

COURSE STRUCTURE FOR B. TECH. (MINING ENGINEERING)**B.TECH. (MINING ENGINEERING) PART-II SEMESTER-III**

SUBJECT CODE	SUBJECT	CONTACT HOURS/ WEEK	CREDITS
THEORY			
MN2101	Mining Geology – I	4	4
MN2102	Mine Surveying – I	3	3
MN2103	Underground Mine Environment – I	3	3
MN2104	Mining Machinery – I	3	3
MN2105	Mine Development	4	4
EC2108A	Electronics and Instrumentation	3	3
TOTAL OF THEORY		20	20
PRACTICAL			
MN2301	Mining Geology – I	3	2
MN2302	Mine Surveying – I	3	2
MN2303	Underground Mine Environment – I	3	2
TOTAL OF PRACTICAL		9	6
TOTAL FOR SEMESTER-III		29	26

B.TECH. (MINING ENGINEERING) PART-II SEMESTER-IV

SUBJECT CODE	SUBJECT	CONTACT HOURS/ WEEK	CREDITS
THEORY			
MN2201	Mining Geology –II	3	3
MN2202	Rock Mechanics	4	4
MN2203	Mining Machinery –II	3	3
AM2208A	Numerical Methods	3	3
EE2208A	Electrical Engineering –I	3	3
TOTAL OF THEORY		16	16
PRACTICAL			
MN2401	Mining Geology –II	3	2
MN2402	Rock Mechanics	3	2
EE2408A	Electrical Engineering	3	2
MN2403	Tour Report & Viva-Voce	-	2
TOTAL OF PRACTICAL		9	8
TOTAL FOR SEMESTER- IV		25	24
TOTAL FOR PART –II			50

B.TECH. (MINING ENGINEERING) PART-III SEMESTER-V

SUBJECT CODE	SUBJECT	CONTACT HOURS/ WEEK	CREDITS
THEORY			
MN3101	Ground Control	3	3
MN3102	Underground Mine Environment – II	3	3
MN3103	Mine Surveying – II	3	3
MN3104	Underground Coal Mining – I	4	4
MN3105	Surface Mining – I	3	3
EE3108A	Electrical Engineering – II	3	3
TOTAL OF THEORY		19	19
PRACTICAL			
MN3301	Ground Control	3	2
MN3302	Underground Mine Environment –II	3	2
MN3303	Mine Surveying –II	3	2
TOTAL OF PRACTICAL		9	6
TOTAL FOR SEMESTER- V		28	25

B.TECH. (MINING ENGINEERING) PART-III SEMESTER-VI

SUBJECT CODE	SUBJECT	CONTACT HOURS/ WEEK	CREDITS
THEORY			
MN3201	Mineral Processing	4	4
MN3202	Environmental Management in Surface Mines	4	4
MN3203	Underground Coal Mining -II	3	3
MN3204	Surface Mining –II	3	3
MN3205	Computer Applications in Mining	3	3
	*Open Electives (Humanities)	3	3
TOTAL OF THEORY		20	20
PRACTICAL			
MN3401	Mineral Processing	3	2
MN3402	Environmental Management in Surface Mines	3	2
MN3403	Mining Machinery	3	2
TOTAL OF PRACTICAL		9	6
TOTAL FOR SEMESTER- VI		29	26
TOTAL FOR PART- III			51

*** Open Electives**

HU3208A : History of Science and Technology
 HU3208B : Industrial and Organisational Psychology
 HU3208C : Environment and Ecology
 HU3208D : Energy Management
 HU3208E : Industrial Sociology
 HU3208F : Human Values

NB: Six weeks of training will be undertaken after VI semester, which will be evaluated in VII semester

B.TECH. (MINING ENGINEERING) PART-IV SEMESTER-VII

SUBJECT CODE	SUBJECT	CONTACT HOURS/ WEEK	CREDITS
THEORY			
MN4101	Mine Management	3	3
MN4102	Mine Economics	3	3
MN4103	Mining Machinery-III	3	3
MN4104	Mine Disasters	3	3
	*Elective	3	3
TOTAL OF THEORY		15	15
PRACTICAL			
MN4301	Computer Applications in Mining	3	2
MN4302	Project	3	2
MN4303	Seminar/Group Discussion	3	2
MN4304	Training Report and Viva-Voce	-	2
TOTAL OF PRACTICAL		9	8
TOTAL FOR SEMESTER-VII		24	23

