SCHEME OF EXAMINATION & DISTRIBUTION OF MARKS

SEMESTER - I

Paper No.	Title of the Paper (s)	Internal Assessment	Term End Exam	Total Marks
1.	Structural Geology	20	80	100
2.	Mineralogy	20	80	100
3.	Geochemistry	20	80	100
4.	Crystallography & Crystal Optics	20	80	100
Lab-1	Structural Geology & Survey	-	-	100
Lab-2	Crystallography, Crystal Optics, Mineralogy & Geochemistry	-	-	100
			TOTAL	**600**

SEMESTER - II

Paper No.	Title of the Paper (s)	Internal Assessment	Term End Exam	Total Marks
1.	Igneous Petrology	20	80	100
2.	Metamorphic Petrology	20	80	100
3.	Sedimentalogy & Crustal Evolution	20	80	100
4.	Stratigraphic principles and Indian Geology	20	80	100
Lab-1	Petrology and Stratigraphy	-	-	100
Lab-2	Fieldwork	-	-	100
			TOTAL	**600**

SEMESTER - III

Paper No.	Title of the Paper (s)	Internal Assessment	Term End Exam	Total Marks
1.	Palaeontology	20	80	100
2.	Ore & Fuel Geology	20	80	100
3.	Geomorphology and Remote Sensing	20	80	100
4.	Mineral Exploration	20	80	100
Lab-1	Ore Geology and Mineral Exploration	-	-	100
Lab-2	Palaeontology Geomorphology and Remote sensing	-	-	100
			TOTAL	**600**

SEMESTER - IV

Paper No.	Title of the Paper (s)	Internal Assessment	Term End Exam	Total Marks
1.	Mining and Engineering Geology	20	80	100
2.	Environmental Geology	20	80	100
3.	Hydrogeology	20	80	100
4.	Disaster Management	20	80	100
Lab-1	Hydrogeology	-	-	100
Lab-2	Engineering Geology and Mining Geology	-	-	100
			TOTAL	**600**
			GRAND TOTAL	**2400**

SEMESTER-I
PAPER-I
STRUCTURAL GEOLOGY

UNIT-I

1.1 Rock deformation; Theory of stress & strain, their relationship.
1.2 Properties of elastic, plastic and brittle materials.
1.3 Strain analysis: types of strain; strain ellipse; strain ellipsoid; geological application of strain theory,
1.4 Stress analysis: compressive and shear stress; biaxial and triaxial stress. Mohr's Circle and envelope.

UNIT-II

2.1 Fold: Definition; Classifications- Geometrical and Genetic.
2.2 Mechanism of Fold formation and types of fold.
2.3 Fractures; their nomenclature, are relationship, orgin and significance
2.4 Joints its types; their analysis and relation with major structures

UNIT-III

3.1 Fault: Types and mechanism of faulting.
3.2. Principal stress orientation for the main fault types.
3.3 Analyses of brittle-dectile and ductile shear zones
3.4 Petrofabric Analysis; Field and laboratory techniques; Preparation of petrofabric diagrams and their interpretation.

UNIT-IV

4.1 Cleavage & Schistosity: definition and types.
4.2 Mechanism of formation of Cleavage & Schistosity; its relationship with major deformation structures
4.3. Lineation: definition and its types; their mode of development and relation to major structures
4.4 Plutons: Definition & description; its role in progressive deformation.

UNIT-V

5.1 Tectonics: definition and its types
5.2 Stereographic Projection: Principles and application
5.3 Tectonics and structural characteristics of Plate Boundaries.
5.4 Geodynamic evolution of the Himalayas

SEMESTER-I
PAPER-II
MINERALOGY

UNIT-I

1.1 Composition of minerals and Mineraloids.
1.2 Physical Properties of Minerals depending on Crystal Structure.
1.2.1 Electrical, Magnetic, Luminescence, Thermal and Radioactive Properties of Miner
1.3 Structure of Silicates.

UNIT-II

2.1 Ionic Radius Coordination Principles, Close Packing, Pauling's Rules.
2.2 Unit Cell, Bonding Forces in crystals; Ionic Bond, Covalent Bond, Van Der Waal's Bond, Metallic Bond. Van Der Waal's Bond, Metallic Bond.
2.3 Solid solution; Substritution, Interstitial and Omission solid solution. Ex-solution.
2.4 Polymorphism, polytypism, pseudomorphism.

