Name of the Department: **Geology**

Name of the Programme: **M.Sc. Geology**

Vision

- To impart commendable knowledge-based integrity in the field of Geology to empower the skills of the students for the betterment of the geological community and relevant national development.

Mission

- Motivating the students is our prime mission to learn, practice, and implement their skills during the course duration.
- To maximize the research activities and make the department a shrine of geological knowledge.
- Adopting effective teaching methods, field, laboratory training, and extending the research activities to meet national and international standards.
- Creating awareness among the students about the job market in the Geological domain.
- Ensuring employment opportunities for the students upon successful completion of their M.Sc. programme.

Program Outcomes (PO)

- During the two-year tenure of the program, students can identify, examine, and understand different geological activities and also carry out their characterization using geological, geophysical, and geochemical knowledge.
- The students also learn fundamental requirements of geological mapping in varied geological terrains, analysis of the geological data, software used in the geological domain, petrological microscopy, identification of different fossils, the behavior of groundwater, and need for the hour engineering and environmental issues related to Planet Earth.
- At the fag end of the program, the student will be able to understand the different core concepts of the Earth and its processes.
- Another prime outcome of this program is geological exploration including rock sampling, and protocols for sample processing, geochemical analysis, interpretation, and targeting the ore deposits of economical importance.
- The student will be able to understand the causes of natural Geo-calamities including earthquakes, floods, landslides, tsunamis, and volcanic eruptions, and mechanisms for mitigating the damages.

Program Specific Outcomes (PSO)

- The specific outcome of the M.Sc. Geology is to up skill the student's geological knowledge for securing jobs as geo-scientists in the government, public, private sector, and in scientific organizations for research activities.
- The M.Sc. curriculum was prepared to meet the following challenges:

1) Assume responsible positions in government agencies.
2) Serve as Lecturer in colleges that offer geology as a subject.
3) Ability to apply the imparted theoretical, conceptual, and observational knowledge to the analysis and interpretation of geologic information.
4) Compile and compare the available geologic literature pertinent to original research and effectively communicate geologic knowledge, findings, and interpretations in both written and oral.
5) Finally, students can establish consultancies in the domains of Groundwater exploration, Geophysical, Engineering, GIS, Remote sensing and Environmental studies.
6) At the end of the program, students can able to demonstrate content knowledge appropriate to professional career goals.

Course Outcomes

Semester-I

Course code	Course name	Course Outcomes
G.1.1	Crystallography and Crystal Optics	• Ability to understand laws of crystallography, different crystals and crystal systems • Students can know the relationship between the crystal symmetry and physical properties of minerals • Students can understand the optical properties of minerals • Students can gain the knowledge to identify different minerals under a polarizing microscope
G.1.2	Mineralogy and Geochemistry	• Identify the different minerals based on physical properties. • Able to understand their uses and association with different rock types. • Ability to understand the abundance of chemical elements in the Universe and Earth as a whole. • Basic knowledge of geochemical analytical Instruments and operating procedures and protocols, data acquisition and interpretation. • Complete understanding of different geochemical techniques employed in geology
G.1.3	Physical Geology and Geomorphology	• Understanding the internal structure and composition of the Earth. • Students can learn about various geological processes involved in shaping various landforms due to varied geological agents.

		• Students can gain knowledge about volcanoes, earthquakes, and mountain-building activities.
G.1.4	Igneous and Metamorphic Petrology	• Students can able to understand the formational conditions of igneous and metamorphic rocks. • Ability to understand various forms, textures, structures, and classifications of igneous and metamorphic rocks. • Students can understand the genesis of igneous and metamorphic rocks
Practical-I		
G.1.5	Crystallography, Crystal Optics and Mineralogy	• Able to understand the symmetry of different crystals. • Ability to understand the components of petrological microscope and its applications • Ability to identify different minerals based on optical properties under the microscope.
Practical-II		
G.1.6	Igneous and Metamorphic Petrology	• Able to discriminate igneous and metamorphic rocks by physical and optical properties. • Able to classify the igneous rocks based on norm calculation.
	Semester-II	
Course code	**Course name**	**Course Outcomes**
G.2.1	Principles of Stratigraphy and Palaeontology	• Students can able to understand the description, interpretation and classification of different geological formations. • Detailed Stratigraphy of India and Standard Geological Time scale • Able to understand different species of fossils, morphology, mode of fossilization and age. • Understand the evolution of life on Earth based on fossil record • Application of fossils in Stratigraphic correlation and hydrocarbon exploration.
G.2.2	Indian Geology	• Students are able to know the sequence stratigraphy and their subdivisions with Indian examples • Students can understand the physiographic divisions of India • Able to learn the availability of the mineral wealth of Indian geological formations.
G.2.3	Structural Geology and Tectonics	• Students can able to recognize different deformative geological structures, their geometry and associated mineralization in rocks. • Have an understanding of rock deformation and types of primary and secondary structures • Learn the concepts and evidences of Continental Drift and plate tectonic theories.

G.2.4	Sedimentology and Fuel Geology	• Able to understand different sedimentary rocks and their structures, textures and modes of formation. • Able to gain the knowledge about fuel minerals like coal, petroleum and atomic minerals, their origin, occurrence and distribution in India
Practical - I		
G.2.5	Palaeontology and Structural Geology	• Identification of fossils based on morphological characters. • Preparation of geological cross sections based on geological maps. • Able to learn and practice the usage of Clinometer and Brunton compass in the field.
Practical - II		
G.2.6	Sedimentology and Fuel Geology	• Identification of sedimentary rocks based on megascopic and microscope observation. • Grain size analysis by sieve method to understand the environment of deposition. • Identification of different varieties of fuel minerals. • Calculating the fuel mineral-related problems
Semester-III		
Course code	**Course name**	**Course Outcomes**
G.3.1	Oregenesis	• Able to understand the different genetical processes, proposed theories, and classification of Ore minerals • Able to learn mode of occurrences of Ore deposits with in different geological formations.
G.3.2	Hydrogeology	• Importance of Groundwater its source and usage. • Able to understand the statistics of the Earth's water. • Able to understand the Hydrological cycle, water-bearing properties of rocks. • Occurrence and distribution of groundwater in various geological formations and provinces of India.
G.3.3(a)	Remote sensing (Elective-I)	• Able to learn the principles of remote sensing. • Able to understand, observe and discriminate the Earth's surface features using remote sensing techniques. • Application of remote sensing in mineral exploration and allied fields.
G.3.3 (b)	Statistical Geology (Elective-II)	• Able to learn the applications of statistics to geological concepts • Making use of standard software analysis and interpretation of geological data. • Studying the multivariate data in varied fields of geology.
G.3.4 (a)	Mining and Mineral Beneficiation (Elective-I)	• Able to learn different types of mining methods and their importance. • Methods of open cast and underground mining special reference to coal mining.