***Electives:**

MN4105 : Mine Safety Engineering
 MN4106 : Drilling and Blasting of Rocks
 MN4107 : Technology of Underground Excavation
 MN4108 : Numerical Methods in Geomechanics

B.TECH (MINING ENGINEERING) PART-IV SEMESTER-VIII

SUBJECT CODE	SUBJECT	CONTACT HOURS/ WEEK	CREDITS
THEORY			
MN4201	Underground Metalliferous Mining	3	3
MN4202	Mine Legislation	4	4
MN4203	Mine Planning	3	3
	*Elective	3	3
TOTAL OF THEORY		13	13
PRACTICAL			
MN4401	Underground Metalliferous Mining	3	2
MN4402	Project	9	6
MN4403	Comprehensive Viva-Voce	-	2
TOTAL OF PRACTICAL		12	10
TOTAL FOR SEMESTER- VIII		25	23
TOTAL FOR PART-IV			46

*** Electives :**

MN4204 : Operations Research in Mining
 MN4205 : Mining Induced Subsidence Engineering
 MN4206 : Fundamentals of Drilling Technology
 MN4207 : Fundamentals of Rock Mechanics Instrumentation

B.TECH. (MINING ENGINEERING) PART-II SEMESTER-III

MN2101: MINING GEOLOGY – I (4 Credits)

Importance of Geology in Mining

Mineralogy

Minerals – definition, formation and occurrences. Identification – physical, chemical and optical. Classification of minerals.

Crystallography

Scope, crystal systems. Polymorphism and isomorphism.

Economic Geology

Ores and gangue – genesis, classification, distribution in India and geological occurrences. Uses of important metallic and non-metallic minerals.

Atomic mineral resources of India – genesis and occurrence.

Structural Geology

Stratified rocks and their structures. Attitude of strata. Outcrop and incrop.

Folds – genesis, classification, identification in field, impact on landscape, mineral deposits, mining and tunnelling.

Faults – mechanism of faulting, classification, impact of faulting on topography, significance of faults in mining engineering and tunnelling.

Joints – definition and characteristics, classification, occurrence of joints in igneous, sedimentary and metamorphic rocks. Engineering considerations and treatments.

Prospecting and Exploration

Geological guides for prospecting of mineral deposits. Introduction to different methods of prospecting for mineral deposits – geological, geophysical, geochemical, geobotanical, aerial photography and remote sensing.

Exploratory drilling methods. Trenching and pitting. Sampling grids. Drill hole logging. Deviation of drill holes and drill hole surveying. Directional drilling.

Reserve Estimation

Selection of methods, merits and demerits, applicability.

MN2102: MINE SURVEYING – I (3 Credits)

Distance Measurement

Chains, tapes, electronic distance measurement, total station.

Levelling

Levels, reduced level, corrections for curvature and refraction, reciprocal levelling, contouring, tacheometry.

Traversing

Triangulation and Trilateration

Theodolites, control point framework, baseline, satellite station, extension and double extension of base. Trilateration.

Plane Table Surveying

Methods, two and three point problems, errors.

Curve Ranging

Minor Instruments

Planimeter, sextant, abney level, optical square.

Computations

Area and volume calculations.

Theory of Errors

Definitions, indices of precision and weights, correction and adjustment of measurements.

MN2103: UNDERGROUND MINE ENVIRONMENT – I (3 Credits)

Introduction

Ventilation requirements in mines, natural ventilation and mechanical ventilation.

Mine Gases

Composition of atmospheric air. Mine gases - occurrences, properties, physiological effects, detection; sampling, analysis, monitoring. Methane layering, methane drainage. Radon and its daughter products - effects and control.

Heat and Humidity

Sources, effects and control of heat and humidity in mines. Cooling power of mine air – psychrometry, Kata thermometer, effective temperature. Air conditioning. Spot coolers.

Airflow in Mine Workings

Reynold's number, laminar and turbulent flow. Square law of mine ventilation. Frictional and shock losses. Equivalent orifice. Resistance in series and parallel. Ventilation control devices. Splitting of air current. Ventilation network analysis – conventional method and scope for computer application.

Airborne Respirable Dust

Definition – generation, physiological effects, sampling, measurement and control measures.