UNIT-III

Classification of Minerals. Systematic Mineralogy of common rock forming, silicate groups.
3.1 Classification of Minerals
3.2 Nesosilicates –a) Olivine Group b) Garnet Group c) AI2SIO5 Group.
3.3 a) Topaz, b) Staurolite, c) Sphene.
3.4 Sorosilicates – Epidote

UNIT-IV

Systematic Mineralogy of common rock forming silicate groups
4.1 Cyclosilicates-a) Cordierite b) Tourmaline c) Beryl
4.2 Inosilicates- a) Pyroxene Group
4.3 Inosilicates-a) Amphibole Group
4.4 Phyllosilicates – a) Mica Group b) Chlorite Group c) Clay Mineral Group.

UNIT-V

5.1 Tectosilicates-a) SiO2 Group b) Zeolite Group
5.2 Tectosilicates – a) Feldspar Group b) Feldspathoid Group
5.3 Carbonates and Phosphates.
5.4 Gem and Semi precious minerals.

SEMESTER-I
PAPER-III
GEOCHEMISTRY

UNIT-I

1.1 Cosmic Abundance of the Elements. Formation of Solar System and Planets.
1.2 Composition and Classification of Meteorites, Geochemical classification of elements.
1.3 Trace, Volatile, Semi volatile, Alkali and Alkaline earth elements, its behaviour in magmatic processes.
1.4 REE and Y, HF. SE elements, Transition & Noble elements –its importance and concentrations in various igneous rocks and its behaviour in various magmatic process.

UNIT-II

2.1 Partition coefficient, Factors governing partition co- efficient.
2.2 Fundamental Laws of Thermodynamics. Free energy. Phase equilibrium and Gibb's Phase Rule.
2.3 Thermodyanamics of magmatic Crystallization
2.4 Geochemistry of Crust.

UNIT-III

3.1 Geochemistry of inland arcs.
3.2 Composition of Mantle, mineralogy of lower mantle.
3.3 Phase transition in the Mantle.
3.4 Formation of Core.

UNIT-IV

4.1 Aquatic Chemistry-Acid Base reaction, Dissolution and Precipitation of $CaCO_3$ Solubility of Mg, SiO_2 and $Al(OH)_3$.
4.2 Geochemical properties of clays- Kaolinite. Ion exchange of clays
4.3 Redox in Natural Waters. Eutrophication.
4.4 Factors controlling Weathering. Soil profile. Chemical and biogeochemical cycling in the soil.

UNIT-V

5.1 Basics of radiogenic isotope geochemistry. Scope of stable isotope geochemistry.
5.2 Composition of Rivers. Composition of Seawater.
5.3 Distribution of CO_2 in Ocean. Carbonate dissolution and precipitation.
5.4 Sources and sinks of Dissolved matter in seawater.

SEMESTER-I
PAPER-IV
CRYSTALLOGRAPHY & CRYSTAL OPTICS

UNIT-I

1.1 Crystal growth. Development of ideas of internal structure of crystals.
1.2 Space lattices and point systems. X-ray analysis of crystal structure.
1.3 Morphology of crystals. Fundamental Laws of Crystal Zones.
1.4 Symmetry elements. Classification of Crystals in 32 Classes.

UNIT-II

2.1 Symmetry and forms of crystals of holohedral class of isometric, tetragonal and hexagonal systems.
2.2 Symmetry and forms of crystals of holohedral class of orthorhombic, monoclinic and triclinic systems.
2.3 Goinometry of crystals. Crystal Projection – Stereographic.
2.4 Crystal Aggregates, Twinning. Irregularities & Imperfection in Crystals.

UNIT-III

3.1 Principles of transmission reflection of light from crystals. Interference colour.
3.2 Refraction and Refractometry. Methods of determination of R.I.
3.3 Birefringence in Crystals. Significance and use of plates, wedge and Bereck Compensator.
3.4 Pleochroism in Crystals.

