SYLLABUS OF MINING ENGINEERING

(BRANCH CODE 13)

Compulsory

IC 402 Engineering Management
MN 403 Mining Geology and Development of Mineral Deposits
MN 404 Exploitation of Mineral Deposits
MN 405 Mining Machinery and Material Handling
MN 406 Mine Ventilation and Environmental Hazards
MN 407 Geomechanics and Mine Design

Optional (Any three from any one Group)

Group I : Mine Environment
MN 411 Advanced Mine Ventilation
MN 412 Environmental Pollution and Control in Mines
MN 413 Electrical Equipment and Instrumentation in Mines
MN 414 Mine Surveying
MN 415 Mine Management and Legislation

Group II : Mine Systems
MN 421 Mine Systems Engineering
MN 422 Economics of Mining Enterprises
MN 423 Geostatistics
MN 424 Quality, Reliability and Safety in Mines
MN 425 Mine Management and Legislation

Group III : Mining Methods and Planning
MN 431 Advanced Rock Mechanics
MN 432 Advanced Methods of Mining
MN 433 Mine Planning and Excavation
MN 434 Mine Surveying
MN 435 Mine Management and Legislation
ENGINEERING MANAGEMENT

Group A

Management and Organisations

Management process: Definition, planning organizing, directing, controlling, coordinating, types of management.

Organisation Definition, planning, design and development, types of organizations.

Management planning and control: Classical, new classical and modern principles. General Management, scientific management, engineering, management, systems management.

Planning: Procedures, resources and constraints, objectives, goals, policies and procedures.

Control: Setting of reference or standards, appraisal or evaluation, monitoring and controlling, types of control.

Human resource planning and management, selection, recruitment, training, retraining, skill development, competence development, promotion and career development, participative management, trade unions, and collective bargaining.

Management of Physical Resources

Plant: site selection procedures, factors affecting selection. Layout-types and relative merits and demerits, Maintenance-Objectives, different types of associated decisions, strategies for effective maintenance, computer applications.

Material : Functions, objectives, planning and control including inventory models with or without storage costs, price break (excluding dynamic and probabilistic considerations). Different classes of inventory. Material Requirement Planning (MRP).

Group B


Quality management: Quality definition, quality planning, quality control and quality management, Total quality management, ISO 9000 systems, simple quality control techniques like control charts and acceptance sampling.

Marketing management consumer behaviour, market research, product design and development pricing and promotion.

Project management: Introduction. Concept of a project, project management concepts, project simulation, cost or project and means of financing, economic evaluation criteria of the project, project implementation, project planning, scheduling and monitoring, project control (PERT, CPM techniques including crashing). Project evaluation.

Information technology and management. Role of information, management information system and decision support system, Information technology-introduction to e-business, e-commerce and integration tools like enterprise resource planning (ERP).
MINING GEOLOGY AND DEVELOPMENT OF MINERAL DEPOSITS

Group A


Mode of occurrence, distribution and origin of important metallic and non-metallic minerals including fuel minerals.

Prospecting and exploration of mineral deposits—geological, geophysical and geochemical methods, groundwater. Geological documentation for mine planning.

Group B


Mine entries—types, location, orientation, etc. Primary and secondary development underground. Shaft sinking-conventional and special methods. Deeping and widening of shafts, tunnelling.

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EXPLOITATION OF MINERAL DEPOSITS

Group A

Methods of working coal by pillar mining methods—applications, layouts, development and extraction by partially and fully mechanised methods. Longwall mining methods. Influence of depth, seam thickness, inclination, etc. Continuous mining.

New developments and special methods of mining thick seams, support of roadways and face supports. Power support. Hydraulic stowing- Subsidence and strata control.

Group B

Methods of development and sloping metalliferrous deposits—open slopes, filled stope, shrinkage stapes and caving methods. Handling of ore and waste materials. Stope mechanisation.

MINING MACHINERY AND MATERIAL HANDLING

Group A

Principles and basic design features of mechanical, hydraulic and pneumatic power transmission. Transport machinery—rope haulage, locomotive, conveyors, their basic construction, operation and safety devices.

Hoisting system—system components, duty cycle, torque time and power time diagrams. Drum and friction winders. Mining pumps—basic construction and operation. Pumping system in underground.

