life preserved in them if any. |
| M2GEO01-CT05 | Structural Geology | The objective of the course is to teach the students how does the Earth respond to applied forces. This course looks at how rocks deform and change shape, and how we can recognise and use structures within rocks to determine ancient magnitudes and orientations of stress fields. Basic concepts of the rheological properties of rocks and their control on the deformation processes. | At the conclusion of this class, students should be able to quantitatively describe the three-dimensional structure of rocks in the earth's crust, using geologic maps and/or outcrop data and reconstruct the deformation history of deformed rocks based on fabrics and geometric relationships. |
| M2GEO02-CT06 | Sedimentary Petrology | Students will understand the nature of sediment formation, transport and deposition as well as different types of sedimentary rocks, their textures and structures in interpretation and reconstruction of sedimentary facies, paleogeography, paleoclimates and depositional histories. | After successful completion of this course the student will be able to classify different sedimentary rocks. Also this course will help them in interpreting different sedimentary depositional environment. |

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| M2GEO03-CT07 | Palaeontology – II | Students come to know some important groups of fauna and flora keeping importance in the geologic history of the earth. | Through the key groups of invertebrate fossils students will come to know about the major concepts such as the origin of life, patterns of evolution and extinction, the importance of exceptional fossil assemblages, and the relationship between ecology and evolution. Through the vertebrate's evolution and Gondwana Plants study students will come to know their importance in geological history. |
| M2GEO04-CT08 | Phanerozoic Stratigraphy | Phanerozoic periods exceptionally covers important geological history of evolution of life that stands buried in the rocks but need to be revealed through study of outcrops, fossils, rocks that includes distribution and age components. | It is expected that the outcomes from the study of paper will include stratigraphic sequencing during Phanerozoic time. The knowledge based outcome will include characterization, lithology, structure, extension, location, age and life preserved in these rocks. |
| M3GEO01-CT09 | Economic Geology | The course educates the concepts of Economic Geology in general, starting with details of various ore forming processes, their controls and relation with tectonic processes. The course also enables students to learn about important metallic and non-metallic minerals, their ore, geologic and geographic distribution. The course further introduces students about fuel minerals including coal and petroleum. | The students upon successful completion of this course will be well versed with various processes involved in formation of ore deposits. It is expected that student will be able to better appreciate the potential of various mineral commodities across the country. |
| M3GEO02-CT10 | Igneous Petrology | • To impart knowledge about the magmatic systems<br>• To train the students about the dynamism of the earth in the field of igneous petrology.<br>• To gain an appreciation for how the igneous rocks is controlled by chemical and physical properties of magmas. | Upon successful completion of course the students would be able to<br>• Understand the mantle system and magmatic processes.<br>• Understand the basic principles of phase rule and its relation with binary and ternary systems and origin of different igneous rocks. |

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| M4GEO01-CT11 | Metamorphic Petrology | • To impart knowledge on Metamorphism and metasomatism process.<br>• To train the students to understand the different processes of formations of metamorphic rocks and their significance. | Upon successful completion of course the students would be able to<br>• Understand the factors and agents of metamorphism.<br>• Understand the textures and mineral assemblages of different zones of metamorphism.<br>• Understand the processes of metasomatism and their types.<br>• Understand the representation of mineral paragenesis & graphical representation of metamorphic rock. |
| M4GEO02-CT12 | Mineral Exploration & Mining Geology | • To impart knowledge of geological field survey.<br>• To train the students to understand functioning of necessary instruments required during geological field survey.<br>• To Understand various geological structures found at outcrops.<br>• To Understand fundamentals of geological processes and stratigraphic correlation.<br>• To Understanding observations and recording of important filed information and to classify various types of features procured from field study.<br>• To Understand fundamentals of the geophysical methods of mineral exploration.<br>• To Understand the principles of mineral economics and bore hole logging. | Upon successful completion of course the students would be able to:-<br>• Understand the basic concept of geological field work and various instruments used in field work.<br>• Learn about the geological processes that lead to the formation of mineral deposits in nature, and about which minerals and rocks represent important resources for society. At the end of the study period, will be in a position to contribute to the exploitation of known mineral deposits, and to contribute to exploration for new deposits. You will also learn how exploitation of mineral deposits can take place with minimal negative consequences for the environment, and how harmful emissions from mines and mineral deposits can be stopped or limited.<br>• Field work including geological and structural mapping.<br>• Preparation of field report based on the recorded data, mapping data as well as laboratory work on the rock samples collected |