UNIT-IV

4.1 Clasification of Crystals into isotropic, Uniaxial and Biaxial minerals.
4.2 Isotropic, uniaxial and biaxial indicatrix.
4.3 Optical characters of Isotropic and uniaxial minerals.
4.4 Optical characters of biaxial minerals.

UNIT-V

5.1 Optical Orientation –Extinction angle..
5.2 Dispersion in mineral , optic axial angle.
5.3 Optical anomalies.
5.4 Systematic determination of optical properties of minerals.

SEMESTER-II
PAPER-I
IGNEOUS PETROLOGY

UNIT-I

1.1 Factors affecting magma and its evolution. Composition of primary magma.
1.2 Partial melting of mantle- different models. Trace element behaviour during partial melting.
1.3 Magmatic differentiation processes.
1.4 Behaviour of major and trace elements during fractional crystallization.

UNIT-II

2.1 Concurrent assimilation and fractional crystallization. Magma mixing.
2.2 Various criterion for classification of Igneous rocks.
2.3 Petro graphic Province. Different variation diagrams and their applications.
2.4 Crystallization of basaltic magmas.

UNIT-III

Study of the petro genetic significance of following silicate systems:
3.1 Albite- Anorthite and Forsterite – Silica
3.2 Diopside- Albite- Anorthite
3.3 Diopside- Forsterite- Nepheline-Silica.
3.4 Nepheline- kalsilite- silica

UNIT-IV

Petrogenetic study of the following rock types and their distribution in India :
4.1 Basalt and Ophiolite
4.2 Peridotite, Ultramafite.
4.3 Granite, Anorthosite
4.4 Komatite, Kimberlite.

UNIT-V

5.1 Petrogenetic study of the carbonatite, Lamprophyre, and their distribution in India.
5.2 Mid-ocean ridge, volcanism.
5.3 Magmatism associated with subduction related igneous activity-continental and island arcs.
5.4 Magmatism in Large Igneous Plutons.

SEMESTER-II
PAPER-II
MATAMORPHIC PETROLOGY

UNIT-I

1.1 Definition of metamorphism, Agents and kinds of metamorphism.
1.2 Classification of metamorphic rocks.
1.3 Phase rule and its application in metamorphism.
1.4 Structure and texture of metamorphic rocks and their significance.

UNIT-II

2.1 Fabric of metamorphic rocks.
2.2 Depth zones. Systematic study of Barrovian and Abukuma zones of metamorphism.
2.3 Grade of metamorphism, Isograde & Isoreactiongrade and constrction of petrogenetic grids.
2.4 Concept of facies and facies series.

UNIT-III

3.1 Study of ACF, AKF and AFM diagrams.
3.2 Polymetamorphism and paired metamorphic belts.
3.3 Metamorphic differentiation.
3.4 Retrograde Metamorphism and Crystalloblastic scries.

UNIT-IV

4.1 General Characters of thermal and regional metamorphism of limestone, shale and basic igneous rocks.
4.2 Metamorphism in relation to magma and orogeny.
4.3 Metasomatism-Principles and types of measomatism. Granitization.
4.4 Anataxis, Palingenesis. Origin of Migmatites in the light of experimental studies.

UNIT-V

5.1 Kinetics of metamorphic mineral reaction. Pressure- temperature- time paths.
5.2 Ultra-high temperature and ultra-high pressure and ocean floor metamorphism.
5.3 Layering in metamorphic rocks.
5.4 Petrogenetic significance of following rocks with special to Indian occurrences: charnockite, amphibolites, khondalite, Gondite, Eclogite.

SEMESTER-II
PAPER-III
SEDIMENTOLOGY AND CRUSTAL EVOLUTION

UNIT-I

1.1 Earth surface system-liberation and flux of sediments.
1.2 Processes of transport and generation of sedimentary structures.
1.3 Stromatolites and their significance.
1.4 Textural analysis of sediments, Graphical representation statistical treatement and geological significance.

UNIT-II

2.1 Classification of sandstone and carbonate rocks. Dolomite and dolomitization.
2.2 Volcaniclastics. Sedimentary environments and facies.
2.3 Continental: alluvial-fluvial facies, Lacustrine, Desert- Aeoliana and glacial sedimentary environments.
2.4 Shallow constal clastics and shallow water carbonates.