Mine Illumination

Flame safety lamp – construction, maintenance, gas testing. Cap lamps. Lamp room layout and organization. Underground lighting from mains. Illumination standards. Photometry. Illumination survey.

Miners' Diseases

MN2104: MINING MACHINERY – I (3 Credits)

Transmission of Power

Belt, rope, chain, gear, hydraulic and electro-hydraulic transmission.

Compressed Air

Comparison with other sources of power. Air compressors – types, construction, installation and maintenance. Compressed air transmission and distribution, compressed air drills, pneumatic picks, air motors and other compressed air equipment.

Wire Ropes

Types, construction and uses. Rope deterioration and maintenance. Capping and splicing of rope.

Haulage

Rope haulages. Track, mine tubs and cars. Safety appliances on haulage roads. Locomotive haulage. Mono rail.

Statutory Provisions

MN2105: MINE DEVELOPMENT (4 Credits)

Introduction to Surface and Underground Mining Terms

Definition of common mining terms. Overview of unit operations in surface and underground mines.

Explosives

Types of explosives and blasting agents. Detonators, fuses, delays and other accessories. Stemming materials. Testing of explosives. Storage and transport of explosives. Causes of accidents and safety precautions. Substitute of explosives.

Types of Support

Prop, bar, cog, friction and hydraulic prop, girder.

Mine Entries

Choice, location and size of mine entries. Shafts, inclines and adits – merits and demerits, applicability. Cross-measure drifts and laterals.

Sinking

Conventional methods of shaft sinking. Drilling, blasting, loading and hoisting of muck. Lining, ventilation, drainage and lighting. Sinking through loose, fractured, flowing and water bearing ground. Widening and deepening of shafts. Shaft boring.

Primary and Secondary Development Drivages in Underground Mines

Drivage of drifts and main development headings. Conventional methods. Drilling, blasting, loading and transport of muck. Support, ventilation, drainage and lighting. Special methods through loose, fractured, flowing and water bearing ground. High speed drivages.

EC2108A : ELECTRONICS AND INSTRUMENTATION (3 Credits)

Semi-conductor diode characteristics, load line, half-wave and full-wave rectifiers, filters.

Power supply, regulators (723, 78XX, 79XX).

Amplifying devices (Vacuum tube, BJT, FET), their characteristics with LF equivalent circuit.

Single stage and multistage RC-coupled amplifiers (including types of coupling), calculations of voltage gain, impedances, frequency response, and feedback.

High input impedance circuit.

Oscillators (RC, LC, distributed X-tal.) criterion and one practical circuit.

Op-Amp and its applications, filters, VCO and PLL.

Timer and applications to systems.

Logic gates and basic logic circuits (SSI, MSI and basic system ICs).

Transducers, load cell, strain gauge, LVDT, optical shaft encoder, display devices, A/D and D/A converters.

CRO and multimeters (A&D) (Intersil's A/D for instrumentation).

A typical instrumentation system.

Introduction to microprocessors and their basic peripherals.

B.TECH. (MINING ENGINEERING) PART – II SEMESTER – IV

MN2201: MINING GEOLOGY – II (3 Credits)

Geological Time Scale

Petrology

Definition and scope, main classes of rocks forming minerals.

Igneous, sedimentary and metamorphic rocks – origin, characteristics, classification, uses and mining importance. Significance of texture and structure of rocks on geomechanical properties of rock mass.

Stratigraphy

Definition and scope. Stratigraphic correlation. Standard stratigraphic scale. mode of preservation and uses.

Fossils – conditions,

Major geological formations of India – Dharwar, Cuddapah, Vindhyan, Gondwana, Tertiary & Quaternary systems and their economic significance.

Fuel Geology

Coal and lignite - origin, occurrences, petrography. Structural features of coal-seam. Grades of coal. Occurrences in India.

Petroleum and natural gas – formation of gas and oil basins, traps and reservoirs, occurrences in India. Coal bed methane.

Geohydrology

Sources of water in mines. Classification of rocks based on porosity and permeability. Water table and types of ground water. Geological controls on ground water movement in mines.

Environmental Geology

Geological hazards and their management. Weathering of ore and overburden – environmental complications.

MN2202: ROCK MECHANICS (4 Credits)

Status of Rock Mechanics

Role and status of rock mechanics in mining and civil engineering.

