Qualifying Examination Syllabus for M Sc Geology at Savitribai Phule Pune University through Online Entrance Examination

OEE - 2026

Instructions: The examination will be based on multiple-choice questions, with a Total of 100 marks, comprising:

Section A: General knowledge/aptitude/logic/comprehension: 20 marks.

Section B: Subject-specific questions: 80 marks.

Examination for both sections will be conducted together.

Section A

Section A (20 Marks) Syllabus will be to test the ability of the candidates on the following aspects/topics:

General Knowledge Questions to test: General Knowledge and awareness, Current affairs, Quantitative aptitudes, Analytical ability, logic and reasoning, General statistical knowledge, Interdisciplinary knowledge and General aptitude, Comprehension skills, Application of scientific knowledge to Society and Nation, Geography and Environment, Geography and Geology of India, Human-environment-climate interactions, Climate Change and Environmental issues, Natural resources, Energy resources, Natural hazards and disasters.

Section B

This section tests the candidate's foundation for the qualifying degree as per eligibility to pursue the M Sc. Geology 2026-2028 Course as per the NEP 2020 or concurrent updates. The questions can be varied from 1 Mark to 2 Marks each. The candidate should follow the instructions carefully.

Unit I: Mineralogy

Introduction: Definition, branches and scope of mineralogy. Importance and conservation of minerals.

Formation of minerals: Introduction and description of geological processes of mineral formation;

a. Crystallization from melt.
b. Crystallization from Solution. (Evaporation and precipitation)
c. Crystallization from Vapour. (Sublimation)
d. Metamorphic processes.
e. Alteration and related weathering. (oxidation and supergene enrichment)

Utility of Minerals in Industries:

Ceramic, Refractory, Pharmaceutical, Paint, Glass, Cement, Fertilizer, Oil Industry, Electrical and Electronics.

CRYSTALLOGRAPHY:

A) Definition of a Crystal, External and Internal Imperfections in Crystals, Growth of crystals in Cavities, Etch figures and Solution Pits.

B) Study of Holohedral, Hemihedral and Hemimorphic forms of crystals with suitable examples

Physical properties of minerals

a. Colour, streak, lustre, cleavage, fracture, hardness, form, magnetism, electrical property, radioactivity, specific gravity & luminescence.
(Phosphorescence and Fluorescence)

b. Methods of determining specific gravity – Chemical balance, Walker's steelyard, Jolly's spring balance, pycnometer, heavy liquids.

Approximate Weightage 7 Marks Out of 80 Marks

Unit II. Igneous Petrology

Definition and major divisions

a. Definition of petrology, lithology, petrography, petrogenesis.
b. Major divisions and diagnostic characteristic of rocks : igneous, Sedimentary and metamorphic.
c. Rock cycle.

Igneous Petrology

Magma:

a. Magma and its composition.
b. Formation of crystals and glass.

Forms of Igneous bodies

a. Intrusive: Concordant and discordant intrusions
    1. Concordant: sill, laccolith, lopolith.
    2. Discordant: dyke and veins, batholith.
b. Extrusive: lava flows

Textures and Structures

a. Textures: Definition and factors controlling textures: Equigranular (granitic), Inequigranular (porphyritic), glassy
b. Structures: Vesicular, amygdaloidal, blocky, pillow, flow and columnar.

Classification of Igneous Rocks

Basis of Classification: Depth of formation, silica percentage,Type of feldspar content and colour index.Tabular classification.

Physico-chemical constitution of Magma.

a) Temperature
b) Pressure
c) Viscosity
d) Volatiles

Crystallization of Magma.

Unicomponent Magma; Factors controlling grain size of igneous rocks; Bicomponent Magma, Eutectic crystallization, Solid solutions (Plagioclase series)

Textures and Microstructures:

a) Definition, factors determining the texture of rocks
b) Study of following texture with respect to characters examples and genesis - Poikilitic, Ophitic, Subophitic, Intergranular, Intersertal, Directive, Intergrowth (Graphic)

c) Study of following structures / micro structures with respect to characters, examples and genesis- Orbicular, Spherulitic, Perlitic, Expansion Cracks and Reaction Rims.

Characteristics and generation of magmas

a) The physico-chemical nature of magma – density, viscosity, chemical constituents and temperature-pressure.
b) Role of magma in geological processes: melting of rocks and generation of magmas temperature-pressure conditions and volatile constituents. Generation of magmas in different tectonic settings.