UNIT-III

3.1 Evaporites. Deep-sea basins.
3.2 Paleocurrents and basin analysis.
3.3 Plaeoclimates and paleoenvironment analysis.
3.4 Diagenesis of sandstone and carbonate rocks- changes in mineralogy, fabric, and chemistry.

UNIT-IV

4.1 Petrogenesis of arkoses and greywacke.
4.2 Evolution of lithosphere, hydrosphere, atmosphere and biosphere.
4.3 Application of Trace, REE and stable isotopes geochemistry to sediment logical problems.
4.4 Evolution of continental and oceanic crust.

UNIT-V

5.1 Lithological, geochemical, stratigraphic characteristics of granite-greenstone belts.
5.2 Evolution of Proterozoic sedimentary basins of India.
5.3 Anatomy of Organic belts.
5.4 PreCambrian-Cambrian boundary with special reference to India..

SEMESTER-II
PAPER-IV
STRATIGRAPHIC PRINCIPLES AND INDIAN GEOLOGY

UNIT-I

1.1 Principles of stratigraphic scales and its divisions.
1.2 Stratigraphic units- lintostratigraphic, biostratigraphic and chronostratigraphie.
1.3 Rules of stratigraphic nomenclature.
1.4 Stratigraphic correlation.

UNIT-II

2.1 Concept of sequence stratigraphy.
2.2 Chief divisions of Indian sub continent and teir physiographic characters.
2.3 Archaean Era. Distribution and classification in Peninsula and extrapeninsular regions, their correlation and economic importance.
2.4 Dharwar Supergroup (Classification, Distribution, Economic importance)

UNIT-III

3.1 Cuddaph Supergroup its distribution, classification & equivalent in extra peninsula.
3.2 Vindhan Supergroup-its distribution classification age economic importance and
correlation and economic importance.
3.3 Chhattisgarh Group. Indravati Group and Khairagarh Group, their classification, age
correlation and economic importance.
3.4 Palaeozic formations of extra peninsular regions with special reference to their classification distribution and correlation.

UNIT-IV

4.1 Distribution, geological succession, classification and climate of Gondwana supergroup. Age and correlation of Gondwana formations.
4.2 Jurassic system of rocks.
4.3 Distribution, Classification of cretaceous formation of Peninsular India.
4.4 Distribution, structural features and age of the Deccan Traps, Inter trappeans and
infra trappeans of India.

UNIT-V

5.1 Problems of Permo-triaassic and Cretaceous- Palaeocene boundaries.
5.2 Distribution, succession, correlation and life of siwalik formations.
5.3 Distribution, lithology, correlation & life of the Cenozoics of Assam and Pleistocence
(Quaternary) deposits, Karewa Beds, Indogangetic Alluvium.
5.4 Quaternay climate, glacial and interglacial cycle, Eustatic change.

SEMESTER-III
PAPER-I
PALAEONTOLOGY

UNIT-I

1.1 Definition of fossil and modes of fossilization their application in age determination, paleoclimatology, palaeogeography and evolution.
1.2 Modes and theories of organic evolution , concept of bathymetric distribution of animals, migration and extinction of species.
1.3 Outline classification of organisms.
1.4 Study of morphology, classification, evolutionary trends and geologic and Geographic distribution of Brachiopod.

UNIT-II

Study of morphology, Classification, geologic history of the following.
2.1 Pelecypoda (Lamellibranches)
2.2 Gastropoda.
2.3 Cepholopoda
2.4 Trilobites.

UNIT-III

Study of morphology, Classification, Evolutionary geologic history of the following.
3.1 Echinoids. Graptolites and Rugose Corals.
3.2 An elementary idea about the origin of major groups of vertebrates.
3.3 Study of evolutionary history of Horse and Elephant Man.
3.4 Study of evolutionary history of Man.

UNIT-IV

4.1 General study of siwalik mammalian fauna.
4.2 Pant life through geologic ages
4.3 Study of fossil flora of Gondwana Group and Tertiary Formations of India.
4.4 Definition and scope of micropaleontology.

UNIT-V

5.1 Techniques in micropaleontology.
5.2 Application of microfossils in stratigraphic correlation, age determination and Palaeo environmental interpretations.
5.3 Study of morphology of foraminifers.
5.4 Classification, evolution and geological distribution of foraminifers.