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| | | | during the field work |
| M1GEO05-CP01 | Practical – I : Tectonics and Geomorphology & Mineralogy | For Tectonics and Geomorphology<br>To be able to recognize, analyze, and describe landforms, materials of which they are composed, and processes by which they form. Students come to know about to explain the concepts and theories of plate tectonics, mass balance, dynamics and hydrology and will be able to understand the processes by which transportation of earth material occurs through fluvial and gravitational processes.<br><br>For Mineralogy<br>The student will learn the basic principles behind the arrangement of atoms how these atoms are coordinated and bonded and how this is reflected in the external form and its link with chemical composition. The student will learn how to identify the most common minerals in hand specimen and, by using optical techniques, learn how to identify the common minerals in thin section | For Tectonics and Geomorphology<br>Students will have knowledge of represent relief features of the plateaus, hills, foothills, valleys, plains and flood plains through superimposed, composite, serial or projected profiles. Will be able to demarcate basin with representation of basin relief through profiles and will draw interpretations. Will become able to express slope and gradients from a topographical map, draw longitudinal profiles of rivers from topographical maps, chalk out water discharge curve and calculate the sediment transport and erosion within a landscape.<br><br>For Mineralogy<br>At the completion of the course student will be able to<br>• Explain why different minerals have distinctly different structures.<br>• Demonstrate how the internal structure of minerals affects the external structureand physical properties of a minerals.<br>• Identify minerals based on megascopic and microscopic observations. |

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| M1GEO06-CP02 | Practical – II : Palaeontology I & Precambrian Stratigraphy | For Paleontology I<br>To explore students knowledge with the basic practical approach through the hand specimens of mode of preservation and groups of Foraminifera, Trilobita and Echinodermata.<br><br>For Precambrian Stratigraphy<br>To make learn students about distribution of Precambrian Stratigraphic units of India along with the palaeogeographic conditions | For Paleontology I<br>Students will be able identify to morphological features through hand specimens of types of fossils. Through specimens of Foraminifera, Trilobita and Echinodermata of organism, practically he/she will be able to study about palaeoenvironment, stratigraphic position, age and correlation with other organism.<br><br>For Precambrian Stratigraphy<br>Student is expected to come out with the knowledge of extension of lithostratigraphic units in relevance to chronostrtaigraphy with sum-toto knowledge of the Indian subcontinent specifically during Precambrian time. |
| M2GEO05-CP03 | Practical – III : Structural Geology & Sedimentary Petrology | For Structural Geology<br>Measurement of various orientation data from the structures, plotting them in suitable diagrams and make a quantitative analysis.<br><br>For Sedimentary Petrology<br>To give students hands-on practical classes aimed at<br>1. Developing skill for identifying the different types of sedimentary rocks in hands specimen as well as under microscope<br>2. Using graphic, mathematical calculations and other means for data analysis and interpretation | For Structural Geology<br>To prepare the students for future research and teaching career in the field of Structural Geology.<br><br>For Sedimentary Petrology<br>After completion, students will learn<br>1. How to identify and differentiate between different sedimentary rocks in field as well as thin sections under microscope<br>2. How to represent data in different ways and to interpret data for paleocurrent analysis and other objectives |

