UPSC Geologist Exam Syllabus

Geology - Paper I

Section A: Geomorphology and Remote Sensing

Basic principles
Weathering and soil, Mass wasting
Influence of climate on processes
Concept of erosion cycles
Geomorphology of fluvial tracts, arid zones, coastal regions, 'Karst' landscapes and glaciated ranges
Geomorphic mapping, slope analysis and drainage basin analysis
Applications of geomorphology in mineral prospecting, civil engineering, hydrology and environmental studies
Topographical maps
Geomorphology of India
Concepts and principles of aerial photography and photogrammetry, satellite remote sensing - data products and their interpretation
Digital image processing
Remote sensing in landform and land use mapping, structural mapping, hydrogeological studies and mineral exploration
Global and Indian Space Missions
Geographic Information System (GIS) - principles and applications.

How To Become A Geologist

Section B: Structural Geology

Principles of geological mapping and map reading, projection diagrams
Stress-strain relationships of elastic, plastic and viscous materials
Measurement of strain in deformed rocks
Behaviour of minerals and rocks under deformation conditions

Structural analysis of folds, cleavages, lineations, joints and faults Superposed deformation
Mechanism of folding and faulting
Time-relationship between crystallization and deformation
Unconformities and basement-cover relations
Structural behaviour of igneous rocks, diapirs and salt domes
Introduction to petrofabrics

UPSC Previous Question Papers

Section C: Geotectonics

Earth and the solar system, Meteorites and other extra-terrestrial materials, Planetary evolution of the earth and its internal structure
Heterogeneity of the earth's crust
Major tectonic features of the Oceanic and Continental crust
Continental drift - geological and geophysical evidence, mechanics, objections, present status
Gravity and magnetic anomalies at Mid-ocean ridges, deep sea trenches, continental shield areas and mountain chains
Palaeomagnetism. Seafloor spreading and Plate Tectonics. Island arcs, Oceanic islands and volcanic arcs
Isostasy, orogeny and epeirogeny. Seismic belts of the earth
Seismicity and plate movements
Geodynamics of the Indian plate

Section D: Stratigraphy

Nomenclature and the modern stratigraphic code
Radioisotopes and measuring geological time
Geological time-scale
Stratigraphic procedures of correlation of unfossiliferous rocks
Precambrian stratigraphy of India
Stratigraphy of the Palaeozoic, Mesozoic and Cenozoic formations of India

Gondwana system and Gondwanaland
Rise of the Himalaya and evolution of Siwalik basin
Deccan Volcanics
Quaternary Stratigraphy
Rock record, palaeoclimates and palaeogeography

How to Make a Habit of Studying

Section E: Palaeontology

Fossil record and geological time-scale
Morphology and time-ranges of fossil groups
Evolutionary changes in molluscs and mammals in geological time
Principles of evolution
Use of species and genera of foraminifera and echinodermata in biostratigraphic correlation
Siwalik vertebrate fauna and Gondwana flora, evidence of life in Precambrian times, different microfossil groups and their distribution in India.

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Geology - Paper II

Section A: Mineralogy

Physical, chemical and crystallographic characteristics of common rock forming silicate mineral groups
Structural classification of silicates
Common minerals of igneous and metamorphic rocks
Minerals of the carbonate, phosphate, sulphide and halide groups
Optical properties of common rock forming silicate minerals, uniaxial and biaxial minerals
Extinction angles, pleochroism, birefringenece of minerals and their relation with mineral composition
Twinned crystals. Dispersion
The U-stage

5 Tips To Complete Exam On Time

Section B: Igneous and Metamorphic Petrology

Forms, textures and structures of igneous rocks
Silicate melt equilibria, binary and pernery phase diagrams
Petrology and geotectonic evolution of granites, basalts, andesites and alkaline rocks
Petrology of gabbros, kimberlites, anorthosites and carbonatites
Origin of primary basic magmas
Textures and structures of metamorphic rocks
Regional and contact metamorphism of pelitic and impure calcareous rocks
Mineral assemblages and P/T conditions
Experimental and thermodynamic appraisal of metamorphic reactions
Characteristics of different grades and facies of metamorphism
Metasomatism and granitization, migmatites
Plate tectonics and metamorphic zones
Paired metamorphic belts

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Section C: Sedimentology

Provenance and diagenesis of sediments
Sedimentary textures
Framework matrix and cement of terrigenous sediments
Definition, measurement and interpretation of grain size
Elements of hydraulics
Primary structures, palaeocurrent analysis
Biogenic and chemical sedimentary structures
Sedimentary environment and facies.
Facies modelling for marine, non-marine and mixed sediments
Tectonics and sedimentation

