

Tamil Nadu Public Service Commission
Syllabus
Mining Engineering and Geology
(Degree Standard)

Code: 573

Unit I: General Geology and Geomorphology (15 Questions)

Origin, Evolution, Age and Interior of the Earth - Principles of geodesy – Rock cycle – Isostasy - Continental drift, Seafloor spreading, Plate tectonics - Paleomagnetism and its application for determining paleoposition of continents – Orogeny and Epeirogeny – Volcanoes and earthquakes – Effects and causes – Seismic Hazard zonation of India - Tectonic deformation and seismicity in the Extra Peninsular, Indogangetic plains and Peninsular India - Applications of geomorphology in mineral prospecting and coastal studies - Weathering – processes and products - Geomorphic cycles and their interpretation - Morphology and its relation to structures and lithology - geomorphic landforms formed by action of rivers, wind, glaciers, waves and groundwater - Features of ocean floor - continental shelf, slope and rise - concepts of landscape evolution, major geomorphic features of India – coastal, peninsular and extra peninsular - Classification of shorelines and their evolution - submarine canyons, Geosynclines and Island arcs.

Unit II: Stratigraphy and Paleontology (20 Questions)

Principles of stratigraphy - Code of stratigraphic nomenclature of India - lithostratigraphy – biostratigraphy – chronostratigraphy – magnetostratigraphy, sequence stratigraphy - Principles of stratigraphic correlation; Indian stratigraphy and economic importance - Cratons of India – Dharwar, Bastar, Singhbhum, Aravalli and Bundelkhand Cratons - Proterozoic mobile belts – Eastern Ghats Mobile Belt, Southern Granulite Terrain, Central Indian Tectonic Zone, Aravalli – Delhi Belt, North Singhbhum Mobile Belt - Proterozoic sedimentary basins – Cuddapah, Delhi, Vindhyan, Kurnool and Kaladgi - Phanerozoic stratigraphy – Paleozoic - Spiti - Mesozoic - Spiti, Kutch, Narmada Valley and Trichinopoly - Gondwana Supergroup, Deccan Traps - Himalayas – Siwaliks - Fossil record and geological time scale - modes of preservation of fossils and concept of taphonomy – Body and ichno-fossils, Ediacara Fauna - Morphology and time range of Graptolites, Trilobites, Brachiopods, Lamellibranchs, Gastropods, Cephalopods, Echinoids and Corals - Evolutionary trends in Trilobites, Gastropods, Cephalopods; and Graptolites – Micropaleontology – methods of preparation of microfossils, morphology of microfossil groups (Foraminifera, Ostracoda).

Unit III: Structural Geology and Mineralogy (15 Questions)

Mechanical principles of rocks – Strain markers in deformed rocks - Mohr's circle – V rules and outcrop patterns – Stereographic Projections of structural elements - Mechanics and causes of folding and faulting - Classification of folds and faults - Recognition of folds and faults in the field - Joints – Cleavage and Schistosity types and origin – Secondary lineation - Types of unconformity and their recognition in the field – Definition, Classification and elements of minerals and Crystallography – Optical, Electrical and Magnetic Properties of minerals - Physical, chemical and optical properties of Quartz, Feldspars, Feldspathoids, Pyroxene, Amphibole, Olivine, Garnet, Mica, Zeolites and Carbonate groups – Concept of optical mineralogy – Identification of minerals using petrological microscope.

Unit IV: Petrology (25 Questions)

Classification of Igneous rocks: Mineralogical, Chemical and IUGS classification – Structures and textures - Petrography and petrogenesis of Granites, Alkaline rocks, Anorthositic, Carbonatites, Dolerites, Ultramafics - Bowen's reaction series - Diversity of Igneous rocks – variation diagrams - Crystallisation of Basaltic magma.

Sedimentary depositional environments – Important clastic and non-clastic rocks – Heavy minerals and Provenance – Tectonics and Sedimentation – Sedimentary Basins of India – Paleocurrents and Basin Analysis - Classification of sedimentary rocks - sedimentary textures grains size, roundness, sphericity, shape and fabric - grain size analysis - sediment transport and deposition - sedimentary structures - composition and significance of different types of sedimentary rocks

Sandstone, Limestone, Banded Iron Formation, Mudstone and Conglomerate - carbonate diagenesis and dolomitisation.

Metamorphism – Agents and kinds of metamorphism – classification of metamorphic Rocks – Textures and Structures – Different grades and depth Zones – Metamorphic facies – Metamorphic differentiation – Thermal – Clastic and Regional Metamorphism – Origin of Eclogites – Charnockitisation – Granitisation – Metasomatism.

Unit V: Economic Geology and Hydrogeology (20 Questions)

Classification of mineral deposits – Process of formation of mineral deposits - Magmatic, Hydrothermal, Sedimentary, Metamorphic, Sublimation, Evaporation, Oxidation and Supergene enrichment - Metallogenic Epochs and provinces of India - Controls of ore Localisation – Origin, Occurrences, Indian distribution and uses of the following ores - Iron, Manganese, Copper, Lead, Zinc, Aluminium, Chromium, Gold, Barite, Graphite, Asbestos and Silica, Uranium, Thorium and Industrial Minerals. Origin of coal and petroleum - Physical and Chemical Properties of coal and petroleum – Deposits of coal and Petroleum in India – Distribution of Gondwana and Tertiary coal fields of India. Gas hydrates and Coal bed methane, Petroliferous basins of India – Strategic, Critical and essential minerals – National mineral policy 2019 – Conservation and Utilization of mineral resources.