Stress and Strains

Stresses in two and three dimensions. Stress tensors. Principal stresses. Stress invariants. Displacements and strains. Mohr's circle.

Stress-strain relationships. Effect of temperature and pressure on stress and strain relationships. Equilibrium and compatibility equations.

Rockmass Classification Systems

Q-system, RMR, Modified RMR and their applications.

Physico-Mechanical Properties of Rocks

Specific gravity, hardness, porosity, moisture content, permeability, thermal conductivity. Compressive, tensile and shear strengths. Modulus of elasticity. Poisson's ratio and triaxial strength.

Swell index, slake durability, point load index, Protodyakonov index.

Determination of in-situ strength.

Determination of In-situ Stresses

Methods of measurement – hydrofracturing and stress-relief.

Rheological Models and Time Dependent Properties of Rocks

Theories of Rock Failure

Griffith, Mohr-Coulomb, Hoek and Brown. Types of rock fractures.

Post-failure Behaviour.

MN2203: MINING MACHINERY – II (3 Credits)

Surface and Underground Layout

Pit top and pit bottom circuits. Surface structures. Surface handling systems – coal and ore handling plants. Storage bunkers. Railway siding. Pit bottom layouts.

Winding

Drum and friction winding, headgears, headgear pulleys, cages and skips, suspension gear, keps and guides. Steam and electric winders, safety devices in winders, duty cycle. Automatic winding. Multilevel winding.

Trackless Haulage

Types of conveyors and their sequence control. High angle conveyor. Free steered vehicles - shuttle cars, LHD, SDL and low profile dump trucks (LPDT).

Aerial Ropeways

Types, construction and installation. Loading, unloading and angle stations,

Man-riding Systems

Statutory Provisions

AM2208A : NUMERICAL METHODS (3 Credits)

Absolute, relative, round-off, truncation errors, significant digits. Estimation of errors. Tabulation of a function. Interpolation- ordinary differences, operators E and D, subtabulation, divided differences; Lagrange's formula; central differences, formulae of Gauss, Bessel, Everett. Method of ordinary least squares; cubics, splines. Inverse interpolation. Solution of algebraic and transcendental equations - graphical method, Iterative methods, Newton-Raphson Method; multiple roots. Solution of systems of linear equations - method of elimination, method of relaxation, iterative methods, ill-conditioned systems. Computing the inverse matrix. Eigenvalues and eigenvectors, matrix decomposition.

Numerical differentiation. Numerical integration - finite-difference methods; Gaussian quadrature, Euler-Maclaurin series, asymptotic expansions. Newton-Cotes formula numerical solution of ordinary differential equations: Series solution, methods of Runge-Kutta, Adams-Bashforth, Adams-Moulton, Runge-Kutta methods. Difference equations; numerical solution, relaxation method. Solution of partial differential equations by difference methods. Numerical solution of elliptic, parabolic and hyperbolic partial differential equations.

EE2208A : ELECTRICAL ENGINEERING – I (3 Credits)

Electrical Circuits

Network element – voltage and current sources, Kirchhoff's voltage and current law, loop and nodal analysis. Superposition theorem. Thevenin's theorem. Norton's theorem. Maximum power transfer theorem. Sinusoidal steady state analysis – R L and C elements, power and power factor, phasor diagram, resonance, mutual inductance and coefficient of coupling. Three-phase circuits- line and phase relationship, power measurement.

Electrical Machines

Transformer – principle of working, EMF equation, equivalent circuit, voltage regulation and efficiency, open-circuit and short-circuit tests, autotransformer. DC machines – constructional features. DC Generators- no load magnetization and external characteristics. DC motors – starting, speed-torque characteristics, speed control, applications. Induction machines – principle of operation, constructional details, torque-slip characteristics, starting and speed control. Synchronous Machines – Constructional features. Alternators – voltage regulation and its determination by synchronous impedance method. Synchronous motor - starting, V and inverted-V curves, applications.

Distribution of Electrical Power

Tariff calculation. House and factory wiring.

Introduction to Electrical Measurements

Indicating instruments, voltmeter, ammeter, wattmeter and energy meter.