		• Able to study different mineral processing techniques and beneficiation methods.
G.3.4 (b)	Mineral Exploration and Mineral Economics (Elective-II)	• Able to learn different mineral exploration methods. • Guides for locating mineral deposits • Conservation and substitution of minerals • Mineral policy of India.
Practical-I		
G.3.5	Oregenesis and Elective-I-3.3 (a)/Elective-II-3.3(b)	• Identification of Ore minerals by physical properties. • Identification of textures and structures of ore minerals using microscope. • Estimation of Ore reserves by direct and indirect methods. • Determination of thickness, dip direction of ore deposits using borehole data.
Practical-II		
G.3.6	Hydrogeology and Elective-I-3.4(a)/Elective-II-3.4(b)	• Able to determine hydrological characters of geological formations. • Rainfall data analysis and interpretation. • Interpretation of geo-morphological and structural features using satellite images and aerial photographs. • Studying the land use land cover, and drainage patterns using remote sensing techniques

Semester-IV		
Course code	**Course name**	**Course Outcomes**
G.4.1	Mineral Deposits	• Students are able to study the origin, mode of occurrence, uses and distribution of metallic and non-metallic minerals in India.
G.4.2	Groundwater Exploration and Management	• Groundwater exploration by geological and geophysical methods. • Types of wells and its rehabilitation. • Groundwater quality based on physical and chemical parameters. • Surface and subsurface water pollution. • Water conservation and management techniques.
G.4.3(a)	Geographical Information System (GIS) (Elective-I)	• Able to learn basic concepts of GIS techniques. • Knowledge about digitization software techniques • Editing, manipulation, and restoration of spatial data. • Applications of GIS in national development activities.
G.4.3(b)	Chemical Geology (Elective-II)	• Able to learn methods of sampling, preparation, and analysis. • Knowledge about the geochemical instrumentation • Major and Rare elemental distribution in the rocks. • Variation diagrams
G.4.4(a)	Environmental Geology (Elective-I)	• Man-induced activities in Environmental quality modification.

		• Understanding fundamental concepts of Geological Hazards. • Able to understand geotechnical construction and its effects on the environment. • Understanding the causes of Global warming and its effect. • Policy planning of environment.
G.4.4(b)	Engineering Geology (Elective-II)	• Studying the engineering properties of different rocks and soils • Able to understand geological considerations for site selection of Dams and Tunnels etc... • Able to understand the impact of natural hazards on civil engineering structures and preventive methods.
Practical-I		
G.4.5	Mineral Deposits and Elective-I-4.3(a)/Elective-II-4.3(b)	• Identification of metallic and nonmetallic minerals by physical properties, their uses, mode of occurrence and distribution in India. • Preparing data sets as input for GIS software. • Analysis and manipulation of data in the GIS. • Graphical representation of data using GIS software • Plotting of geochemical data in bivariant and triangular classification diagrams. • Plotting and interpretation of geochemical data against petrogeny's residua system. • Preparation of trace and REE normalized diagrams.
G.4.6	Groundwater Exploration and Elective-I- 4.4(a)/ Elective-II-4.4(b)	• Exploration of groundwater by geophysical methods. • Interpretation of geophysical data and curve matching techniques. • Collection of water samples for analysis and graphical interpretation of data. • Interpretation of water quality for Irrigation purposes by Wilcox and USSL diagrams. • Air quality instruments and monitoring. • Interpretation of Geological maps pertaining to the dams and tunnel sites. • Locating the suitable sites for Dams and Tunnels using geological maps.

CBCS

M. Sc. GEOLOGY
I and II- SEMESTER
SYLLABUS (2016 Onwards)

SEMESTER-I

S.NO.	Paper Code	Title of the paper	Instruction Hrs./Week	No. of Credits	Marks		Total marks
					External	Internal	
1	G. 1.1	Crystallography and Crystal Optics	04	04	80	20	100
2	G. 1.2.	Mineralogy and Geochemistry	04	04	80	20	100
3	G. 1.3.	Physical Geology and Geomorphology	04	04	80	20	100
4	G. 1.4	Igneous and Metamorphic Petrology	04	04	80	20	100
5	G. 1.5.	**Practical-I:** Crystallography, Crystal Optics & Mineralogy	09	04	100	--	100
6	G. 1.6.	**Practical-II:** Igneous and Metamorphic Petrology	09	04	100	--	100
7		Seminar		01		25	25
		TOTAL		25	520	105	625

Total Credits for Semester -I is 25

SEMESTER-II

S.NO.	Paper Code	Title of the paper	Instruction Hrs./Week	No. of Credits	Marks		Total marks
					External	Internal	
1	G. 2.1	Principles of Stratigraphy and Palaeontology	04	04	80	20	100
2	G. 2.2.	Indian Geology	04	04	80	20	100
3	G. 2.3.	Structural Geology	04	04	80	20	100
4	G. 2.4	Sedimentology and Fuel Geology	04	04	80	20	100
5	G. 2.5.	**Practical-I:** Palaeontology and Structural Geology	09	04	100	--	100
6	G. 2.6.	**Practical-II:** Sedimentology and Fuel Geology	09	04	100	--	100
7		Seminar		01		25	25
		TOTAL		25	520	105	625

Total Credits for Semester -II is 25

Note : A geological field trip is recommended for the MSc. Geology previous students

SEMESTER-I

PAPER-I

CRYSTALLOGRAPHY AND CRYSTAL OPTICS

UNIT-I

Definition of crystal- amorphous and crystalline states, morphology of crystals-face, edge, solid angle, interfacial angle. Forms: simple, combination, closed and open forms. Symmetry : plane, axis, centre. Crystallographic axis. Parameters, indices, Crystallographic notation-parameter system of Weiss, index system of miller.

UNIT-II

Classification of crystals into 7 systems and study of their normal class. Cubic system-Galena type, Tetragonal system-Zircon type, Hexagonal system-Beryl type, Trigonal division-Calcite type

UNIT-III

Orthorhombic system-Barytes type, Monoclinic system-Gypsum type, Triclinic system- Axinite type Twinning in crystal – Definition of twin plane, twin axis and composite plane.

UNIT-IV

Crystal optics-fundamentals, double Refraction, refractive Index, construction of Nicol Prism. Behavior of isotropic and anisotropic minerals between crossed nicols, extinction, pleochroism, interference colours. Definition of Uniaxial and Biaxial minerals. Accessory plates, Berek's compensator. Petrological microscope (polarizing) its mechanical and optical parts. Indicatrix-Uniaxial and biaxial. Orthoscopic and conoscopic examination of minerals. Birefringence, sign of elongation, pleochroism, optic sign dispersion.

References:

1. A text book of Mineralogy- E. S. Dana and W. E. Ford
2. An introduction of crystallography –R. C. Phillips
3. Elements of Mineralogy-Rutleys
4. Phillips, Wm, R. & Griften, D.T 1986. Optical Mineralogy, CBS edition.

SEMESTER-I

PAPER-II

MINERALOGY AND GEOCHEMISTRY

UNIT-I

Definition of a mineral-classification of minerals into rock forming and ore forming minerals. Physical properties of Minerals. Chemical properties of minerals - Isomorphism, solid solution, polymorphism, pseudomorphism, radioactivity, silicate structures. Crystal chemistry. Different types of chemical bonds in minerals.