Origin and Occurrence of groundwater – Vertical Distribution of Ground Water - Aquifers - Hydraulic conductivity and Hydrological parameters - Transmissibility, Permeability - Specific yield and retention - Hydrogeological characters of different types of rocks - Rock water interaction – Ground Water Quality and Pollution - Types of wells - Well logging methods - Pumping test methods - Managed Aquifer recharge – Rainwater Harvesting techniques and methods - Aquifer recharge methods - Seawater intrusion - Study and methods - Electrical methods of groundwater exploration.

Unit VI: Geology of Tamil Nadu (25 Questions)

Archean Formations - Sathyamangalam Group - Bhavani Gneissic Complex - Khondalite Group – Kolar Group - Anorthosite Complex - Archean to Proterozoic - Charnockite Group – Granites - Migmatitic Complex – Proterozoic – Proterozoic – Ultramafic - Alkaline rocks and Carbonatites – Granites - Palaeozoic to Mesozoic - Gondwana Plant beds – Cretaceous - The Cretaceous Period is divided into three Groups as under - Uttatur Group - Trichinopoly Group - Ariyalur Group - Tertiary Sediments – Lignite - Petrified Wood of Thiruvakkarai - Cuddalore Sandstone - Conjeevaram Gravels – Cenozoic - Quaternary Sediments - Mineral wealth of Tamil Nadu.

Descriptive study related to origin, mode of occurrence and use of iron ores of Kanjamalai and Kavuthimalai, Chromite and PGE of Sittampoondi, Magnesite deposits of Chalk hills, Bauxite deposits of Shevroy hills, Graphite beds of Sivaganga, Lignite deposits of Neyveli and Jayamkondam, Beach placer deposits of southern Tamil Nadu. Mode of occurrence and distribution of precious and semi-precious stones in Tamil Nadu - Silica Sands of coastal areas in Kanchipuram, Thiruvallur, Cuddalore and Nagapattinam districts- River sand deposits of Tamil Nadu.

Unit VII: Mine Development and Mining Methods (20 Questions)

Exploratory & production drilling, types of drilling and Explosives and accessories, properties, classification; Selection; Storage, transport and handling and use of explosives, different types of initiation systems, mechanics of blasting, drilling & blast design for opencast and underground mines, misfires, adverse impacts of blasting in mines and their control, controlled blasting in granites, alternatives to blasting. Different modes of entry into underground mines, their location and design. Different methods of shaft sinking, modern & mechanized techniques of shaft sinking, Drivage of drifts and tunnels covering all associated activities including continuous and tunnel boring techniques.

Suitability of surface mining and limitations, Cut-off grades, Pit limits, Stripping ratios, Design of pit slope, haul roads, benches box cuts, Earth moving machinery - shovels, continuous surface miners, bucket wheel excavators, dumpers, rippers, Dredgers, rock breakers etc., Productivity

and maintenance of Heavy Earth Moving Machinery. Types of slope failures, Slope stability analysis and stabilization including dumps, In-pit-crushing and conveying, Continuous surface mining. Placer mining and solution mining, Machine availability, productive and maintenance scheduling, manpower and calendar planning.

Metal Mining: Classification of mining methods, Stopping methods – supported and unsupported, cut and fill, backfilling, etc., Techno-economic analysis of mining systems, Mining at great depths.

Unit VIII: Mine Legislation, Safety & Mine Management (20 Questions)

General provisions of Mines and Mineral Regulation and Development Act 1957 & 2023, Mineral Concession Rules 1960, Mines Act 1952, Metalliferous Mines Regulations 1961, and Mines Rules 1955, Tamil Nadu Minor Mineral Concession Rules 1959, Directorate General of Mines Safety (DGMS) issued Technical Circulars related to Surface Mining Operations, Mines Vocational Training Rules 1961, Land Acquisition Act, Explosives Rules 2008, Workmen's Compensation Act, Mine accidents, classification and occupational diseases, Accident inquiry reports, Mine disaster management, Safety audit in Mines, Environmental protection Act 1986, Environmental Impact Notifications – 1994 & 2006 and Forest Conservation Act 1980, Ministry of Environment, Forest & Climate Change issued Notifications, Office Memorandum related to Mining Industry, Occupational Health, Risk Assessment and Management, Organization structure of a mine and a mining company, Royalty and taxation, Assessment of cost of various mining Methods operations, cost control methods, Preparation of Feasibility and detailed project reports, Mine Closer Planning and Management for sustainability.

Unit IX: Mining Machinery (20 Questions)

Different types of motive power used in mines, Wire ropes, safety devices, Hydraulic, pneumatic and gravity transport, Distribution of electrical power in mines, Mine cables, Flame-proof and intrinsically safe apparatus, Mine communication, Winding systems, Surface and pit-bottom arrangements, High angle conveying, Hydraulic & Pneumatic transport, Aerial ropeways, Dredging Equipments, Design and construction of silos and bunkers, Stacking and blending, Condition monitoring of mining machinery, Computer applications in mine planning and Equipment System.

Unit X: Mine Environment (20 Questions)

Mine illumination, Pollution due to mining - Noise, air, water and land pollution, Ground vibrations, monitoring and control, Pollution standards and remedial measures, Inundation – causes, prevention and control, Application of rock mechanics in mining, Design of water Dams, Mine rescue and recovery, investigation after an explosion, rescue organization of a mining company, Rescue and First aid in mines, Concept of environment and ecology, Landscape planning and analysis, Air quality sampling and modeling, Impact of pollution on human health. Reclamation of mined out land, Tailings management and subsidence, Environmental impact assessment, Environmental management plans, Environmental audit, Environmental clearance for mining projects, Environmental legislations, Safety and environmental protection.

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