B.TECH. (MINING ENGINEERING) PART – III SEMESTER – V

MN3101: GROUND CONTROL (3 Credits)

Design of Mine Opening

Stress distribution around narrow and wide openings. Extent of failure around mine openings. Determination of size of opening and extent of failure.

Design of Pillars

Determination of shape and size of pillars in coal and hard rock mines, barrier pillars.

Rock Supports

Design of support systems in tunnels, shafts, headings, junctions, depillaring areas, gates, longwall faces and stopes. Rock bolting. Cable bolting. Shotcreting. Roof stitching. Mechanics of strata control by stowing.

Caving

Mechanics of caving. Caveability of rocks. Induced caving.

Subsidence

Theories of subsidence. Factors affecting subsidence. Sub-critical, critical and super-critical widths of extraction. Subsidence prediction and control. Design of shaft pillar.

Slopes

Types of slope failure. Analysis of slope failure. Factors affecting slope stability. Drainage and reinforcement of slopes. Monitoring of slopes. Stability of waste dump.

Rock Bursts

Rock bursts and bumps – mechanism, prediction and control.

Load and Deformation Monitoring

Visual monitoring, instrumental monitoring – load cells, convergence recorders.

MN3102: UNDERGROUND MINE ENVIRONMENT – II (3 Credits)

Main Mechanical Ventilation

Centrifugal and axial flow fans – construction, pressure development, characteristic curves, series and parallel operations, installation and testing. Forcing and exhaust ventilation. Fan drift, evasee, diffuser. Reversal of airflow.

Auxiliary and Booster Ventilation

Distinction between auxiliary and booster ventilation. Booster fans and installation. Auxiliary ventilation by brattice. Auxiliary fans and installation. Risk of uncontrolled recirculation. Controlled recirculation – concept, schemes for controlled recirculation in long heading and working district.

Ventilation Planning

Classification of ventilation systems – central & boundary, homotropical & antitropical, ascending & descending, U, V & W ventilation. Desirable features of ventilation planning. Short term and long term ventilation planning. Ventilation layout for mining coal and ore deposits. Calculation of air quantity and pressure requirements. Fan selection.

Ventilation Survey

Purpose, instrumentation, procedure and data tabulation for air quantity and pressure survey. Determination of fan and mine characteristic. Ventilation Plans.

MN3103: MINE SURVEYING – II (3 Credits)

Mine Plans and Sections

Mining plans and sections. Statutory requirements, conventional signs, limits of accuracy.

Underground Traversing

Traversing through roadways and drifts.

Surface and Underground Correlation

Orientation of underground net through adits, inclines and shafts. Depth of shaft. Magnetic and gyroscopic orientation.

Stope Surveying

Tape triangulation. Traversing. Radiation. Auxiliary telescope. Hanging compass.

Photogrammetry

Terrestrial and aerial photogrammetry. Flight planning. Applications in mine surveying.

Global Positioning System

Theory and applications in mine surveying.

Subsidence Surveying

Construction and layout of subsidence monitoring stations. Subsidence measurements.

Borehole Surveying

Laser

Types, characteristics and mining applications of Laser.

MN3104: UNDERGROUND COAL MINING – I (4 Credits)

Coal and coal measure rocks. Classification of mining methods. Division of mine area into panels on district and level patterns.

Factors influencing the choice of mining method.

Bord and Pillar Method

Size of headings, pillars and panels.

Development of panels by drivage of group of headings to strike, dip and rise with V, diagonal and straight fronts. Cycle of operations, work-organisation and scheduling for drivage of heading groups by conventional and continuous methods.

Depillaring of panels with V, straight and diagonal fronts. Conventional and mechanized depillaring schemes with emphasis on coal, water, air routes and supports.

Simultaneous development and depillaring, partial extraction, room and pillar methods.

Longwall Method

Classification of longwalls, advancing and retreating methods, working in districts and levels (central and boundary ventilation) size of panel, development of panel with single and multiple heading gate roads, various orientations of longwall face, single and double unit longwalls.

Extraction of longwall panels with conventional and fully mechanized methods, length of face, daily advance, cycle of operations, organisation, scheduling and layouts with special reference to coal, water and air routes.

Bleeder ventilation scheme.

Gate, goaf and face area support in conventional and fully mechanised longwalls. Room and Pillar Method

Shortwall Method

Stowing: Applicability conditions, classification and description of various methods of goaf stowing. Surface and underground arrangements and precautions with stowing, full bore stowing and problems associated with stowing at surface and below ground.