Group B

Electric, pneumatic and hydraulic drills. Cutting, loading and winning machinery for underground mines. Longwall and open cast mining machinery. Aerial ropeways—classification, construction and operations.

Principles of hydraulic and pneumatic conveying. Storage and reclamation of bulk materials. Developments in bulk materials handling technology.

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MINE VENTILATION AND ENVIRONMENTAL HAZARDS

Group A

Group B

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GEOMECHANICS AND MINE DESIGN

Group A

Physico-mechanical properties of rocks and soils. Deformation characteristics' and time dependent behaviour of rocks. Rock mass classification.

Stress analysis and theories of rock failure. Stress distribution around mine openings. In-situ stress and deformation measure.

Group B

Design of pillars, support design for mine roadways. Mechanics of caving and support design for Longwall workings.

Rock slope design and design of pit layout, introduction to finite element methods.

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ADVANCED MINE VENTILATION

Group A

Group B
Natural ventilation pressure. Fan and system interaction, fails in series and parallel. Dust control in underground workings. Controlled recirculation.
ENVIRONMENTAL POLLUTION AND CONTROL IN MINES

Group A

Atmospheric considerations: Basics of meteorology, atmosphere, ozone layer, and greenhouse effect. Contaminant dispersion, plumes from chimney, Gaussian plume dispersion, and isokinetic sampling. Point, line, and area sources of contamination. Significant air pollution parameters, CPCB and NEERI norms, effects, assessment, and sources. Dust control in mines, mills, and haul roads.


Group B


Miscellaneous factors; Noise control and ground vibrations. Issues in the preparation of EMP/EIA. Legislation relating to environmental protection. ISO 14CC0. Visual impact due to mining. Environmental economics and auditing.

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ELECTRICAL EQUIPMENT AND INSTRUMENTATION IN MINES

Group A

Mine power supply: Choice of voltage in surface and underground supply; tariff computation; Mine cables-construction, installation, fault location; Gate end boxes and switchgears; Earthing methods; Protective devices; Overload, under voltage, earth leakage, DC supply-rectifiers, storage batteries.

Electrical equipment: Mining transformers, lighting transformers; AC and DC motors—speed torque characteristics, starting, braking speed control; Drives for haulage, ventilation fans, pumps, compressors, electric locomotives, winders; Introduction to thyristor devices; Flame-proof and intrinsic safety.

Group B

Control and instrumentation: Open- and closed-loop systems, remote control, sequence control, winder control, control of open cast mine equipment; Sensors for measurement of various operational, environmental and safety parameters in underground and open cast mines.

Communication and data transmission: Mine telephone systems; Signalling systems, local area network (LAN)-FOLAN.

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MINE SURVEYING

Group A

Chain surveying, Compass-miner's dial. Contouring—characteristics, methods, uses. Levelling instruments-dumpy, tilting, and automatic levels. Levelling procedures, booking. Plane table surveying—methods and uses. Theodolite—different parts, horizontal and vertical angle measurements. Temporary and permanent adjustments.


Group B


MINE MANAGEMENT AND LEGISLATION

Group A

Concept of management, concept of system, production system. Organisation structures, span of control, number of levels and management functions. Production economics—kinds of costs, evaluation of capital investment and capital budgeting. Break even analysis.

Human factor engineering—methods, analysis and work measurement, method study. Time study—types of studies and procedures.

Materials management—purchasing, distribution and inventory control. Inventory concepts, types of inventories and their relative costs.

Group B


Coal and metalliferrous mine regulations and their interpretation.

Indian Electricity Rules, Mines Rescue Rules, and other related rules. Mine accidents—reports and records. Accident investigation and analysis. Disaster management.

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MINE SYSTEMS ENGINEERING

Group A


Introduction to linear programming: Graphical and simplex method, duality, sensitivity analysis. Transportation and assignment models. Integer programming.

Group B

Introduction to queuing theory. Basic structure of queuing models. Single channel-single server and other queuing models. Inventory' system and models. EOQ and different inventory control systems. ABC analysis. Replacement of capital equipment.

Introduction to simulation, scope and limitation. Simulation of different mining subsystems and total system. Monte Carlo simulation for discrete systems. Some mining-oriented illustrations.