Types of magma: Primary and derivative

Crystallization of magmas

a) Binary magma with an incongruent melting compounds: Leucite – silica system
b) Ternary system: Albite-Anorthite-Diopside system.
c) Reaction series and its importance

Textures/structures in igneous rocks & their singnificance

Textures : Granitic, porphyritic, glomero-porphyritic, poikilitic, ophitic & sub-ophitic, inter-granular, inter-sertal, cummulate, glassy, corona/ reaction rim, myrmeketic,

Structures : Ropy, vesicular, amygdaloidal, columnar, graphic, Orbicular, expansion cracks, flow,

Classification of igneous rocks

a) Complexity in classification
b) Types of classification,
   i) Shand's classification
   ii) CIPW classification
   iii) IUGS (plutonic, volcanic) classifications

Petrographic Provinces, Rock Kindreds and Description of Igneous Rocks

Concept of tectono-magmatic association

Petrographic Provinces & Rock Kindreds

Description of rock types

Description of rock types with regard to their characteristics, composition, Origin and occurrence in relation to their tectonic setting: i) Peridotite clan rocks; ii) Basalt; iii) Anorthosite; iv) Andesite; v) Granite; vi) Pegmatite; vii) Aplite

Approximate Weightage 7 Marks Out of 80 Marks

Unit III: Sedimentary Petrology

Sediments, sedimentation, sedimentary environment (definition and types) and formation of sedimentary rocks **-** Weathering (mechanical and chemical), erosion, denudation, transportation, deposition, compaction, cementation and lithification

Textures and structures of sedimentary rocks:

A. Clastic and non-clastic textures.
B. Structures: Lamination, bedding (concordant and discordant), graded bedding and ripple marks.

Derivation of sediments.

i. Sources of sediments
ii. Mineral composition of clastic / detrital sediments
iii. Concept of matrix and cement and its effect on porosity and permeability 5

Transportation of Detrital/ Clastic sediments:

i. Modes of Transportation (Including phases of traction)
ii. Definition of Competence, Capacity and Load of transporting Medium iii. Progressive changes in sediments during transport with respect to size, shape and mineral composition.

Diagenesis: Outline of following diagenetic processes:- Cementation, Authigenesis, Diagenetic Metasomatism, Diagenetic Differentiation and Intrastratal Solution.

Primary Sedimentary Structures: Description of following primary structures with respect to their origin and environmental significance:- Lamination, Bedding, Cross Bedding, Graded Bedding, Ripple Marks, Mud-Cracks.

Texture & Structures of Sedimentary Rocks

a) Definition of texture & factors controlling textures of sedimentary rocks;
b) Concept of shape & size classification;
c) Classification of sedimentary aggregates;
d) Grade scales (Udden, Wentworth, Krumbein & Phi scale);
e) Mechanical / Sieve analysis: procedures & format for plotting & interpretation in brief;
f) Inorganic primary sedimentary structures & their
g)Study of organic sedimentary structures

Approximate Weightage 7 Marks Out of 80 Marks

Unit IV: Metamorphic Petrology

A) Definition of metamorphism, agents of metamorphism, kinds of metamorphism, characteristics of different types of metamorphism

B) Tabular classification giving original rock, predominant agent of metamorphism, type of metamorphism and their metamorphic product of the following rocks: Slate Quartzite, Marble, Hornblende schist, Mica schist, Hornblende gneiss.

C) Structures in metamorphic rocks: maculose, slaty cleavage, granulose, schistose, gneissose

A) Metamorphism and Metamorphic minerals:
   a) Salient features of metamorphism as a process
   b)Difference between Metamorphism, Weathering, Diagenesis and Metasomatism
   c) Metamorphic minerals- Stress and anti-stress minerals, Idioblastic and Xenoblastic crystals.

B) Metamorphism and Metamorphic Products: Definition, general characteristics, textures/structures and mineral transformation involved during –
   a) Regional Metamorphism of
      i) Argillaceous rocks
      ii) Quartzofeldspathic rocks
      iii) Basic igneous rocks
   b) Cataclasis and its products- Crush Breccia, Crush Conglomerate, Cataclasite
   c) Thermal Metamorphism of
      i) Pure and impure limestones
      ii) Arenaceous rocks

Approximate Weightage 5 Marks Out of 80 Marks

Unit V: Structural Geology

Introduction and definition.