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| M2GEO06-CP04 | Practical – IV : Palaeontology II & Phanerozoic Stratigraphy | For Paleontology II<br>To explore students knowledge for the study of fossil groups of Anthozoa, Gastropoda, Bivalvia, Chephalopoda, Brachiopoda, Gondwana plant and some vertebrate fauna.<br><br>For Phanerozoic Stratigraphy<br>It is intended for students to learn anout distribution of Phanerozoic Stratigraphic units of India along with the changing palaeogeographic conditions relevant to distribution of landmass, sea and fresh water provinces. | For Paleontology II<br>Students will be able to identify all morphological features of the particular groups of fauna and flora. He/She will be able to find about palaeoenvironment, stratigraphic position, age and correlation with other organism.<br><br>For Phanerozoic Stratigraphy<br>With respect to outcome it is expected that student should bear the knowledge of Phanerozoic lithostratigraphic units in Indian subcontinent, palaeogeographic linkages with the surrounding landmasses and position of India within the various Supercontinents. |
| M3GEO05-CP05 | Practical – V : Economic Geology & Igneous Petrology | For Economic Geology<br>This practical course has following objectives:<br>• To study ore minerals in hand specimen with special focus to its physical properties for identification<br>• To study polished sections of ore specimens under reflected light.<br>• To study the distribution of various important ore minerals across world and India<br>For Igenous Petrology<br>• To impart knowledge about the magmatic systems<br>• To train the students to identify different igneous rocks in hand specimen and further by thin section through optical properties of different minerals. | For Economic Geology<br>The students upon successful completion of this course will be well versed with:<br>• Identification of ore minerals in hand specimen<br>• Identify, describe and understand texture and structures in polished section of ore minerals and appreciate ore genesis.<br>• Distribution of ore important ore minerals in India and World<br>For Igneous Petrology<br>Upon successful completion of course the students would be able to<br>• Identify the common rock forming minerals of igneous rocks in both hand specimen and thin-section.<br>• Identify key textural/micro structural features of igneous rocks appreciate the significance of such features with regard to geological processes that have operated. |

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| | | • To train student to classified rocks based on the modal mineralogy. | • Assign a name to igneous rocks on the basis of its mineralogical and textural characteristics, and appreciate the environment(s) of formation.<br>• Ability to interpret phase diagrams relevant to igneous systems.<br>• Ability to make detailed and annotated petrographic sketches from thin-section observation and to summarise the salient features and relate the chemistry of the system and environment of formation. |
| M4GEO05-CP06 | Practical – VI : Metamorphic Petrology & Mineral Exploration and Mining Geology | For Metamorphic Petrology<br>• To impart knowledge about metamorphic processes.<br>• To train the students to identify different metamorphic rocks in hand specimen and further by thin section through optical properties of different minerals<br>• To train the students to understand the different processes of formations of metamorphic rocks and their significance in the geodynamic evolution.<br><br>For Exploration and Mining Geology<br><br>• To understand the importance of surveying and Levelling in the field of Geology.<br>• To study the basics of linear/angular measurement methods like, compass and Plane table surveying.<br>• To study the significance of plane table surveying in plan making.<br>• To know the basics of levelling and | For Metamorphic Petrology<br>Upon successful completion of course the students would be able to<br>1. Identify the common rock forming minerals of metamorphic rocks in hand specimen and thin-section.<br>2. Identify key textural/micro structural features of metamorphic rocks and appreciate the significance of such features with regard to geological processes that have operated.<br>3. Assign a name to metamorphic rock on the basis of its mineralogical and textural characteristics, and appreciate the environment(s) of formation.<br>4. Ability to interpret phase diagrams relevant petrogenic grids relevant to metamorphic systems on the basis of mineral assemblages recorded in the rock.<br><br>For Exploration and Mining Geology<br>Upon successful completion of course the students would be able to:-<br>• Calculate angles, distances and levels by Theodolite.<br>• Identify data collection methods and prepare |