Comparison of Various Mining Methods

MN3105: SURFACE MINING – I (3 Credits)

Classification and Basic Parameters

General information and classification of surface mining methods – associated terms, determination of major dimensions and main parameters. Annual production and life of mine.

Surface mining methods – Scope, applicability and limitations.

Opening of Deposits

Opening of deposits and formation of benches – trenching, non-trenching and underground methods and their combinations. Width & slope of entry trenches. Driving of opening and entry trenches.

Overburden Removal

Systems for removal and disposal of overburden – overcasting haulage and combination methods with scope and limitations. Design of waste dumps.

Basic Layouts

Layout planning for horizontal, inclined and steep deposits. Factors influencing the choice of layouts. Design of benches.

Special Mining Situations

Quarrying of dimensional stones, hydraulicking, dredging of placers and deep-sea mining. Mining over old underground workings.

Ultimate Pit Design

Global and Indian Status of Surface Mining

EE3108A : ELECTRICAL ENGINEERING – II (3 Credits)

Electric Drives

Advantages and disadvantages, factors affecting the selection, direct and indirect drives. DC, induction and synchronous motors – principle, starting, speed control and braking. Rating of machines and duty cycle, cooling curve. Speed-time relationships, time-revolution required to reach a particular speed or to stop. Load equalization. Selection of drives to meet specific requirement in mines and mineral treatment plants.

Electric Power Distribution

Types of distributors, AC & DC distribution, feeders, design.

Voltage Regulation of Lines

Short lines, medium lines, ABCD constant, over-head line insulator. Mechanical design of lines.

Underground Cable

Types, grading, heating, rating and laying in.

Neutral grounding – methods and grounding practices. Opencast and underground mine electrical system installation in hazardous atmospheres. Flameproof enclosures. Intrinsically safe circuits.

Instrumentation

Transducers, measurement of displacement, temperature, pressure, stress, strain and acceleration.

B.TECH. (MINING ENGINEERING) PART – III SEMESTER - VI

MN3201: MINERAL PROCESSING (4 Credits)

Introduction

Scope, objectives and limitations of mineral processing.

Liberation and Comminution

Concept and importance of liberation and its measurement. Theories of Comminution. Crushing and grinding equipment, their fields of application and limitations. Comminution circuits.

Sizing and Classification

Laboratory sizing techniques. Industrial screens – selection and performance. Laws of settling of solids in fluid. Types of classifiers, their selection and performance. Interpretation of sizing data.

Concentration Methods

Principles, equipment and circuits for various concentration processes such as gravity concentration, dense media separation, magnetic separation, high tension separation, flotation. Applications and limitations of each method.

Solid-Liquid Separation

Principles, techniques and application of dewatering units such as filters and thickeners.

Plant Practices

Location, layouts and selection of equipment for mineral processing plants. Processing flow sheets for coal and important ores. Associated environmental problems and their controls. Metallurgical accounting and control. Developments and research trends in mineral processing.

MN3202: ENVIRONMENTAL MANAGEMENT IN SURFACE MINES (4 Credits)

Environmental Issues

Air Pollution

Sources, characterization, ill effects, measurement, monitoring, standards, mitigating measures.

Water Pollution

Sources, ill effects, water quality parameters – physico-chemical, biological and bacteriological. Water quality criteria, standards, monitoring and mitigating measures. Heavy metal pollution and its abatement. Ground water pollution – detection and management. Acid mine drainage.

Noise Pollution

Basics of acoustics. Sound power, intensity and pressure levels. Noise indices, effects, standards, instrumentation, monitoring and control.

Biological Land Reclamation

Environmental factors affecting revegetation – climatic, physical and chemical factors. Analysis and evaluation of site and soil. Plant species selection. Methods of vegetation establishment. Vegetation survey.

Socio-economic Rehabilitation

Environmental Impact Assessment

Methods of EIA and their applicability.

Environmental Management Plan

Structure and preparation of EMP.

Environmental Laws

MN3203: UNDERGROUND COAL MINING – II (3 Credits)

Global and Indian Status

Global and Indian status of different underground coal mining methods and scenario of coal production in India.