Planar features and their measurements, Clinometer compass (construction and uses)

Folds: Definition, parts of fold, anticline, syncline, symmetrical, asymmetrical.
Faults: Definition terms associated with fault, normal fault, reverse fault, step fault, horst and graben.
Joints: Definition, general characteristics, sheet joints, columnar joints.
Unconformities: Definition and types (disconformity, angular unconformity, nonconformity)
Tectonic and Non-tectonic structures.
Scale of tectonic structures (Micro, Meso, Macro & Regional)

PLANAR/LINEAR STRUCTURES, OUTLIER/INLIER

i) Attitude of planar feature - Strike and Dip

ii) True & Apparent Dip, True & Apparent thickness, True & Apparent Width of Outcrop and Vertical Thickness of planar feature.

iii) Attitude of Linear Feature, Bearing, Plunge and Rake of Linear Feature in given Planar Feature.

iv) Outlier and Inlier- Definition & Formation. v) Brunton Compass & its uses.

FOLDS: i)Introduction: Definition, causes and parts of folds: - axis, axial plane, limb, hinge, crystal line, crystal plane, trough line and trough plane.

ii) Definition, causes and characters of the following types of folds: - anticline, syncline, anticlinorium, synclinorium, symmetrical, asymmetrical, overturned, recumbent, isoclinal, chevron, box, fan, monocline, homocline, Structural terrace, open, close, drag, plunging and nonplunging, doubly plunging, dome and basin. Decollement, diapir, disharmonic, supratanеous.

iii) Concepts of fold systems and refolding

iv) Method to determine the depth of folding- Principle, assumptions, merits and limitations.

v) Recognition of folds by direct observation, plotting attitude of beds on map, topographic studies, drilling and mining data.

vi) Methods of representation of folds

FAULTS**:**

i) Definition of fault as a Planar zone, terms associated with Faults / fault zones

ii) Movements along faults- absolute, relative, apparent, translational and rotational

iii) Slips, separations, shift along faults

iv) Effects of faulting on disrupted strata

v) Geometric classification of faults

vi) Genetic classification of faults

vii) Recognition of faults in the field

JOINTS:

i)Definition and general characteristics of joints

ii) Rupturing under tension, compression, couple and torsion

iii) Geometric and genetic classification of joints with examples

Landforms associated with tectonic structures. Determination of top of bed with the help of primary structures (sedimentary & igneous) and interpretation of major structures with which they are associated.

Rock Deformation- Definition, Concept & fundamental principles

a) Force: Definition, representation, types (balanced & unbalanced) & unit of force.
b) Confining / Hydrostatic pressure & differential forces.
c) Stress & Strain-Definition and concept.
d) Stress-Strain diagram with reference to following :

e) Elastic & Plastic deformation
f) Brittle & Ductile substance
g) Rupture strength, Ultimate strength & Fundamental strength.
h) Factors controlling rock deformation: Confining pressure, temperature, time, solution, anisotropy & inhomogenity of rocks.
i) Rheology (definition & concept).

Plastic deformation:

a) Definition & examples of plastic deformation
b) Mechanisms of plastic deformation: Intergranular & intragranular movements, recrystallization with & without change in shape, Reckie's principle.

Concept & Mechanics of folding: (Based on internal processes operative within the rock)

Study of the following genetic styles of folding:

a) Flexure / Flexure-slip folding
b) Flow / Incompetent folding
c) Shear / Slip folding
d) Folds due to vertical movements

Mechanics of Rupturing & Faulting:
Mechanics of Rupturing; Mechanics of faulting
Definition, types & examples of foliations; Map symbols to express attitude of foliations & rock cleavages; Types of cleavages & schistosity (Secondary foliations); Slaty cleavages / schistosity; Fracture cleavages; Slip cleavages; Bedding cleavages; Origin of slaty cleavages / schistosity; Origin of fracture cleavages, slip cleavages & bedding cleavages; Cleavage banding & Segregation banding; Introduction to Superimpose Deformation
Definition, types & examples of lineations (Primary & Secondary), Types of secondary lineations & their origin; Linear parallelism of stretched pebbles / prismatic minerals / elliptical mica plates; Intersecting planar features; Cenulations; Slicken-sides; Boudins or Boudinage structures; Rodings; Axes of folds; Mullion structure; Map symbols to express attitude of lineations; Lineations in relation to major structures.