UNIT-II

Structure, chemistry, physical properties, optical properties and paragenesis of the following mineral groups, olivine, pyroxene, amphibole. mica, garnet, epidote, silica, feldspar, feldspathoid, aluminum silicates and of miscellaneous minerals: cordierite, zircon and beryl, corundum.

UNIT-III

Geochemistry: Introduction: Definition, scope and objectives. Elements: origin, abundance of elements in the solar system and earth and its constituents; average mineralogical, petrological and, major and trace elemental composition of crust. Meteorites: Classification, mineralogy, chemical composition, origin and age of meteorites. Goldschmidt's geochemical classification of elements: Definition, theoretical basis and significance of the classification, siderophiles, chalcophiles, lithophiles and atmophiles with examples.

UNIT-IV

Primary geochemical differentiation of earth. Periodic table: Definition and examples of transition elements, platinum group of elements, rare-earth elements (LREE and HREE), compatible elements,incompatible elements, high-field strength elements (HFSE), large ion lithophile elements (LILE). Major and trace elemental distribution in igneous rocks during magmatic crystallisation.

References:

1. An introduction to rock forming minerals-Deer, Howie and Zussman.
2. Elements of Mineralogy- Mason and Berry.
3. Principles of Geochemistry-Brain Mason.
4. Manual of Mineralogy. Klein, C and Hurbut, Jr., C.S. 1993 John Wiley.
5. Introduction to Mineral Science, Putnis Andrew, 1992, Cambridge University press.

SEMESTER-I
PAPER-III
PHYSICAL GEOLOGY AND GEOMORPHOLOGY

UNIT-I

Definition of Geology- Branches of Geology. Earth as a planet, its shape, size, movement and their effects. Origin, age and interior of the earth. Earthquakes-Causes, kinds of seismic waves and mode of their propagation, intensity and effects of Earthquakes. Ritcher's scale, seismograph and seismogram. Volcanoes – origin and types of Volcanoes and their products. Seas Offshore profile, landforms of sea. Coral Reefs.

UNIT-II

Geological processes – Exogenic and endogenic. Weathering – Types of weathering, erosion and denudation. Rivers – erosion and denudation. Agents of transportation and deposition . waterfalls, meanders, Ox-bow likes. Glaciers-Definition and types of glaciers. Glacial erosion and deposition. Moraines, drumlins. Groundwater-storage of groundwater. Porosity and permeability aquifer, water table, artesian wells, springs, geysers, stalactites, stalagmites. Wind – wind erosion and deposition. Incelbergs, ventifacts, sand dunes.

UNIT-III

Fundamental concepts, analysis of Geomorphic processes, Geomorphic agents and processes. Fluvial geomorphic cycle. Stream deposition. Valley development and classification. Peneplain concept, topography of faulted and folded structures. Criteria relating to topography and structures.

UNIT-IV

Arid cycle, origin of deserts, arid erosion cycle, eolian land forms. Karst topography. Geomorphology of coasts, marine erosion, topographic features resulting from marine erosion. Use of applied geomorphology in hydrogeology, exploration of mineral deposits and engineering problems.

References

1. Holmes principles of physical Geology – D.L. Holmes(1978)
2. Physical Geology-A. N. Stracher
3. Principles of Geomorphology- Williams D. Thornbury
4. Indian Geomorphology-S. R. Jog .
5. Basic physical Geology- E.S. Robinsion.
6. Principles of Physical geology by Arthur Holmes
7. Field Geology by Lahee

SEMESTER-I

PAPER-IV

IGNEOUS AND METAMORPHIC PETROLOGY

UNIT-I

Nature and scope of petrology-definition of rock, classification into plutonic hypabyssal and volcanic rocks, igneous rock body forms. Structure and textures of igneous rocks. Classification of igneous rocks.

UNIT-II

Phase relations-Equilibria and the phase rule. One, two, and three component systems-Diopside – Albite –Anorthite, Diopside-Forstchite-Silica, Petrogeny's residual system. Partial melting and Zone melting, Bowens reaction principle. Generation and evolution of magma, magmatic differentiation and assimilation. Petrography and petrogenesis of the following rocks; Granites, Basalts, Anorthosites, Alkaline rocks, Lamprophyres, Kimberlites and Carbonatites.

UNIT-III

Definition and types of Metamorphism, Agents of metamorphism, grades and zones of metamorphism, classification of metamorphic rocks, structures and textures of metamorphic rocks.

UNIT-IV

Concept of Metamorphic facies, contact metamorphic facies – Honfels and Sanidinite.

Regional metamorphic facies; Zeolites, Greenschist, Amphibolite, Granulite and Eclogites. Definition and types of metasomation. Charnockites and khondalites. Definition and types of metasomatism.

References:

1. The principles of Petrology – G. W. Tyrrell.
2. Petrology of the Igneous Rocks – F. H. Hatch, Wells and Wells.
3. Igneous Petrology – R. MC. Birney.
4. Igneous and Metamorphic Petrology – J. Turner, John Verhoogen.
5. Igneous and Metamorphic Petrology – Myron G.Best.
6. Igneous Rocks – Alok K. Gupta.
7. Igneous and Metamorphic Petrology- Best.
8. Igneous petrology – Middlemost.
9. Igneous Petrology – Anthony Hall.

SEMESTER-I

PRACTICALS - PAPER – I

CRYSTALLOGRAPHY, CRYSTAL OPTICS & MINERALOGY

Crystallography:

Study of crystal systems and forms (Normal Class):

1. Study of important crystal models corresponding to Normal Class of cubic system, tetragonal system, orthorhombic system, hexagonal system, monoclinic system, triclinic system.

Crystal Optics:

1. Identification of rock forming minerals by optical properties : Olivines, pyroxenes, Amphiboles, Micas, Feldspars, Feldspathoids, Silica minerals and Alumino silicates.
2. Identification of accessory minerals by optical properties : Apatite, zircon, magnetite, ilmenite, calcite, epidote, sphene.

Mineralogy

1. Identification of Megascopic rock forming minerals by physical properties : Olivines, Pyroxenes, Amphiboles and Micas.
2. Identification of Megascopic rock forming minerals by physical properties : Feldspars, Feldspathoids, Silica minerals and Alumino silicates
3. Identification of accessory minerals by physical properties : Apatite, Zircon, Magnetite, Ilmenite, Calcite, Epidote, Sphene etc

PRACTICALS - PAPER – II

IGNEOUS AND METAMORPHIC PETROLOGY

1. Study of petrography and petrogenesis of megascopic ultramafic, basic, intermediate and acidic Igneous rocks and metamorphic rocks.
2. Study of petrography and petrogenesis of Microscopic ultramafic, basic, intermediate and acidic Igneous rocks and metamorphic rocks.
3. Calculation of the CIPW norm of gabbro, basalt, granite, syenite and nepheline syenite etc. Calculation of normative minerals of rocks with the help of Norm form.