SEMESTER-III
PAPER-II
ORE AND FUEL GEOLOGY

UNIT-I

1.1 Modern concepts of ore genesis. Spatial and temporal distribution of ore deposits- Global perspective.

1.2 Concept of ore bearing fluids, their origin and migration. Flulid inclusion in ores- limitations and applications.

1.3 Texture, paargensis and zoning in ores.

1.4 Wall rock alteration. Structureal, physic-chemical and stratigraphic controls of ore localization.

UNIT-II

2.1 Orthomagmatic ores of mafic-ultramafic association Diamonds n kimberlistes, REE in Carbonatite, Ti—V Ores, Chromite and PGE, Ni Ores.

2.2 Cyprus type Cu-Zn Ores.

2.3 Ores of Silicic igneous rocks-Kiruna type Fe-P. Pegmatoids, Greisen and Skarn deposits.

2.4 Porphyry associations- Kuroko type Zn-Pb. Pegmatoids. Greisen and Skarn deposits.

UNIT-III

3.1 Ores of Sedimentary affiliations- Chemical and Clastic sediments. Stratiform and Stratabound ore deposits (Fe, Mn, Non ferrous). Placers and paleoplacers.

3.2 Ores of Metamorphic affiliations. Metamorphism of ores and metamorphogenic ores.

3.3 Ores related to weathered surfaces- Bauxite. Ni and Au laterite.

3.4 Mineralogy, genesis, distribution in India and uses of Cu,Pb,Zn,

UNIT-IV

Mineralog, genesis, distribution in India and uses of following ore deposits

4.1 Ion and manganese

4.2 Gold and Silver

4.3 Aluminum and chromium

4.4 National Mineral Policy and mineral concession rules.

UNIT-V

5.1 Definition and origin of Kerogene and coal. Rank, Grade and type of coal. Microscopic constituents of coal.

5.2 Chemical characterization of coal Proximate and ltimate analysis. Coal bed methane. Distribution of Coal in India.

5.3 Origin, nature and migration of oil and gas. Characteristics of reservoir rocks.

5.4 Oil bearing basins of India. Geology of productive oil fields of India. Mode of Occurrence and association of atomic minerals in nature. Prodctive geological horizons.

SEMESTER-III
PAPER-III
GEMORPHOLOGY AND REMOTE SENSING

UNIT-I

1.1 Geomorphic concepts and geomorphic cycle.
1.2 Geomorphic processes – Weathering, soil formation, Mass-Wasting
1.3 Valley development, cycle of erosion, rejuvenation.
1.4 Drainage patterns and their significance.

UNIT-II

2.1 Fluvial landforms and Glacial landforms
2.2 Karst topography
2.3 Arid and Eolian landforms
2.4 Coastal and volcanic landforms.

UNIT-III

3.1 Terrain evaluation and concept of morphometric analysis.
3.2 Geomorphic regions of India.
3.3 Principles of terrain analysis.
3.4 Concept and physical basis of remote sensing. Platforms: Terrestrial and Aerial, Advantages and Limitations.

UNIT-IV

4.1 Electromagnetic spectrum and principles of remote sensing.
4.2 Interaction of EMR with atmosphere and earth surface features.
4.3 Remote sensing sensors, data acquistition, visual interpretation and digital processing techniques. Interpretation of topographic and tectonic features.
4.4 Aerial photography, photographs and their geometry. Photogrammetry.

UNIT-V

5.1 Stellite remote sensing. Global and Indian space missions.
5.2 Application of remote sensing in geology.
5.3 Application in Geomorphology.
5.4 Application in groundwater evaluation, terrain evaluation and strategic purposes.

SEMESTER-III
PAPER-IV
MINERAL EXPLORATION

UNIT-I

1.1 Prospecting & Exploration, surface and subsurface methods.

1.2 Guides to ore search: Stratigraphic, litho logical, mineralogical and structural guides.

1.3 Drilling: Type of drills, Diamond drilling, Drilling records and logs.

1.4 Sampling: General principles various methods and procedures, Average assays, weighting of samples. Precautions.

UNIT-II

2.1 Calculating grade and tonnage of ore: Average grade, volume, specific gravity, tonnage factor, calculations from data obtained from bore holes, geological maps and sections.