Approximate Weightage 8 Marks Out of 80 Marks

Unit VI: Geotectonics

Introduction to Geodynamics; evolution & formation of the solar system & earth & its physical properties; Interior of the Earth; Direct & indirect observations in exploration of Earth's interior; The variable interior- evidences; Seismic waves & Earth's interior; Types of seismic waves & their characteristics; Seismic wave velocity & depth curve to indicate layered structure of the Earth; Physical-chemical characteristics of the different layers of the Interior of the earth; Composition, physical properties & characteristics of three spherical zones of the Earth namely crust, mantle (including LVZ) & core; Concept of Lithosphere, Asthenosphere & Mesosphere; Concept & types of discontinuities –Conrad, Moho, Guttenberg & Lehman's Discontinuity; Introduction to Convection Currents & mantle dynamics

Plate Tectonics

Historical background of the plate tectonics theory, Plate tectonics as a unifying theory; Introduction to Wilson's cycle & Concept of plate tectonics; Characteristics of lithospheric plates; Concept of plate margin & plate boundary; Migration & motion of the plate boundaries; Present motion of world's large plates

Global tectonics

Three plate boundaries- (Divergent, Convergent & Transform faults-description examples). Divergent boundary as a constructive plate boundary & source of new oceanic crust; Concept of a rift valley & mid-oceanic ridges; Structural environment at divergent plate boundary; Examples of divergent plate boundary. **Convergent boundary as a destructive plate boundary;** Description & examples of the following types of convergent plate boundaries: i) Oceanic-oceanic subduction, ii) Oceanic-continental subduction, Continent-continent collision- case study of Alpine-Himalyan Orogeny, Concept of trench, subduction zone, Benioff zone & Ophiolite suites. T**ransform fault boundary,** Transform fault boundary as conservative plate boundary, ii) Distinction between Transform & Transcurrent faults, iii) Examples of Transform fault boundary.

Approximate Weightage 6 Marks Out of 80 Marks

Unit VII Stratigraphy

Introduction, definition, principles of stratigraphy, development of stratigraphic concepts, importance of stratigraphy. ii) Stratigraphic classification & Nomenclature, study of stratigraphic elements, lithostratigraphy and its units, chronostratigraphy and its units, biostratigraphy and its units. Inter-relationship between lithostratigraphic, chronostratigraphic and biostratigraphic units. iii) Methods of collecting stratigraphic data (stratigraphic procedures on outcrop and subsurface

Stratification: processes, Controlling stratification-physical, chemical and biological. Vertical succession, alternations, varves, cycles (symmetrical and asymmetrical)

Unconformity: definition, importance in stratigraphy environmental classification and stratigraphic evidence of unconformities.

Correlation: definition and evidence for correlation-physical and palaeontological.

Stratigraphy of India

Introduction to Indian and World Precambrian History: Physiographic / Tectonic divisions of India and their comparisons; Definition of Tectonic Elements of continents (cratons, shield, folded mountain belts)and oceans (mid-oceanic ridges, trenches and transform faults); Cratons of India and associated Proterozoic basins; General review of Indian Stratigraphy & Classification of the Indian litho-stratigraphic units, according to the Geological time scale; Earlier and current classification of Precambrian formations of India; World Precambrian history in brief; Cratons and mobile belts of the World.

Precambrian rocks of Peninsular India

Brief account of their distribution, Geographical location, classification lithological succession, structure and economic importance, with a broad stratigraphic correlation.

a) **The Dharwar Craton:** General Stratigraphy of Dharwar craton (in tabular form), distinction between older and younger Greenstone belts: Sargur Supergroup, Peninsular Gneisses, Dharwar Supergroup, Clospet Granite, Chamundi Granite.
b) **The Singhbhum – Odisha Iron Ore Craton:** General Stratigraphy of the region (in tabular form) Older Metamorphic Group (OMG), Iron Ore Group (IOG), Singhbhum Granite, Singhbhum Group, Extrusive and intrusive phases in the craton.
c) **The Central Indian Craton/ Bastar Craton:** General Stratigraphy of the region (in tabular form). Sakoli Group and Dongargarh Supergroup.
d) **Aravalli Craton:** General Stratigraphy in the Bhilwara Supergroup (Mangalwar Complex Sandmata Complex, Hindoli Group),Aravalli Supergroup
e) **Bundelkhand Craton:** Supracrustal and gneisses, Bundelkhand Granite and mafic dyke swarm

