Code: MN   <u>Mining Engineering</u>

SECTION- I: ENGINEERING MATHEMATICS

Linear Algebra: Matrices and Determinants; Systems of linear equations; Eigen values and Eigen vectors.

Calculus: Limit, continuity and differentiability; Partial Derivatives; Maxima and minima; Sequences and series; Test for convergence; Fourier series.

Vector Calculus: Gradient; Divergence and Curl; Line; surface and volume integrals; Stokes, Gauss and Green's theorems.

Differential Equations: Linear and non-linear first order ODEs; Higher order linear ODEs with constant coefficients; Cauchy's and Euler's equations.

Probability and Statistics: Measures of central tendency; Random variables; Poisson, Normal and Binomial distributions; Correlation and regression analysis.

Numerical Methods: Solutions of linear algebraic equations; Integration of trapezoidal and Simpson's rule; Single and multi-step methods for differential equations.

SECTION- II: MINING ENGINEERING

(1) **Mining Geology:** Theories of Rock formation, Various minerals, rocks and their origin

(2) **Mine Development and Surveying**

Mine Development: Methods of access to the mineral deposits; Underground Drivages and Tunneling; Drilling methods; Explosives, Blasting devices and Blast design practices in underground and opencast mines.

Mine Surveying: Leveling, theodolite, tacheometry, triangulation; Contouring; Errors and adjustments; Correlation; Underground surveying; Curves; Photogrammetry; Field astronomy; EDM and Total Station; Introduction to GPS.

(3) **Geomechanics and Ground Control**

Engineering Mechanics: Equivalent force systems; Equations of equilibrium; Two dimensional frames and trusses; Free body diagrams; Friction forces; Particle kinematics and dynamics; Beam analysis.

Geomechanics: Geo-technical properties of rocks; Rock mass classification; Instrumentation and in-situ stress measurement techniques; Theories of rock failure; Ground vibrations; Stress distribution around mine openings; Rock bursts and coal bumps; Slope stability; Slope monitoring instruments.

Ground Control: Design of pillars; Shaft Pillar; Roof supporting systems and Roof monitoring instruments; Subsidence; Mine filling; Strata control and monitoring plan.

(4) **Mining Methods and Machinery**

Mining Methods: Introduction to coal mining; Surface coal mining: layout, development, loading, transportation and mechanization, continuous surface mining systems; Underground coal mining: bord and pillar systems, room and pillar mining, longwall mining, thick seam mining methods; highwall mining; Introduction to metal mining and various methods of underground metal mining; stope mechanization, ore handling systems.

Mining Machinery: Generation and transmission of mechanical, hydraulic and pneumatic power. Face development and depillaring machinery, Longwall machinery. Materials handling: Wire ropes, Haulages, Conveyors, Hoisting systems; Crushers, Pumps.

(5) Surface Environment, Mine Ventilation, Surface & Underground Hazards

Surface Environment: Air, Water, Soil and Noise pollution: Standards of quality, causes and dispersion of contamination, and control. Land reclamation, Overburden dumps reclamation, Environmental Impact Assessment (EIA).

Mine Ventilation: Underground atmosphere; Heat generation sources and thermal environment, air cooling; Mechanics of air flow, distribution, natural and mechanical ventilation; Mine fans: Main fans and booster fans; and their usage; Auxiliary ventilation; Ventilation planning; Ventilation networks.

Subsurface and Underground Hazards: Subsurface and Underground hazards from fires, Mine Gases, explosions, dust and inundation; Rescue apparatus and practices; Safety in mines; Accident data analysis and statistics; Mine lighting; Mine legislation; Occupational safety, Safety Management Plan (SMP).

(6) Mine Planning, Mine Economics, Systems Engineering

Mine Planning: Mine Planning & its Components, Feasibility report & its components, Sampling methods, practices and interpretation; Reserve estimation techniques: Basics of geo-statistics and quality control; Optimization techniques; Work-study.

Mine Economics: Mineral resource classification; Discounted cash flow analysis; Mine evaluation; Mine investment analysis; Mineral taxation.

Systems Engineering: Concepts of Reliability; Maintainability and availability; Linear programming, transportation and assignment problems; Network analysis; Inventory models; Decision theory; Queueing theory; Basics of simulation.

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