Mining Under Difficult Geological Situations

Winning of contiguous, steeply inclined and thick seams – slicing methods, sublevel caving, integral sublevel caving, blasting gallery method and wide-stall method. Winning of thin seams – methods, equipment and associated problems. Situations of stress concentrations during winning of seams. Stress relaxations. Winning of seams prone to gas outbursts. Winning of fractured and crushed seams.

Hydraulic Mining

Concept, hydro-monitors, coal flumes and pipes, hydraulic elevators and pumps, coal sumps. Layout of working on district and level systems.

In-situ Gassification

Concept, chemistry, and applicability. Methods using underground excavations – vertical and directional drilling boreholes from surface. Linkages and innovations.

MN3204: SURFACE MINING – II (3 Credits)

An overview of unit operations in surface mining.

Drilling

Classification of drilling equipment, construction and design considerations, criteria for selection and performance of drilling equipment, drillability, mechanics of drilling.

Blasting

Selection of explosives, primary blast round design considerations and calculations, multi-row blasting, inclined hole blasting, initiation systems, secondary blasting, monitoring and assessment, blast nuisances (vibration, airblast, flyrock), blast casting.

Excavation and Loading

Classification of excavation and loading equipment. Front end loaders. Backhoe. Power shovel. Dragline and its balancing diagram. Bucket Wheel Excavator. Bucket Chain Excavator. Surface Miners. Criteria for selection and performance of excavating and loading equipment.

Transport

Classification, choice and performance of various transport systems. Dumpers, rail transport, belt conveyers, in-pit crushing and conveying, high angle conveying. Optimization of shovel-dumper combination, computerised truck despatch. Auto truck control. Haul road design.

Storage

Stockpiling and blending. Spreaders. Reclaimers.

Lighting

Requirements, types and layouts.

Drainage

Sources of water, assessment of drainage requirements, sump design and drainage patterns.

Reclamation

Methods of reclamation of mined out areas, dumps and tailings pond.

MN3205: COMPUTER APPLICATIONS IN MINING (3 Credits)

Introduction to Software Packages Applicable to Mining

Development of Algorithms

Slope stability. Pillar design. Open pit configuration. Design of mine ventilation system. Optimisation of cycle of operations. Blast design. Simplex technique for mining. Rock reinforcement design. Modelling of mining pollution phenomena. Management information systems.

Development of Programs

Simple computer programs based on the above algorithms.

B.TECH. (MINING ENGINEERING) PART – IV SEMESTER - VII

MN4101: MINE MANAGEMENT (3 Credits)

Evolution of management thought. Classical theory. Scientific Management Administrative theory, behavioural approach. Neo classical theory. Modern theory. Systems approach. Total quality management.

Management Process

Planning, organizing, directing, motivating, controlling, coordinating and communicating, staffing, manpower planning and recruitment. Performance appraisal, human resource development and planning.

Organizations

Principles of organization. Departmentation. Levels of management and organizational chart.

Management information systems, human resource development, workers participation in management, trade unionism, inventory control and materials management.

MN4102: MINE ECONOMICS (3 Credits)

Mineral Economics

Special features of mineral and mining industry, statistics of important and strategic minerals of India. Grading and pricing of coal, limestone, bauxite and iron ore. Pricing of metals, concentrates and ores. Conservation of minerals. National mineral policy. Global mineral marketing.

Sampling and Estimation of Reserves

Methods of sampling during exploration, mining and dispatch. Records and analysis of core sampling data. Tenor, grade and specification. Classification of reserves. Estimation of reserves. Applications of geostatistics.

Economic Evaluation

Break-even analysis. Economic appraisal of capital investments by NPV and IRR methods. Comparison of investment alternatives. Feasibility studies. Critical variables, price forecasting and sensitivity analysis.

Organisational and Financial Management

Forms of business organizations. Sources of finance. Winding up of companies. Wage systems and incentives. Cost accounting and budgetary control.

MN4103: MINING MACHINERY – III (3 Credits)

Mine Pumps

Types, construction and characteristics. Pipes. design, installation and maintenance of pumping systems. Series and parallel operations of pumps. Borehole and submersible pumps. Slurry pumps. Airlift pumps. Automatic pump control

Rock Drivage Machines

Roadheaders. Tunnel Boring Machines. Raise climbers. Raise and shaft boring machines, Rock bolting machines.