The Precambrian Mobile belts and Precambrians of the Extra-Peninsula:

The Proterozoic rocks of India:

A) a) The Archaean – Proterozoic boundary.
b) Proterozoic history in brief, changes in marine and terrestrial environments, tectonic zonation in platformal and geosynclinals basins

B) Classification, Succession, lithology, fossils and economic importance of:
a) The Delhi Supergroup; b) Cuddapah Supergroup; c) The Vindhyan Supergroup:
d) The Kaladgi Supergroup; e) The Chhattisgarh Supergroup.

Introduction to Phanerozoic Stratigraphy:

A) Precambrian – Cambrian boundary
B) Study of following Geological systems with reference to their type area, broad lithology, fossils content:

Cambrian, Ordovician, Silurian, Devonian, Carboniferous, Permian, Triassic, Jurassic, Cretaceous & Tertiary

The Paleozoic and Mesozoic Formations of Peninsular India:

Palaeozoic Formations of Peninsular India
a) A brief history of the Paleozoic Formations,
b) Gondwana Supergroup:

The Mesozoic Formations of Peninsular India:

a) A brief history of the Mesozoic formations.
b) Jurassic of Kachchh
c) Cretaceous of Narmada Valley/ Bagh beds.
d) Cretaceous of Cauvery basin.

Cenozoic Formations of Peninsular India and Geology of Maharashtra

The Deccan Volcanic Province:

Distribution, extent, age, structure, mode of eruption and occurrence, Petrological characters and variations, Lithostratigraphic classification, Infra trappeans and Intertrappean beds.

The Cenozoic Formations of Peninsular India:

a) Tertiary of Assam
b) Tertiary of the K-G basin
c) Tertiary formations along the West Coast.

Laterites: Definition, Origin, Types and distribution.
The Geology and Stratigraphy of Maharashtra
The Phanerozoic Stratigraphy of Extra-Peninsular India and Palaeontology:
The Phanerozoic Stratigraphy of Extra-Peninsular India

Approximate Weightage 8 Marks Out of 80 Marks

Unit VIII: Economic Geology

Basics of Economic Geology & Primary processes of formation of mineral Deposits:

Introduction:

Definition of ore minerals, gangue, tenor, overburden, country rock, syngenetic & epigenetic deposits
Classification of economically important metalliferous & non metalliferous mineral deposits

Processes of formation of mineral deposits: Magmatic Concentration; Hydrothermal processes; Principles of hydrothermal processes, characters of solutions, types of openings in rocks, factors affecting deposition from hydrothermal solution, wall rock alternations.
Types of hydrothermal deposits (Cavity filling & Metasomatic replacements); Cavity filling deposits; Metasomatic replacement: Definition, Criteria of replacement& resulting mineral deposits
Secondary processes of formation of mineral deposits; Oxidation &Supergene enrichment**: O**xidation& solution in the zone of oxidation; Gossans & Cappings, the role of iron in gossans, indigenous& transported limonite, false gossans & gossans as guides to the hidden deposits.
Ore deposition in the zone of oxidation & their method of precipitation; Supergene Sulphide Enrichment; Requirements for supergene enrichment; Factors influencing supergene enrichment; Recognition of supergene enrichment.
Evaporation, Residual concentration & Mechanical concentration; process of mineral formation by evaporation; Evaporation deposits: Brief account of deposits of oceanic water, lake water, ground water & hot springs
Residual concentration (residual deposits); Conditions favouring of residual deposits; Brief account of residual deposits: Bauxite, clay & iron formation.
Mechanical concentration (placer deposits); Principles involved in the process of mechanical concentration; Study of placer deposits: Eluvial, Alluvial, Beach & Aeolian.
Major ore forming processes and Mineral deposits of India.