UNIT-III

3.1 Seismic prospecting: Methods of seismic prospecting and interpretation of seismic data.

3.2 Basic principles of resistivity method. Resistivity survey. Application and interpretation of resistivity data. S.P. Method and interpretation of data.

3.3 Radiometric prospecting. Radiometric survey. Application and interpretation of data.

3.4 Borehole logging: Principles of various borehole-logging methods, Interpretation of data.

UNIT-IV

4.1 Geochemical cycle, Forms of primary and secondary dispersion of elements. Secondary dispersion processes and anomalies.

4.2 Factors affecting dispersion patterns. Main types of geochemical surveys.

4.3 Methods of litho geochemical and pedogeochemical surveys.

4.4 Methods of hydro-geochemical, atmogeochemical and biogeochemical surveys.

UNIT-V

5.1 Case studies of regional exploration for deposits of pltonic associations and vein and replacement types.

5.2 Analytical methods- sample preparation and decomposition. Precision and accuracy.

5.3 Instrumentation and application of Atomic absorption spectrometer. Emission spectrograph and XRF.

5.4 Statistical treatment of geochemical data.

SEMESTER-IV
PAPER-I
MINING AND ENGINEERING GEOLOGY

UNIT-I

1.1 Definition of mining terms: pitting, trenching, panning, adits. tunnels, and shafts.
1.2 Role of geologist in mining industry. Strata control in different rocks and structures.
1.3 Geological structures of ore deposits and choice. Of mining methods.
1.4 Subsidence and rock bursts, mine supports, Ventilation and drainage.

UNIT-II

2.1 Open pit mining geologic and geomorphic conditions, different methods of opencast mining, advantages and limitations.
2.2 Underground mining methods gophering, shrinkage, stoping, caving and slicing sublevel, over hand, under hand methods.
2.3 Coal mining methods long wall, board and pillar.
2.4 Engineering properties of rocks and soil. Physical characters of building stones.

UNIT-III

3.1 Role of geologist in civil construction projects.
3.2 Geological considerations for evaluation of Dam and reservoir sites. Dam foundation problems.Dam faiure.

UNIT-IV

4.1 General principles, economic justification and scope of mineral dressing.
4.2 Properties or rocks and minerals applied to mineral dressing.
4.3 Previous and secondary breaking, crushing and grinding. Liberation by sizes, reduction.
4.4 Principles and methods of screening.
4.5 Principles and methods of classification. Classification as a means of concentration.

UNIT-V

5.1 Concentration methods hand sorting, washing, jigging, tabling heavy fluid.
5.2 Magnetic and electrostatic methods of separation of minerals.
5.3 Floatation methods- Principles and techniques with examples.
5.4 Concentration methods- with flow sheets of common types of mineral and ore dressing practices in India. Gold, copper, Lead-zinc, coal, beach sand, fluorite, iron, manganese, chromite and limestone.

SEMESTER-IV
PAPER-II
ENVIRONMENTAL GEOLOGY

UNIT-I

1.1 Definition, history and scope of environmental Geology.
1.2 Environment, Ecology, Ecosystems and habitat.
1.3 Nature of its degradation.
1.4 Basic concepts of Environmental Geology.

UNIT-II

2.1 Interaction of man and natural systems.
2.2 Conservation principle, conservation of mineral and fuel resources.
2.3 Conservation of soil and water resources.
2.4 Geological hazards- Lands slides, volcanic activity, Earthquake.

UNIT-III

3.1 Draught and desertification, Measures of mitigation.
3.2 Geological hazards- River flooding, erosion and sedimentation, coastal erosion, cyclones and tsunamis.
3.3 Transgression and Regression of sea. Measures of mitigation.
3.4 Human modifications of nature in surface and subsurface by engineering constructions. Dams. Reservoirs, biridges and buildings.

UNIT-IV

4.1 Changes in surface and subsurface by mining activities.
4.2 Changes in surface and subsurface by mineral based industries.
4.3 Human settlement and contamination of atmosphere soil surface water and groundwater by waste disposal and agro-industries.