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ECONOMICS OF MINING ENTERPRISES

Group A
Principles of micro and macro economics and the application of econometric techniques in mining industry. Mineral statistics—national and global. Important mineral deposits and mine fields in India.

Theory and importance of sampling, different methods of sampling, classification and estimation of reserves. Computation for tonnage average assay width, scoping width, clear width, milling width, etc. Geostatistical techniques of computation of reserves and quality.

Group B
Financial appraisal methods, NPV, IRR, etc. Risk analysis for mining projects. Valuation of mines and mineral properties.


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GEOSTATISTICS

Group A

Review of basic statistics in mineral appraisal, classical statistics—normal and lognormal distributions and their applications in reserve estimation, grade-tonnage curve; Correlation and regression, auto-covariance and autocorrelation; Theory and methods of sampling—drill hole compositing.

Group B
Theory of regionalized variables, variogram. semi-variogram—sill, range, nugget effect, properties of variogram—isotropy, anisotropy, variogram models-linear, spherical, exponential, gaussian.

Kriging: Point kriging—kriging system of equations, kriging estimation variance, block kriging, applications of kriging in reserve estimation.

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QUALITY, RELIABILITY AND SAFETY IN MINES

Group A


Introduction to reliability concepts, basic statistics, probability distributions in reliability evaluation—exponential, normal, lognormal, and Weibull—failure rate, reliability function, application of reliability in mining system.

Network modelling concepts in reliability engineering—series system, parallel system, series-parallel system, partially redundant systems, network modelling of mining systems, reliability evaluation of mining equipment.

Group B

Safety in Indian mining industry, accident data base, accident analysis—cause of accident, nature of injury, severity of injury, measures of accident rates—frequency rate, severity rate, regulatory measures of accident prevention, proactive, measures of accident prevention.

Basic concept of risk. Risk analysis and mine accidents, hazard tree, fault tree and event tree analysis, systems approach in mine safety, development of safety engineering approaches, human behaviour in mine accidents.

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ADVANCED ROCK MECHANICS

Group A
Rock strata characterization: Geological structures in rock mass, characteristics of rock mass, joints in rock mass, joint survey techniques, rock mass classification systems. Methods of determination of strength and deformability of rock and rock mass, failure criteria for rock and rock mass.

Strata mechanics and ground movement—design of underground excavation in competent and incompetent rock, ground movement and control, rock burst theories of subsidence, subsidence prediction and control. Ground control and stabilization.

Group B
Theories of elasticity—propagation of elastic waves in rock medium and dynamic behaviour of rocks. Factors influencing stress concentration, zone of influence of an excavation, effect of planes of weaknesses and shape of excavation, delinearization of zone of failure. Instrumentation—monitoring instruments, their operation and installation.

Finite element method and boundary element method, their application for stability analysis of excavation and slopes.
ADVANCED METHODS OF MINING

Group A

Recent trend of mechanisation in bord and pillar mining, Longwall mining. Mining of thick seams—methods and design consideration for exploitation of thick seam by inclined slicing and integrated caving, special methods of mining with reference to Indian conditions, salvage operations in Longwall mining; hydraulic mining.


Group B

Ore body modelling. Pit geometry, determination or' ultimate pit configuration—different methods. Production planning and calendar plan for mining programme. Equipment selection, design of haul roads.

Inpit crushing and conveying systems. Bucket wheel excavator—general applicability and fundamentals of operation. Cross pit conveying and high angle conveying.

Dump formation, types of waste dumps—internal and external. Dump formation method and corresponding equipment. Dump stability, stabilization methods and monitoring.

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MINE PLANNING AND EXCAVATION

Group A


Theoretical consideration for opening up and development of mine field. Division of mine field and areas. Determination of optimal output, life and size of mine. Design of unit operations. Equipment selection, planning and control.

Group B

Pit top and pit bottom layout. Planning of power, workshop and surface bulk material handling systems. Planning of layout of waste and overburden dumps. Mine amalgamation, restructuring, reconstruction planning. Post mining land use planning and mine closure planning.

Mechanism of rock breakage and fracture. Rock fragmentation by explosive action, cutting, ripping and impacts. Principles of excavating machines—road headers TBM's, bucket excavators, etc. Excavated material handling systems. Flow of materials in bins and design of chutes. Mechanical and hydraulic transportation of ores and materials.

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