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| | | theodolite survey in elevation and angular measurements.<br>• To understand measurement of horizontal, vertical angles and linear distance from Theodolite.<br>• To Understand how to use and levelling of Theodolite in the field.<br>• To understand process of core logging and its importance in exploration.<br>• To understand applications of GPS and its use in field.<br>• To know the methods of ore reserve estimation and how to calculate ore reserves of a stope and mine. | field notes.<br>• Understand the working principles of survey instruments.<br>• Estimate measurement errors and apply corrections.<br>• Interpret survey data and compute areas and volumes.<br>• Understand the procedures of plane table and compass survey.<br>• Understand how to work Theodolite in field and its use in surveying and levelling.<br>• Understand Theodolite survey takes vertical and horizontal angles in order to establish controls.<br>• Understand contouring and its importance.<br>• Understand techniques and applications of GPS and its uses in field in mapping.<br>• Understand how to do core logging and take visuals of grade from the core.<br>• Understand the methods of ore reserve estimation of a ore body. |

Discipline Specific Electives

| Course /Paper Code | Course /Paper Name | Objective of Course | Outcome of Course |
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| M3GEO03-ET01 | Ground Water Geology | To teach students<br>• The importance of groundwater, its occurrence, distribution and quality<br>• Various hydrological concepts, groundwater flow theories and their applications.<br>• Basic groundwater problems related to different engineering structures. | After completing course, students will be able to<br>• Define the significance of groundwater as an Earth resource<br>• Understand the porous medium properties that control groundwater flow and transport, including porosity, hydraulic conductivity, and compressibility.<br>• Apply groundwater flow equations to confined and unconfined aquifers. |
| M3GEO04-ET02 | Photo geology and Remote Sensing | The objective of the present syllabus of Photo Geology and Remote Sensing is as follows:<br>• To introduce students to concepts and geological applications in remote sensing with an emphasis on aerial photography although other airborne and satellite imagery are also included.<br>• To familiarize students with the fundamentals of both the photo geological interpretation of air-photo stereo pairs and satellite imagery through laboratory practice.<br>• To encourage the use of large-scale air-photo stereo pairs and satellite imagery in field surveying and site investigations | The outcome of the syllabus will be helpful for students in the following way:<br>• The students will be able to understand the concepts, methodologies and applications of Remote Sensing Technology.<br>• They will acquire skills in handling instruments, tools, techniques while using Remote Sensing Technology.<br>• It empowers the students with confidence and leadership qualities. |
| M4GEO03-ET03 | Environmental Geology & Disaster Management | • To impart knowledge of environmental geology, natural hazards and their management.<br>• To understand the Earth's ecosystem and interrelations of various components of the Earth. | Upon successful completion of course the students would be able to:-<br>• Know the basic fundamentals of earth science as applied to the interaction between human activity and the natural environment. |

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| | | • To understand geological aspects of various natural hazards and geo-engineering projects | • Understand the occurrence and availability of both surface and subsurface water resources and the role of the hydrologic cycle and pollution. Understand the role of plate tectonics in causing earthquakes and how this understanding can aid the assessment of seismic hazard. |
| M4GEO04-ET04 | Geochemistry | The objective of the syllabus helps the students to understand the chemical principles which are used to explain the mechanisms that control the large geological systems. The course also helps to understand the distribution of elements in different Earth's spheres and evaluate different processes of element migration. | By attending the courses, the students able to understand the evolution of the early earth and its differentiation to the present-day state. The students also have an idea of the chemical composition of the geochemical reservoirs. The knowledge of the radiogenic isotope's signature helps to trace the source of mineral and rock separation from the magma. |
| M3GEO06-EP01 | Elective Practical - I : Groundwater Geology & Photo-geology and Remote Sensing | For Groundwater geology<br>To give students hands-on practical classes aimed at giving exercises on various topics covered in theory classes of the subject like water quality, groundwater exploration, yield etc.<br>For Photo-Geology and remote sensing<br>• To introduce students with the interpretation of aerial photographs with the help of stereo pairs and satellite imageries through laboratory practice.<br>• To introduce students with the visual interpretation of satellite imageries.<br>• To introduce students with the various application of GIS software in different field of Earth Sciences viz. geomorphology, structural geology, lithological mapping, | For Groundwater geology<br>After completion, students will be able to apply theoretical knowledge and concepts learned during lecture classes by using the data gathered in the field or other source(s).<br>For Photo-Geology and remote sensing<br>The students will be able to interpret aerial photographs and satellite imageries. The students will also be able to apply GIS software in various fields of Earth Sciences geomorphology, structural geology, lithological mapping, environmental geology, hydrogeology etc. |