SEMESTER-II

PAPER-I

PRINCIPLES OF STRATIGRAPHY AND PALAEONTOLOGY

UNIT-I

Definition, scope, branches and inter- relationship of Stratigraphy. Principles of Stratigraphy. Doctrine of uniformitarianism (Hutton). Stratigraphic classification and nomenclature. Standard Geological time scale.

UNIT-II

Definition and modes of preservation of fossils. Significance of fossils, uses of Microfossils with special reference to Petroleum exploration. Morphology and Geological Distribution of the following Animal Microfossils (a) Foraminifera, Ostracoda, Conodonta and Radiolarian. Morphological characteristics and Geological distribution of Phylum – Arthopoda, Brachiopoda and Mollusca.

UNIT-III

Vertebrates: Broad classification of pisces.

a) Ostrocodermi
b) Placodermi
c) Chnodrichthyes
d) Osteichthyes

Detail study and evolution of: Horse, Elephant and Man.

UNIT-IV

Palaeobotany – Definition and scope. Classification of plants. Pteridophyta, Spermatophyte (Gymnosperms, Angiosperms). Gondwana flora of India, and its significance.

Reference:

1. Historical Geology and principles of India Stratigraphy – Ravindra Kumar.
2. Principles and practices in Stratigraphy - Marvin Weller.
3. Palaentology – Invertebrate- Henry Wood.
4. Evolution of Vertebrates –Ed. Win. H.C. Coibert.
5. Outlines of Palaeontology – H. Swinerton.
6. Principles of Invertebrate Palaeontology-H. Swinerton.
7. Principles of Palaeobotany- Arnold.

SEMESTER-II

PAPER-II

INDIAN GEOLOGY

UNIT-I

Stratigraphic succession and Mineral Wealth of Archaean Provinces Dharwar, Eastern Ghat, Central Indian, Singhbhum-Orissa, Aravalli Bundelkhand Provinces.

UNIT-II

Stratigraphic succession and Mineral wealth of important Proterozoic Basins- Cuddapah, Pakhals, Vindhyams, Kurnools and Bhima.

UNIT-III

Introduction to Nomenclature and Divisions and Sub-divisions of Gondwana formations and their distribution in India. Gondwana flora and coal deposition. Cretaceous formations and Tirichinapally.

UNIT-IV

Stratigraphic successions of Triassic of spiti and Jurassic of kutch. Origin, Distribution and age of Deccan traps. Marine transgression. Pleistocene galciation.

References:

1. Geology of India – D. N. Wadia.
2. Geology of India and Burma – M. S. Krishnan..
3. Fundamentals of Historical geology & stratigraphy of India- Ravindra Kumar.

SEMESTER-II

PAPER-III

STRUCTURAL GEOLOGY AND TECTONICS

UNIT-I

Introduction, importance and scope of structural Geology. Principles of stress and stress ellipsoid. Analysis of deformation stress and strain. Ellipsoid, factors controlling behaviours of rock deformation and the response of rock to stress. Description, Causes recognition of unconformities.

UNIT-II

Classification, description, recognition, causes of folds. Classification, description, recognition. Causes of faults and joints. Structural controls of mineralization, structural association.

UNIT-III

Geo Tectonics: Structure and Tectonics of India. Structure of the Earth: Seismological differentiation into crust mantle and core. Classification of Geosynclines.

UNIT-IV

Continental drift: Computer fitting, Geological, Geophysical and Palaeontological evidences in support of continental drift. Seafloor spreading – Hess's concept. Plate Tectonics – Concept of plates and plate movement Nature of plate boundaries.

References:

1. An outline of Structural Geology By John Wiley:: Hobbs, Means and Williams,
2. Structural Geology of rocks and regions By John Wiley:: H. davis,
3. Foundations of structural geology By Blakie:: R.G.Park
4. Structural Geology By McGraw Hill:: L.U.De Sitter,
5. Structural Geology By : Marland.P.Billings,
6. Fundamentals of modern structural geology By S.K.Ghosh., Elsevier Publication,
7. Understanding the earth By Artemis Press:: Gass, Smith and Wilson,
8. Physical Geology By P.H.I.:: Judson, Deffeyes & Hargraves,
9. Plate tectonics and crustal evolution By K.C.Condie, Pergomon press,
10. Holmes principles of Physical Geology. By D.Duff Chapman& Hall,
11. The evolving earth By Sawkins and others. Mac Millan,

SEMESTER-II

PAPER-IV

SEDIMENTOLOGY AND FUEL GEOLOGY

UNIT-I

Sources of sediments – Mechanical and Chemical weathering, Modes of transportation, stratification sedimentary textures, Grain size. Grain shape and Grain fabric. Sedimentary structures; Classification and clastic and non-clastic sedimentary rocks. Classification of sandstones, limestones, dolomites and Dolomitization.

UNIT-II

Classification of sedimentary environments : Non marine environments; Fluvial, Glacial, Eolian and Lacustrine. Transitional, Deltoic and Beach. Marine, shelf and Deep sea sediments. Sedimentary basins in the light of Geosynclinal theory and the concept of plate tectonics.

UNIT-III

Fuel Geology : Definition, Rock and Varieties of coal. Formation and origin of coal. Classification of coal. Constituents of coal. Elements of coal petrography. Chemical analysis of coal, Proximate and analysis, Distribution of Gondwana and Tertiary coals in India. Indian coal reserves preparation for utilization.

UNIT-IV

Origin of petroleum and natural gas, Composition of petroleum and natural gas. Source sediments for petroleum and natural gas. Varieties of petroleum hydrocarbons. Physical properties of petroleum. Different types of traps, structural, stratigraphic and mixed traps. Distribution of onshore and offshore petroliferous basins of India.

References:

1. Sedimentary Rocks – F. J. Pettijohn.
2. Petrology of the Sedimentary Rocks – J. T. Greensmith
3. An Introduction to Sedimentology By Shelly, R.C.
4. Geology of Petroleum – A. I. Laverson
5. Petroleum Geology – F. K. North
6. Petroleum Geology By Chapman, R.C,
7. Economic Mineral Deposits – Meda L. Jensen, Alan M.Bateman.

SEMESTER-II

PRACTICALS - PAPER – I

PALAEONTOLOGY AND STRUCTURAL GEOLOGY

Palaeontology:

1. Morphology, classification, geological age and stratigraphic position of important fossils of Protozoa and corals, Gastropoda, Cephalopoda, Lamellebranchia, Brachiopoda, Echinodermata. Arthropoda,
2. Morphology, classification, geological age and stratigraphic position of important plant fossils.
3. Morphology, classification, geological age and stratigraphic position of important microfossils
4. Morphology, classification, geological age and stratigraphic position of important vertebrate fossils.

Structural Geology:

1. Maps with uniformly dipping beds.
2. Maps with beds dipping with different dips.
3. Maps with folded formations.
4. Maps with faulted formations.
5. Maps with intrusives / unconformities.
6. Identification of Plant and Animal Fossils
7. Structural Problems – Borehole Problems, calculation of bed thickness and dip.