Classification and definition of sedimentary basins, Sedimentary basins of India
Cyclic sediments
Seismic and sequence stratigraphy
Purpose and scope of basin analysis
Structure contours and isopach maps

Section D: Geochemistry

Earth in relation to the solar system and universe, cosmic abundance of elements
Composition of the planets and meteorites
Structure and composition of earth and distribution of elements
Trace elements
Elementary crystal chemistry and thermodynamics
Introduction to isotope geochemistry
Geochemistry of hydrosphere, biosphere and atmosphere
Geochemical cycle and principles of geochemical prospecting.

Section E: Environmental Geology

Concepts and principles
Natural hazards - preventive/precautionary measures - floods, landslides, earthquakes, river and coastal erosion.
Impact assessment of anthropogenic activities such as urbanization, open cast mining and quarrying, river-valley projects, disposal of industrial and radio-active waste, excess withdrawal of ground water, use of fertilizers, dumping of ores, mine waste and fly-ash
Organic and inorganic contamination of ground water and their remedial measures
Soil degradation and remedial measures. Environment protection - legislative measures in India

Section A: Indian mineral deposits and mineral economics

Occurrence and distribution in India of metalliferous deposits - base metals, iron, manganese, aluminium, chromium, nickel, gold, silver, molybdenum
Indian deposits of non-metals - mica, asbestos, barytes, gypsum, graphite, apatite and beryl
Gemstones, refractory minerals, abrasives and minerals used in glass, fertilizer, paint, ceramic and cement industries
Building stones. Phosphorite deposits
Placer deposits, rare earth minerals.
Strategic, critical and essential minerals
India's status in mineral production
Changing patterns of mineral consumption
National Mineral Policy
Mineral Concession Rules
Marine mineral resources and Law of Sea

Section B: Ore genesis

Ore deposits and ore minerals
Magmatic processes of mineralization
Porphyry, skarn and hydrothermal mineralization
Fluid inclusion studies
Mineralisation associated with - (i) ultramafic, mafic and acidic rocks, (ii) greenstone belts, (iii) komatiites, anorthosites and kimberlites and (iv) submarine volcanism
Magma-related mineralisation through geological time
Stratiform and stratabound ores
Ores and metamorphism - cause and effect relations.

Section C: Mineral exploration

Methods of surface and subsurface exploration, prospecting for economic minerals - drilling, sampling and assaying

Geophysical techniques - gravity, electrical, magnetic, airborne and seismic
Geomorphological and remote sensing techniques
Geobotanical and geochemical methods
Borehole logging and surveys for deviation

Section D: Geology of fuels

Definition, origin of coal
Stratigraphy of coal measures
Fundamentals of coal petrology, peat, lignite, bituminous and anthracite coal
Microscopic constituents of coal
Industrial application of coal petrology
Indian coal deposits
Diagenesis of organic materials
Origin, migration and entrapment of natural hydrocarbons
Characters of source and reservoir rocks
Structural, stratigraphic and mixed traps
Techniques of exploration
Geographical and geological distributions of onshore and offshore petroliferous basins of India
Mineralogy and geochemistry of radioactive minerals
Instrumental techniques of detection and measurement of radioactivity
Radioactive methods for prospecting and assaying of mineral deposits
Distribution of radioactive minerals in India
Radioactive methods in petroleum exploration - well logging techniques
Nuclear waste disposal - geological constraints.

How To Maximise Your Score In Exam

Section E: Engineering geology

Mechanical properties of rocks and soils
Geological investigations for river valley projects - Dams and reservoirs; tunnels - types, methods and problems

Bridges - types and foundation problems
Shoreline engineering
Landslides - classification, causes, prevention and rehabilitation
Concrete aggregates - sources, alkali-aggregate reaction
Aseismic designing - seismicity in India and earthquake-resistant structures
Problems of groundwater in engineering projects
Geotechnical case studies of major projects in India

Hydrogeology

Section A: Origin, occurrence and distribution of water
Section B : Well hydraulies and well design
Section C : Groundwater chemistry
Section D : Groundwater exploration
Section E : Groundwater problems and management.

Exam Pattern

Sl. No.	Subjects	Total Marks
1	General English	100
2	Geology Paper I	200
3	Geology Paper II	200
4	Geology Paper III	200
5	Hydrogeology	200
Total Marks		900