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| | | environmental geology, hydrogeology etc. | |
| M4GEO06-EP02 | Elective Practical – II : Environmental Geology and Disaster Management & Geochemistry | For Environmental Geology and Disaster Management<br>These are the objectives of this course.<br>1. To analysis of different parameters of air, water and noise.<br>2. To interpretation of air, water and noise data.<br>3. To prepare iso-concentration maps of water quality parameters according to WHO data and their limits.<br>4. To identify the seismic zones and plot them in maps of World, India and Rajasthan.<br>5. To know how to occur slope failure and landslide in landslide prone zones.<br><br>For Geochemistry<br>The students will learn how to present analytical data of geochemistry through various graphical diagrams viz. Multi-Elements spider diagrams and introduction to Geochemical Modelling for interpretation of the petrological processes. | For Environmental Geology and Disaster Management<br>Upon successful completion of course the students would be able to:-<br>1. Understand the different parameters of air, water and noise.<br>2. Understand how to interpretation the air, water and noise data.<br>3. Understand to prepare iso concentration maps of water quality.<br>4. Understand the seismic zones of India, world and Rajasthan.<br>5. Understand some exercises of slope failure on sterionet and their field relation.<br>For Geochemistry<br>At the completion of the course, the student will,<br>• learn to calculate mineral formulae based on mineral chemistry.<br>• be able to do Bi-variate analysis of data (Regression & Correlation).<br>• learn to present the geochemical data via different multi-elements spider diagrams for the interpretation of various petrological processes. |

## Skill Papers

| Course /Paper Code | Course /Paper Name | Objective of Course | Outcome of Course |
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| M2GEO07-SE01 | Application of GIS | The main objective of teaching skill course in M.Sc. is to gain a basic, practical understanding of GIS concepts, techniques and real world applications Class discussions, reading assignments, and class lectures prepare students to develop a mapping project based on the assumptions and interpretations of data selected by the student. | At the completion of the course, students will:<br>• Have a basic, practical understanding of GIS concepts, techniques and real world applications.<br>• Have an understanding of the technical language of GIS.<br>• Know how GIS is utilized in the larger context of business needs and IT strategies. Understand basic GIS data concepts. Have an ability to perform basic GIS analysis of concepts.<br>• Have demonstrated a practical application of GIS.<br>• Have practical experience using basic GIS tools.<br>• Have an understanding of GIS and its relationship to mapping software development.<br>• Have an appreciation of GIS career options and how to pursue them. |
| M4GEO07-SE02 | Survey & Leveling | • To understand the importance of surveying and Levelling in the field of Geology.<br>• To study the basics of linear/angular measurement methods like Tape, chain surveying, electronic distance, compass and Plane table surveying.<br>• To study the significance of plane table surveying in plan making.<br>• To know the basics of levelling and theodolite survey in elevation and angular measurements.<br>• To understand measurement of horizontal, | Upon successful completion of course the students would be able to:-<br>• Calculate angles, distances and levels from theodolite and other equipments.<br>• Identify data collection methods and prepare field notes.<br>• Understand the working principles of survey instruments.<br>• Estimate measurement errors and apply corrections.<br>• Interpret survey data and compute areas and volumes. |

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| | | vertical angles and linear distance from Theodolite.<br>• To Understand how to use and levelling of Theodolite in the field.<br>• To understand characterising and methods of contouring.<br>• To understand applications of GPS and its use in field. | • Understand the procedures of plane table and compass survey.<br>• Understand how to work Theodolite in field and its use in surveying and levelling.<br>• Understand Theodolite survey takes vertical and horizontal angles in order to establish controls.<br>• Understand contouring and its importance.<br>• Understand techniques and applications of GPS and its uses in field in mapping. |