PRACTICAL - PAPER – II

SEDIMENTOLOGY AND FUEL GEOLOGY

1. Megascopy of clastic sedimentary rocks (conglomerates, breccias, sandstones, shales etc.) and non-clastic sedimentary rocks (limestones, fossilifrous limestones, dolomites etc.).
2. Microscopy of clastic(conglomerates, breccias, sandstones , shales etc.) and non-clastic rocks rocks (limestones, fossilifrous limestones, dolomites etc.).
3. Grain size analysis by sieving method.
4. Fuel Geology problems.

Note : A geological field trip is recommended for the MSc. Geology previous students

CBCS
GEOLOGY
III and IV- SEMESTER - SYLLABUS
SEMESTER-III-THEORY

S.No.	Paper Code	Title of the paper	Instruction Hrs./Week	No. of Credits	Marks		Total Marks
					External	Internal	
1	G. 3.1	Ore Genesis	04	04	80	20	100
2	G. 3.2	Hydro Geology	04	04	80	20	100
3	G.3.3 (a)	Remote Sensing (Elective-I).	04	04	80	20	100
4	G.3.3 (b)	Statistical Geology (Elective -II).					
5	G.3.4 (a)	Mining and Mineral Beneficiation (Elective-I).	04	04	80	20	100
6	G.3.4 (b)	Mineral Exploration and Mineral Economics (Elective -II).					
7	G. 3.5	**Practical-I:** Ore genesis and Elective-I- 3.3 (a) / Elective-II 3.3(b)	09	04	100	--	100
8	G. 3.6	**Practical-II:** Hydrogeology and Elective-I- 3.4 (a) / Elective-II 3.4 (b)	09	04	100	--	100
9		Seminar		01	---	25	25
		TOTAL		**25**	**520**	**105**	**625**

Total Credits for Semester -III is 25

SEMESTER-IV-THEORY

S.NO.	Paper Code	Title of the paper	Instruction Hrs./Week	No. of Credits	Marks		Total marks
					External	Internal	
1	G. 4.1	Mineral Deposits	04	04	80	20	100
2	G. 4.2	Ground Water Exploration & Management	04	04	80	20	100
3	G. 4.3 (a)	Geographical Information System (GIS) (Elective-I)	04	04	80	20	100
4	G.4.3 (b)	Chemical Geology (Elective-II)					
5	G.4.4 (a).	Environmental Geology (Elective-I)	04	04	80	20	100
6	G.4.4 (b).	Engineering Geology (Elective-II)					
7	G. 4.5	**Practical-I:** Mineral Deposits and Elective-I- 4.3 (a) / Elective-II 4.3 (b)	09	04	100	--	100
8	G. 4.6	**Practcial-II:** Ground Water Exploration and Elective-I- 4.4 (a) / Elective-II 4.4 (b)	09	04	100	--	100
9		Seminar		01	---	25	25
		TOTAL		**25**	**520**	**105**	**625**

Total Credits for Semester -IV is 25

Total Credits I Semester + II Semester + III Semester + IV Semester = 100

Note: A geological training program / tour is recommended for the MSc. Geology final year students.

SEMESTER-III

PAPER-I

G.3.1: ORE GENESIS

UNIT – I

History and Development of Modern concept of Ore Genesis. Classification of Mineral Deposits. Earth's Evolutionary history and Evolutionary trends in Ore deposits.

UNIT –II

Nature and Migration of Ore bearing fluids: Physico- Chemical controls of Ore Mineralization. Structures and Depositional Textures of Ore Deposition

.

UNIT – III

Processes of Magmatic and Hydrothermal deposits: Residual and Mechanical concentration deposits; Sedimentary Ore deposits.

UNIT – IV

Oxidation and Supergene Enrichment processes of deposition. Paragenesis and Zoning, Wall-rock alteration. Matallogenic Epochs and Provinces.

References:

1. Bateman. A. M. (1961), Economic Mineral Deposits, John Wiely and Sons, New York
2. Smirnov, V. I. (1972), Geology and Mineral Deposits, MIR Publishers, Moscow.
3. Charles F. Park. Jr and Roy A. Mac Diarmid (1975), Ore Deposit, W. H. Freeman & Co New York.
4. Kent, C. Condie (1983), Plate Tectonics and Crystal Evaluation.
5. Anthony M. Evans (1987), An Introduction to the Ore Geology, ELBS Books Wiley Scientific Publications, New York.
6. John M. Golbert and Charles Park (1975), The Geology, of Ore Deposits, W. H. Freeman & Co. New York.

SEMESTER-III

PAPER-II

G.3.2: HYDROGEOLOGY

UNIT-I

Introduction and Scope of Hydrogeology. Groundwater in relation to surface water. Types of Water . hydrological Cycle – Types of Precipitation – Rainfall measurements and Records, Evaporation, Factors controlling evapo-transpiration, Runoff, Infiltration and Factors affecting Infiltration.

UNIT-II

Occurrence of Groundwater –Vertical distribution of Groundwater, Water bearing properties of rocks, Porosity and Permeability, Factors effecting Porosity and permeability.

UNIT-III

Aquifers, types of Aquifers; Geological formations Aquifers; Crystalline rocks, Volcanic rocks, Sedimentary rocks, Unconsolidated Aquifers; Groundwater provinces of India.

UNIT-IV

Groundwater movement and flow, Laminar flow and Turbulent flow Darcy's law, Specific retention, Storage coefficient, Pumping tests. Groundwater fluctuations – Evapo – Transpiration, Seasonal variations, Meteorological phenomena.

References:

1. Groundwater Hydrology – Todd. D.K.
2. Applied Hydrogeology-Fetter, C.W.
3. Hydrogeology – Karanth. K. R.
4. Groundwater – Raghunath. N. M.
5. Groundwater – Shankar Pitchaiah
6. A Textbook of Hydrology – Jaya Ram Reddy
7. The Atmosphere –Anthes
8. Hydrogeology – Davis. S.N. & Dewiest .R.J.M.
9. Geohydrology - Dewiest .R.J.M.
10. Groundwater –Freez. R.S. Allan & Cherry J.A.

SEMESTER-III
PAPER-III
G.3.3(a): REMOTE SENSING (ELECTIVE-I)

UNIT-I

Introduction and scope of Photo geology and Remote Sensing. Principles of remote sensing. Electromagnetic energy, Source of Electromagnetic radiation, Electromagnetic spectral region, Atmospheric windows, Electromagnetic energy – its interaction with atmosphere and Earth surface.

UNIT-II

Remote sensing data acquisition systems, Remote Sensing Platforms, Geostationary and sum Synchronous – Satellites sensors active sensor, Passive sensor, multi spectral scanner (MSS) , image resolution.