Approximate Weightage 8 Marks Out of 80 Marks

Unit IX: Environmental Geology and Natural Hazards

Concept, Objective and Scope of Environmental Geology: Seven concepts, Objectives, and Scope of Environmental Geology; Physical, Biological, and Socio-geological Environment, Bio-geochemical cycles.
Deterioration of land surface: Dimensions of Erosion, processes, causes of accelerated erosion, remedial measures.
Desertification and degradation of land: meaning, extent, causes and preventive measures.
Soil conservation, badland topography, alkalinity and salinity of soils.

Natural Hazard and Mitigation:
Natural hazards: Definition, type, Natural hazard zones and Impact assessment, Natural hazard zonation maps, Role of Geologists in disaster management plan
Distinction between: hazard and disaster (with examples), local and regional context, disaster profile of India
Earthquakes: Introduction, general characteristics, effects of disaster on human life and habitation, origin and severity of earthquakes, precursors (instrumental and natural), vulnerability, seismic zones of India, Impact assessment and mitigation measures
Volcanoes: Introduction, types of volcanic activity and their origin, distribution, hazards, effects (lava flows, pyroclastic activity, toxic gases, mud flows, fires), Prediction and mitigation measures
Mass movement: Introduction, causes and types of mass movements, Identification of landslides zones, control measures, avalanches and their causes, mitigation and concept of safety factor

Floods: Introduction, definition, classification, causative factors, vulnerability, predictability (forecasting), mitigation measures, flood hazards in India

Coastal hazards: Introduction, causes and impacts of coastal erosion, tsunami, storms and their predictability and mitigation measures

Mining hazards: Types of mining hazards and restoration techniques.

Subsidence of land: Causes of subsidence of land, prediction and mitigation measures

Crises, Conservation of natural resources and pollution:

Classification and types of natural resources (renewable and non-renewable, conservation and development of natural resources, Crises faced by mankind with regards to conventional and non-conventional energy resources

Pollution:

Water Pollution: Sources of water pollution (natural and man-made), Case histories related to water pollution: Minamata disease (Japan), Arsenic poisoning (West Bengal), and Flourosis (Bhandara)

Soil Pollution: Sources of soil pollution (use of pesticides, fertilizers, industrial domestic water, and their effects

Air pollution: Sources of air pollution, (aerosols, particulate matters in urban and industrial area), case histories: Chernobyl disaster and Bhopal gas disaster

Solid waste disposal: Solid waste disposal methods (deep well disposal, ocean dumping, hazardous chemical wastes), its effects with geological perspective.

Approximate Weightage 6 Marks Out of 80 Marks

Unit X: Applied Geology (Geomorphology, Remote-Sensing, GIS and Field Geology)

Geomorphology and Principles of Remote Sensing

Geomorphology

a) Introduction to Geomorphic Concepts
b) Landforms: Role Of Lithology, Endogenous and Exogenous Processes, Climatic and Tectonic Forces
c) Study Of Different Landforms Like: Mesa, Butte, Cuesta, Hogback, Ridge and valley topography, Tor topography, Badland topography, Karstic topography-sinkholes, disappearing streams, Sand dunes, Moraines, River terraces, Alluvial fans

Principles of Remote Sensing

a) Definition, Types of Remote sensing Systems (Active & Passive), Elements of passive Remote sensing system (data acquisition & data analysis)
b) Energy source and radiation principles (EM wave, Wave theory, EM spectrum, particle theory, Stefan-Boltzman's law, Emissivity, Black, white & grey bodies)
c) Energy interactions in the atmosphere (Scattering, absorption, atmospheric windows & related sensing systems); Energy interactions with the earth (principles of the Conservation of energy, specular & diffused reflectors), Spectral reflectance of vegetation, soil & water; Data acquisition & interpretation.

Satellites, Satellite data and Applications of Remote Sensing

A) Introduction to Satellites, Sensors & their applications
Brief history, Types of Satellites (Orbital Characteristics, Sensors and applications with reference to latest IRS & LANDSAT: LANDSAT 7 and 8, IRS satellites (Oceansat, Cartosat, Resourcesat, SARAL)

B) Scanners - Hyperspectral Scanners, Active Remote Sensing Systems -RADAR and LIDAR (Principles & applications)

C) Image characteristics & Spectral responses of various features like Lithology, geologic structures, geomorphic features, vegetation (cultivated, forest), land use, water bodies (shallow, deep, clear, polluted), Utility (traffic, telecom, power, settlement etc.) & soils