UNIT-V

5.1 Environmental policies of the Government for air and water pollution. Environmental laws.
5.2 Problems of environment in urban areas, causes and remedies.
5.3 Climate Change and global warming: Causes and Impact (ozone hole).
5.4 Environment impact assessment report and preparation of environment Management plans.

SEMESTER-IV
PAPER-III
HYDROGEOLOGY

UNIT-I

1.1 Scope of hydrogeology and its relation with hydrology, meteorology and their uses in the Hydrogeological investigation.
1.2 Hydrologic cycle. Role of groundwater in the hydrologic cycle.
1.3 Hydrograph, data collection and analysis.
1.4 Water table and piezometric surface. Water table fluctuation. Water table contour maps. Interpretation and used.

UNIT-II

2.1 Water bearing formation-aquifers, aquitard. Aquiclude, aquifer types: perched, unconfined, semi-confined and confined. Isotropic, anisotropic aquifers.
2.2 Porosity, permeability. Ground water movement: Darcy's law and its application.
2.3 Specific yield and specific retention. Storativity and transmissivity.
2.4 Steady and unsteady flow, leaky aquifers, Ground water flow near aquifer boundaries.

UNIT-III

3.1 Bounded aquifers. Image wells.
3.2 Water wells and their types. Construction wells
3.3 Well Development and completion.
3.4 Pumping test and Yield wells.

UNIT-IV

4.1 Geological and Hydrogeological methods of groundwater exploration.
4.2 Geophysical methods-Electrical resistivity method for ground water exploration.
4.3 Application of remote sensing in groundwater exploration.
4.4 Basin wise development of groundwater with special reference to Chhattisgarh region.

UNIT-V

5.1 Groundwater provinces of India.
5.2 Sources of dissolved constituents in groundwater. Groundwater quality standard standards drinking domestic, agriculture and industry. Ground water pollution.
5.3 Groundwater management. Safe yield, overdraft and spacing of wells.
5.4 Conservation of Groundwater, conjunctive use of water, Artificial recharge.

SEMESTER-IV
PAPER-IV
DISASTER MANAGEMENT

UNIT-I

1.1 Natural Disasters: Introduction.
1.2 Causes and impact of Floods, Droughts.
1.3 Cyclone, Landslides,
1.4 Earthquake and Tsunamis

UNIT-II

2.1 Man made Disasters: Introduction
2.2 Causes and impact of Nuclear, Industrial accidents.
2.3 Environmental disasters, fires, rail accidents, road accidents.
2.4 Air accidents and sea accidents.

UNIT-III

3.1 Hazard Risk Concept and Elements.
3.2 Risk Analysis and Risk Assessment.
3.3 Resource Analyses and Mobilisation.
3.4 Strategic Developments for Vulnerability Reduction.

UNIT-IV

4.1 Disaster Preparedness: Conception and Nature.
4.2 Disaster Management- Prevention, Preparedness and Mitigation.
4.3 Search and rescue operations.
4.4 Use and Applications of Emerging Technologies in Disaster preparedness.

UNIT-V

5.1 Disaster Management Plan.
5.2 Disaster Response Plan.
5.3 Communication, Participation and Activation of Emergency Preparedness Plan.
5.4 Logistics Management.

SEMESTER - I
(PRACTICALS)

LAB COURSE - I

A] Structural Geology

1. Concept of line and plane, attitude of plane and line. Bedding plane, dip and strike, and their measurement.
2. Criteria for determination of top and bottom of strata in structurally deformed terrain and its study in hand specimen.
3. Preparation and interpretation of geological maps for simple structure contour maps, as well as, for fold, fault and unconformity.
4. Stenographic projection - problems in angular relationship true dip, apparent dip plunge and rake of the intersection of planes.
5. Three point problems: Geometric solution for three point problems.

B] Survey

Field techniques of geological mapping using:

a) Chain tape; Plane table and,
b) Global Positioning System

LAB COURSE - II

a] Mineralogy and Geochemistry

1. Megascopic study of common rock forming minerals.
2. Microscopic study of common rock forming minerals.
3. Calculation of mineral formulae.
4. Determination of total hardness in water.
5. Spot test for qualitative analysis.

B] Crystallography and Crystal Optics

1. Morphological study of crystal models and twins.
2. Stereographic projection of crystals.
3. Optical determination of
   a. Refractive Index.
   b. Order of Interference colour and birefringence.
   c. Interference figure and optic sign.
   d. Scheme of pleochroism.