UNIT-III

Digital image Processing- Introduction, Preprocessing – Geometric corrections, Radiometric corrections. Image Enhancement – Image rectification & Restoration, Contrast manipulation & Stretching. Spatial feature manipulation – Spatial filtering edge enhancement. Image classification – Supervised classification- & Unsupervised classification.

UNIT-IV

Interpretation- Key elements of image interpretation, application of remote Sensing methods for Geology, Hydrogeology, Agricultural land use and land practice, Natural Hazards. Remote Sensing for National Development.

References:

1. Remote sensing – Principles and Interpretation –Sabins F.F
2. Remote Sensing and Image Interpretation – Lillesand R.M and Kiefer
3. Remote sensing of the Environment - An Earth Resource Perspective- Jensen.
4. Image Interpretation in Geology –Drury.
5. Photo Geology – Miller. V. C
6. Remote sensing and Applications – Orient.
7. Fundamentals of Remote Sensing – George Joseph.
8. Principles of applications of Photo Geology –Shiv. N. Pandey
9. Remote sensing for Earth Resource –D. P. Rao.
10. Remote sensing Techniques for Regional Development – Banerjee.
11. A Guide to remote sensing – Dury.
12. Remote Sensing and GIS – Anji Reddy.
13. Geomorphology and Remote sensing- Jha
14. Handbook of aerial Photography and Interpretation – Rampal.
15. Remote Sensing Applications – Srinivas.

PAPER-III (b)
G: 3.3(b): STATISTICAL GEOLOGY (ELECTIVE-II)

UNIT I:

Statistical methods; mean; median and mode; standard deviation; skewness and kurtosis and their interrelationship; scatter diagrams; frequency distribution; histogram; coefficient of correlation and regression.

UNIT II:

Nature of geological data; scales of measurement; concepts and types of models in geology; sample population; population distribution and population density function and their properties.

UNIT III:

Distribution of sample variance and chi square distribution; probability; testing normal distribution; students 't' test, 'f' test; confidence interval, analysis; calculation of variance- covariance, simple linear models; cluster analysis.

UNIT IV:

Use of standard software analysis and interpretation of geological data; writing of simple programs to apply some elementary statistical techniques to geological data.

References:

1. J.C.Davis: - Statistics and data analysis in Geology
2. B.L.Raktoe and J.J. Hubert: - Basic applied Statistics
3. P.Mukhopadhya: - Mathematical Statistics
4. H.E. Klugh: - Statistics- the essential for research
5. E.B. Mode: - Elements of statistics

SEMESTER-III

PAPER-IV

G. 3.4(a): MINING AND MINERAL BENEFICIATION (ELECTIVE-I)

UNIT-I

Mining Terminology. Types of Mining Methods-Alluvial Mining – pan and Batea. Long Tom, Sluicing (Ground Sluicing) Derricks and Cable Way, Hydraulic Drift Mining. Fore poling and Dredging. Open Cast Mining –Bench Mining- Glory Hole Mining, Kaolin Mining, Strip Mining.

UNIT-II

Underground Mining- Gophering, Breast, Stopping, Open Overhand stopping, Underground Glory Hole Mining. Pillar and Chamber Method, Sub-Level Stopping Method.

UNIT-III

Coal Mining Method – Panel System, Board and Pillar Method, Long wall Mining, Advance and Retreat, Horizon Mining, Strip Mining, Mine Supports, Lighting Ventilation.

UNIT-IV

Crushing- Jaw Crushers, Gyratory Crushers, Cone Crushers, Sledging Rolls, Hammer Mill or Pulverator, Stamping, Spring Rolls, Manual Crushing. Grinding- Sizing by Screening, Flotation, Magnetic Separation, Electro- static Separation.

Reference:

1. Courses in Mining Geology- Arogyaswamy
2. Principles of Mineral Dressing- Gaudin
3. Mining Policy Initiatives- Dhar, Gautam
4. Mineral Processing Technology-Wills

SEMESTER-III

PAPER-IV (b)

G. 3.4(b): MINERAL EXPLORATION AND MINERAL ECONOMICS

(ELECTIVE-II)

UNIT-I

Geological Exploration – Exploration Guides –Physiographic, Lithological, Stratigraphic and Structural.

UNIT-II

Exploration Geochemical Exploration –Types of Geochemical Surveys and Exploration tools. Geochemical Environments, Dispersion and Mobility of Geochemical Associations and Pathfinders and their Application. Primary and Secondary Environments.

UNIT-III

Geophysical Exploration – Concept of Geophysics, Gravity, Magnetic, Seismic and Electrical Methods of Prospecting. Well logging Techniques.

UNIT-IV

Mineral Economics – National Mineral Policy, Expendable and Non Expendable Minerals. Substitutes Conservation. Strategic, Critical and Essential Minerals.

References:

1. General and Applied Geophysics – I. K. Kaul; A. K. Battacharya & S. Sen Gupta.
2. Out lines of Geophysical Prospecting – A Manual for Geologists- M.B. Ramachander Rao
3. Fundamentals of Geophysics- Lowrie.
4. Mining Geology – Hug Exton Mc Kinstry.
5. Mineral Economics – Sinha and Sharma
6. Mineral Economics- Chatterjee.

SEMESTER-III
PRACTICAL - PAPER - I
G: 3.5: ORE GENESIS AND ELECTIVEI/II

Ore Genesis:

Microscopic study of polished sections – ore textures and structures and identification of megascopic ore minerals by physical properties.

ELECTIVES:

I-MINING AND MINERAL BENEFICIATION

1. Determination of true dip, dip direction, thickness and distance of outcrop from the nearest borehole.
2. Estimation of reserves in underground mine using borehole data.

II-MINERAL EXPLORATION AND MINERAL ECONOMICS

1. Calculation of assay values of the ore deposit.
2. Calculation of tonnage by grid pattern.

SEMESTER-III
PRACTICAL - PAPER-II
G: 3.6: HYDROGEOLOGY AND ELECTIVE-I/II

Hydrogeology:

1. Rainfall analysis.
2. Moving average curve problems.
3. Porosity and permeability problems.

ELECTIVES I/II:

I-REMOTE SENSING

1.Study of Satellite data; Digital image techniques; ERDAS Software etc
2.Interpretation of satellite images – False colour composites.
3.Visual image interpretation and extraction of thematic layers.
4. Identification of structures and lineaments.
5. Delineation of land forms, study of geomorphology and hydrogeomorphology.
6. Study of land use and land cover and demarcation of drainage basin.

II- STATISTICAL GEOLOGY

1. Interpretation of histograms, cumulative curves, scatter diagrams;
2. Problems on the student 't' test, chi square test. mean; median and mode; standard deviation; skewness and kurtosis and their interrelationship.

M.Sc. Geology

SEMESTER –IV

PAPER-I

G: 4.1: MINERAL DEPOSITS

UNIT-I

Geology Mode of Occurrence, Origin and Distribution in India and Uses of the following Ore deposits.

Precious Metals : Gold

Ferrous Metals : Iron, Manganese and Chromite

UNIT-II

Geology Mode of Occurrence, Origin and Distribution in India and Uses of the following Ore deposits.