D) Applications of Remote sensing in studying the natural resources like minerals, ground water, soil, forests & in geo-technical investigations

Field Geology

a) Literature review; b) Toposheets and other tools for base map preparation; c) Aims, objectives of fieldwork, reconnaissance survey; d) Study of rock outcrops; e) Determination of attitude of beds, Field correlation; f) Recording observations in Igneous, Sedimentary and Metamorphic terrain; g) Instruments used in the field and their proper utilization; h) Sketching the field area, collection of selective rock/mineral samples, preparing sketches, taking photographs; i) Traverse mapping; j) Preparation of field report

Approximate Weightage 5 Marks Out of 80 Marks

Unit XI: Engineering Geology and Mining Geology

Introduction:

Significance of geology in Civil engineering, knowledge of geomorphology, petrology, mineralogy, stratigraphy, photo geology and structural geology as applied to Civil engineering projects.

Engineering properties of rocks: Specific gravity, porosity, sorption, strength of rocks (Compressive, shear & tensile), elasticity of rocks, residual and shear stresses in rocks. Hardness test and Impact test for aggregates in brief.

Rocks as Construction Material: How are they obtained in nature? Use of rocks as facing stone. Factors influencing engineering usefulness of the rocks.

Use of rocks as an aggregate: Use of rocks as an aggregate in different types of constructions, source of different grades of aggregates, Properties of aggregates (shape, size, surface texture, roundness and coatings), cement aggregates reaction, thermal effects on aggregates. Types of aggregates (Highway, railway ballast and runway).

Geological And Geotechnical Investigations for Civil Engineering Projects

Tunnels:

Terminology, geological conditions for tunnel sites, tunnel in bedded rocks and folded rocks, influence of divisional planes, effects of faults and crushed zones. Tunnels in the vicinity of slopes. Role of groundwater in tunnelling. Tunnels in the Deccan Traps. Names and locations of at least six very important tunnels in India, Case study: Jawahar Tunnel

Dams and Reservoirs:

Geological conditions for the selection of dam and reservoir sites, terminology associated with dams. Types of dams (Gravity, buttress, arch and earthen), types of spillways. Location with type of all the important dams and hydroelectric projects in India.
Case study: Sardar Sarovar Dam

Mining Geology:
Objectives, stages & types of prospecting; Geological Prospecting; Geological Criteria: Climatic, Stratigraphic, Lithological, Structural, Geochemical, Physiographic Guides: Topographic expressions, Physiographic environment; physiography in relation to oxidation & environment; Mineralogical Guides: Rock alteration, Target rings of mineral distribution; Significance of accessory & gangue minerals. iv) Stratigraphic & lithologic guides for Syngenetic & Epigenetic deposits, Fracture pattern as guides, Contacts & folds as guides
Broad outline of geophysical prospecting:
Principles and applications of following geophysical methods along with their measured parameters, operative physical properties and names of the instruments used. Electrical (S.P. & Resistivity); Magnetic; Gravity; Seismic refraction;
M**ining Geology:** Definition, Sampling, Mining methods – opencast and underground mining with Indian examples.

Approximate Weightage 6 Marks Out of 80 Marks

Unit XII: Geohydrology

Introduction: Definition- Hydrology, Geo-hydrology, Hydrogeology. Scope & groundwater development in India. Vertical distribution of groundwater, Origin & rock properties affecting groundwater (porosity, permeability, their types & effects).
Aquifers, Darcy's law, Groundwater distribution & fluctuations: Geologic formations as aquifers; Types of aquifers (Confined, Unconfined, and Perched); Groundwater movement (Darcy's law).
Groundwater fluctuations due to seasonal changes, stream-flow changes, evapotranspiration changes. Springs (cold & hot), conditions for formation of springs. Factors controlling groundwater distribution (topography, climate, structural, geological, proximity of tanks, rivers etc.)
Groundwater recharge methods: Introduction to artificial recharge methods. Types of recharge methods: - Water spreading methods (Flooding, Basin, Ditch & furrow, Natural channel, Irrigation). Recharge through Pits & Shafts, Recharge through wells. Rain water harvesting. Groundwater recharge methods in Maharashtra (bore-blast & jacket-well techniques).

Approximate Weightage 5 Marks Out of 80 Marks