SEMESTER - II
(PRACTICALS)

LAB COURSE - I

[A] INGEOUS &, METAMORPHIC PETROLOGY

1. Megascopic description and identification of igneous and metamorphic rocks.
2. Study of textures and structures of Igneous and metamorphic rocks.
3. Microscopic identification of Igneous and metamorphic rocks.
4. C.I.P.W. Norm calculations and classification of igneous rocks.
5. Constructions of variation diagrams of igneous suits of rocks.
6. Construction of A.C.F., A.K.F. and A.F.M. diagrams.
7. Plotting the Geographical distribution of Igneous and Metamorphic rocks in and outline map of India.
8. Use of software for norm calculation and geochemical modelling.

LAB COURSE - I

[B] SEDIMENTARY PETROLOGY AND STRATIGRAPHY

1. Megascopic description and identification of sedimentary rocks.
2. Study of sedimentary structures in hand specimen.
3. Microscopic study of sedimentary rocks.
4. Graphic representation of sedimentary data and interpretation.
5. Heavy mineral studies of sediments.
6. Distribution of Important geological formations on outline map of India.
7. Construction of fence diagrams
8. Correlation diagrams. Recognition of transgressive- regressive cycles based on vertical columns.

LAB COURSE - I

GEOLOGICAL FIELD WORK

1. Geological mapping in type areas of India to study structural relations and Stratigraphic formations in sedimentary, igneous and metamorphic terrains.
2. Collection and study of primary and secondary structures of rock bodies and their interpretation.
3. Sampling of rocks. Minerals and fossils in the field from study areas.
4. Preparation of geological maps and sections from the geological data obtained in the field.
5. Preparation of geological report based on field studies.
6. Viva-Voce on fieldwork and geological report.

SEMESTER – III
(PRACTICAL)

LAB COURSE: I – ORE GEOLOGY AND MINERAL EXPLORATION

1. Megascopic study of metallic and non-metallic economic minerals. Description and identification, uses and distribution in India.
2. Description and identification of ore minerals in polished section of ores.
3. Study of ore textures and structure under the microscope.
4. Para genetic study of ore minerals and construction of Para genetic diagrams.
5. Location of important metallic and non-metallic mineral compels in a map of India.
6. Calculation of ore reserves and assay values.
7. Study and interpretations of Isopach and Isopach and Isograde maps.
8. Evaluation of simple mining plans.
9. Interpretation of Geophysical and geochemical anomaly maps.
10. Numerical problems based on Geophysical and geochemical data.

LAB COURSE: II

[A] PALEONTOLOGY

1. Study and identification of important invertebrate, vertebrate and plant fossils. Drawing of neat sketches of fossils.
2. Sketching and labelling of representative fossil specimens. 3 Identification and study of important foraminifers.

[B] GEOMORPHOLOGY AND REMOTE SENSING

1. Identification and interpretation of drainage patterns.
2. Drawing of Labelled diagrams of landforms.
3. Determination of stream order, bifurcation ratio, drainage density, stream frequency, infiltration number.
4. Slope studies of landforms.
5. Study of aerial photographs and satellite imageries and identification of landforms.

SEMESTER-IV
(PRACTICAL)

LAB COURSE-I HYDRGEOLOGY

1. Hydro geological properties of rocks.
2. Interpretation of water table maps.
3. Computation of pumping test data.
4. Interpretation of Hydro geochemical data and their plotting in different diagrams.
5. Sieve analysis and screen gravel pack design.
6. Plotting of groundwater provinces on an outline map of India.
7. Computation of Resistivity (VES) data.

LAB COURSE-II ENGINEERING GEOLOGY AND MINING GEOLOGY

1. Interpretation of engineering properties of rocks in hands specimens.
2. Determination of compressive, tensile and sheer strength of rocks.
3. Determination of porosity and absorption of building materials.
4. Mechanical analysis of soils and unconsolidated materials.
5. Preparation of core-logs and their Geotechnical interpretation from bore whole data.
6. Plotting the geographical distribution of important dams, tunnels on the outline of India.
7. Terrain studies from satellite imageries, aerial photographs and Top sheet.