Base Metals: Copper, Lead and Zinc.

Light Metals : Aluminum and Magnesium.

UNIT-III

Geology Mode of Occurrence, Origin and Distribution in India and Uses of the following Ore deposits. Refractory, Ceramics, Glass, Abrasives and Fertilizers.

UNIT-IV

Geology Mode of Occurrence, Origin and Distribution in India and Uses of the following Ore deposits. Mica, Asbestos, Talc, Gypsum, Barytes and Gemstones.

References:

1. Bateman A. M (1981), Economic Mineral Deposits, John Wiley and Sons, New York
2. DEB. S (1980), Industrial Minerals and Rocks of India, Allied Publishers.
3. Krishna Swamy, A (1979), India Mineral Resources, 2nd Edition, Oxford and IBH Publishing company, New York.
4. R. K. Sinha (1976), A Treatise of Industrial Minerals of India, Allied Publisher.

SEMESTER –IV
PAPER-II
G: 4.2: GROUND WATER EXPLORATION AND MANAGEMENT

UNIT-I

Introduction to prospecting methods – Hydrogeological methods, well inventory studies, Surface geophysical methods for groundwater prospecting, Electrical Resistivity Methods – Schlumberger, Werner Methods. Application of Remote Sensing methods for Groundwater Prospecting.

UNIT-II

Types of Wells – Open Wells, Bore Wells, Tube Wells – Geological Considerations for Sinking of Wells – Well Design- Size, Shape and Depth –Failure of Wells- Causes and Remedies, Incrustation, Corrosion, Air Pumping and Rehabilitation of Wells.

UNIT-III

Water quality and pollution – Introduction to Groundwater quality, Physical and Chemical properties .- Surface and Groundwater pollution – Factors contributing to pollution of surface and subsurface water. Industrial pollution, Agriculture pollution. Urban pollution and Mining Pollution – Saline water intrusion, its causes and control – Water pollution controlling measures.

UNIT-IV

Water conservation and management – Artificial recharge methods – Direct and Indirect methods. Direct methods – Surface spreading techniques – Ditch and furrow methods. Pit method, Run of conservation structures. Sub surface techniques- Injection wells, Sub- surface dykes. Indirect methods- Induced recharge method, Groundwater conservation structures- Check dams, percolation tanks, sub-surface dams and waste surface water recharge. – Rainwater – Harvesting methods, Groundwater management and Conjunction use of water.

References:

1. Ground Water Hydrology – Todd
2. Applied Hydrogeology –Fetter
3. Groundwater Assessment and Development- Karanth
4. The Geochemistry of Natural Water- Dreven
5. Groundwater Management- Raman
6. Water Shid Management- Khan
7. Evaluation and Development of Groundwater- Mahajani
8. Fundamentals of Geophysics –Lowire
9. Groundwater Surveys and Investigations – Mahajani
10. Physical and Chemical Hydrogeology – Domenico
11. groundwater and Tube Wells- Garg
12. Groundwater and Management –Ramesh Ramachandra
13. Principles and Applications of Groundwater Geophysics – Murali and Patangay.

SEMESTER –IV

PAPER-III (a)

G: 4.3 (a): GEOGRAPHICAL INFORMATION SYSTEM (GIS)

UNIT-I

Geographical Information System- History and Developments in Geographical Information System. GIS Terminology, Hardware and Software requirements. Overview of Current GIS Packages. Basic commands for drawing and editing lines, Polygon, Labeling and Annotations.

UNIT-II

Geographical Information System Models and Structures- Geographical data (Spatial and Non Spatial Data), Spatial Data Models- Raster and Vector Data Structures. Non Spatial Data Models- Integrated data Models. Data inputting Methods of GIS and Digitization.

UNIT-III

Editing in GIS – Identifying digitization errors and Correcting the errors – Tolerance – Tic match tolerance, Fuzzy tolerance and Grain tolerance. Dangle length. Spatial Data Analysis (SDA)- Types of Overlay Operations- Single –layer and multilayer operations.

UNIT-IV

Buffer and Network analysis in GIS. Topology-Creations, Connectivity, Containment, Contiguity. Constructing Topology, Feature Attribute Tables, Build and Clean. Data quality and Source of Errors. Digital Elevation Models (DEM), Applications of Geographic Information System.

References:

1. Principles of Geographical Information System for Land Resource Management, P.A. Burrought (1990), Oxford University Press.
2. Geographical Information System- Principles, Vol.1 Good Child,
3. Geographical Information System.- A Guide to the Technology, John C. Antenucci et al (1991), van nontrand reinhold Publications, New York.
4. Geographical Information System for Geoscientist – Modeling with GIS, Graeme F, Bonham Carter (1994),Pergman Publications,Computer Methods in Geosciences,Vol.13.
5. GIS by ESRI, map projections, geo- referencing spatial data, environmental system research institute inc., New York, USA.
6. An Overview and Definitions of GIS, Vol.1, Geographic information System, Meguire, D.J. Good Child, M.F. and Rhind , D.W (1991), Longman Scientist and Technical Publications.
7. Remote sensing and GIS By Anji Reddy

SEMESTER-IV
PAPER-III (b)
G: 4.3(b): CHEMICAL GEOLOGY(ELECTIVE-II)

Unit – I

Introduction: Petrological nomenclature of major element oxides, abundance of major elements in the continental crust, Chemical analysis of rocks: A summary on how rocks are analysed, sampling methods, sample preparation; Instrumentation:XRF (X-Ray fluorescence), EPMA (Electronprobe microanalysis), AAS (atomic absorption spectroscopy), ICPMS (inductively coupled plasma mass spectrometry).

Unit – II

Whole rock chemical compositions: Major and trace elements including rare earth element (REE) distribution in typical igneous rocks such as granite, nepheline syenite, gabbro,anorthosite, dunite, pyroxenite, carbonatite, lamprophyre and basalt; Reflection ofpetrochemistry in mineralogy; Chemical indexes: Silica content, principle of silica saturation, alumina saturation, agpaitic coefficient, agpaicity and miaskicity; Variation diagrams: Binary and ternary variation diagrams for major and trace elements, characteristic REE patterns of important igneous rocks.

Unit – III

Petrological model for upper mantle: Mineralogy, chemical composition, evidences from xenoliths in kimberlites, evidences from xenoliths in alkali basalts, evidences from xenoliths in meteorites, high P-T experiments; Partial melting processes: Normal state of mantle, P-T conditions necessary for the onset of partial melting, causes of partial melting, types of partial melting,

Unit – IV

Trace element behaviour; Trace elemental fractionation: Geochemical fractionation of trace elements in magmatic processes, REE in igneous petrogenesis; Nature of melts: Basaltic magma spectrum in relation to partial melting, primary magma spectrum, definitions of primary, parental and primitive magmas, eutectic nature of the melts.

References:

1. Igneous petrogenesis -a global tectonic approach (1989) M. Wilson Unwin Hyman Ltd.,
2. Using geochemical data; evaluation, presentation and interpretation (1992) H.Rollinson.
3. Igneous petrology - Developments in Petrology, C.J. Hughes (No 7), Elsevier Publications,
4. Igneous petrology – Middlemost.
5. Igneous Petrology – Antony Hall
6. Igneous and Metamorphic Petrology- Best
7. Introduction to Petrology- P.J.Wyllie, Prentice Hall.
8. Petrology – V. Hyndrnam Ed II
9. The evolution of Igneous Rocks – N.L.Bowen, Princeton University Press.
10. Granite Petrology and Granite Problem – Marino V.Elsevier.
11. Natural Histroy of Igneous rocks – Herker A.Mc.Millan.
12. Basalts VolI andII Poldervaart and Hess, H,H.
13. Ultramafic rocks – Wylliie, P.J.Heffer.
14. Principles of Geochemistry by B. Mason and C. B. Moore.

SEMESTER –IV

PAPER-IV (a)

G: 4.4(a): ENVIRONMENTAL GEOLOGY (ELECTIVE -I)

UNIT-I

Introduction and Scope of Environmental Geology, Fundamental Concepts of Hazards, Geological Hazards, Volcanic Earthquakes, Floods and Landslides.

UNIT-II

Man as agent of mass wasting and land Scarification. Environment impact of mining and mineral processing. Health Hazards associated with mining. Nuclear waste disposal and its Hazards on environment. Waste disposal practices and their effects on environment.

UNIT-III

Geotechnical constructions and its effects on environment- Dams, tunnels, Roads, Urbanization and Canals, Pollution- Air, Water (surface and sub- surface), agriculture, industrial and Marine oil pollution.

UNIT-IV

Global warming – Causes, remedies and their effect on Ecosystem. Human impact on environment. Environment conservation and management. Policy planning of environment.

References:

1. Environmental Geology – Valdiya
2. Environmental Geology- Coates
3. Environmental Geology, Geo Ecosystems Protection in Mining Areas- Ghosh.
4. Geology, environment Society – Valdiya
5. Global Warming and Climate Change
6. A Text Book of Environmental Geology- Purohit
7. Environmental Geology- Lundgren
8. Mining environment- Bharath B. Dhar
9. Impact of Mining on Environment Water Pollution – R. K. Sharam
10. Environmental Geology- Montaganery
11. Environmental Geology- Keller
12. Principles of Environmental Sciences- Cunningham.
13. Basic Environmental Technology –Nathanson
14. Environmental Sciences – Wright Nebel
15. Environmental Geography-Saxena
16. Environmental Impact Assessment –Bartiwal
17. A Text Book of Environmental Sciences- Subramanyan
18. Atmosphere, Weather and Climate- Sidhartha.

SEMESTER –IV

PAPER-IV (b)

G: 4.4(b): ENGINEERING GEOLOGY (ELECTIVE -II)

UNIT-I

Role of Geologist in Civil Engineering Constructions. Engineering Properties of Rocks- Building stones and aggregates. Engineering site selections. Types of soil with special reference to Engineering Properties.

UNIT-II

Dams – Types and geological considerations for the selection of Dam sites. Case Histories of some major Dams – Nagarjuna Sagar, Srisailam and Bhakranangal. Reservoirs- Geological Considerations for Reservoirs and Measures to control Silting. Seismic activity in Reservoir areas.

UNIT-III

Tunnels –Types of Tunnels, Geological consideration in the selection of the Tunnel aligment, Lining of Tunnels and alignment. Consideration for Bridge and Building site selection.

UNIT-IV

Impact of Earth Quakes, Landslides and Groundwater on Civil Engineering Constructions and Preventive measures. Coastal Erosion – Causes and Preventive measure.

References:

1. Principles of Engineering Geology and Geotechniques – Krynine Judd
2. Engineering and General Geology – Purbin Singh (6^{th} Edition)
3. Fundamental of Engineering Geology - Khurmi
4. Geology for Engineers – F. G. H. Blynth.
5. A Text book of Engineering Geology- Chenna Kesavulu.
6. Modern Geotechnical Engineering – Alam Singh
7. Engineering Geology for Civil Engineers – D. Venkat Reddy.

SEMESTER – IV
PRACTICALS - PAPER-I
G: 4.5: MINERAL DEPOSITS AND ELECTIVE-I/II

MINERAL DEPOSITS:

1. Megascopic description with physical properties, identification, uses, occurrence and distibution of the Fe ore minerals, Mn ore minerals, Cr ore minerals, Al ore minerals, Cu ore minerals, Pb ore minerals, Zn ore minerals, micas and asbestos, casseterite, pitchblende, molybdenite, orpiment, realgar and cinnabar, gemstones, apatite, gypsum, fluorite, graphite, limestone, dolomite, beryl, corundum and aluminosilicates.

ELECTIVES - I/II:

I-GIS:

1. Introduction to computers, data input devices, key board, scanner, output devices, monitor, printer and plotter.
2. Auto-CAD, digitization techniques, Auto-CAD software, import of images, creation of layers, digitization etc.
3. GIS, softwares, ARC INFO, ARC-GIS.
4. Exploring and planning data sets for GIS.
5. Preparing data sets for input in GIS environment.
6. Integration of spatial and temporal data
7. Analysis and manipulation of data in GIS.
8. Graphical representation of data.
9. Modelling and extrapolation of data.
10. Report writing.

II-CHEMICAL GEOLOGY:

1. Plotting and interpretation of WR chemical data against Harker's and Nockold's indices.
2. Plotting and interpretation of WR chemical data against Thornton and Tuttle's index.
3. Plotting and interpretation of WR chemical data against Macdonald's fractionation Index.
5. Plotting of WR chemical data in AFM and Ca-Na-K diagrams and study of liquidlines of descent of thoeliitic and calc alkaline suites.
6. Preparation of chondrite-normalised REE patterns for fractionated and accumulated rocks.
7. Plotting and interpretation of WR chemical data against Petrogeny's residua system.

SEMESTER – IV
PRACTICALS - PAPER-II
G: 4.6: GROUNDWATER EXPLORATION AND ELECTIVES

GROUNDWATER EXPLORATION:

1. Groundwater prospecting methods : Electrical- Schlumberger and Wenner
2. interpretation of Geophysical data.
3. Curve matching techniques.
4. Water Analysis and Graphical interpretation of data.

ELECTIVES - I/II:

I- ENVIRONMENTAL GEOLOGY

1. Interpretation of water quality by Wilcox diagram,
2. US salinity and Gibbs variation diagram.
3. Water quality monitoring, collection of water samples and analysis.
4. Air quality monitoring, demonstration of instruments, collection of air samples and analysis.

II-ENGINEERING GEOLOGY

1. Study and interpretation of geological maps pertaining to the tunnel sites.
2. Study and interpretation of tunnel alignment problems..
3. Selection of suitable location for dam site from the given geological map based on merits and de merits of sites

Note: A geological training program / tour is recommended for the MSc. Geology final year students.