Underground Face Machinery

Basic principles of drilling, ripping, cutting and ploughing. Drills. Coal cutting machines. Gate end box. Continuous miners. Loaders, shearers, ploughs and powered supports.

Machinery Maintenance

Planned, preventive and predictive maintenance. Routine and remote condition monitoring. Effect on availability and utilisation of equipment.

Automation and Remote Control of Mining

MN4104: MINE DISASTERS (3 Credits)

Spontaneous Combustion

Mechanism, causes, susceptibility indices, detection, preventive measures and control. Incubation period and its determination.

Mine Fires

Classification of fires, causes, detection, preventive measures. Dealing with underground and surface fires. Fire fighting – direct methods, sealing off and inertisation.

Explosions

Mechanism, causes, characteristics, preventive and control measures of firedamp and coal dust explosions. Investigation after explosion.

Reopening of Sealed-off Area

Monitoring of atmosphere behind sealed-off area. Precautions to be taken before reopening. Methods of reopening.

Inundation

Causes and preventive measures. Precautions to be taken while approaching old water-logged workings and while working under water bodies. Safety boring apparatus. Dewatering procedure. Design and construction of water dams and barriers.

Rescue and Recovery

Rescue equipment – constructional features, functions and uses. Rescue station and rescue room. Organisation of rescue work. Fresh air base and its advancing. Rescue rules.

Enquiry Report Preparation**Electives (any one)****MN4105: MINE SAFETY ENGINEERING (3 Credits)**

Safety scenario in Indian mines.

Causes of accidents, accident report.

Accident analysis and control.

Cost of accident.

Systems engineering approach to safety, techniques used in safety analysis.

Safety management and organisation.

Human behavioural approach in safety.

Emergency organisation for disaster management.

MN 4106: DRILLING AND BLASTING OF ROCKS (3 Credits)**Drilling of Rocks in Underground and Surface Mines**

Principles of rock drilling. Classification of drilling system. Rock drilling methods, parameters affecting the choice of drilling system, long hole drilling, ring drilling and rotary drilling methods for underground mines. Drilling bits.

Blasting in Underground Mines

Explosives. Initiation systems and accessories for blasting in the underground mines. Blasting off the solid. Blasting of cut faces. Mass-blasting system for heavy blasting in hard rock mines.

Blasting in Surface Mines

Principles of blast round design for single and multi-row. Blast round design in surface mines. Bulk explosives Initiation systems and accessories.

Evaluation Methods, Nuisances and Mitigation

Evaluation of drilling and blasting methods for underground and surface mines by use of state-of-art techniques and gadgets. Blasting nuisances and their mitigation for underground and surface mines.

MN4107: TECHNOLOGY OF UNDERGROUND EXCAVATION (3 Credits)**Tunnelling**

Drilling and blasting, mucking, transportation support, ventilation and illumination.

Tunnel boring machines – factors influencing its performance, choice of TBMs, types of TBMs.

Design and Construction of Large Underground Excavations

Shape, dimensions, structural behaviour, methods and sequence of excavations.

Power stations.

Storage caverns.

Metro and large diameter trenches for communication.

Nuclear waste repositories and excavations for defence purposes.

MN4108: NUMERICAL METHODS IN GEOMECHANICS (3 Credits)**Finite Difference Method**

Concept, formation of mesh, finite difference patterns, solutions. Application in mining problems.

Finite Element Method

Concept, discretization into elements, element types, element stiffness, assemblage and solution. Simulation based on FEM.

Boundary Element Method

Concept, discretization, solution for isotropic and infinite media.

Application to Mining Engineering Problems.

B.TECH. (MINING ENGINEERING) PART – IV SEMESTER – VIII

MN4201: UNDERGROUND METALLIFEROUS MINING (3 Credits)

Status of Metalliferous Mining Industry in India

Development

Opening of deposits – shafts (vertical and inclined), declines and adits. Cross-cuts. Division of orebody into levels and blocks. Level interval.

Driving of raises – conventional and raise boring machines methods.

Stoping Methods

Classification. Room and Pillar method. Sublevel stoping. VCR method. Shrinkage stoping – conventional and VCR. Cut and fill stoping and its variation. Sublevel caving. Block caving – spontaneous and induced. Dilution and recovery. Productivity. Unit supports and mass support systems. Selection of stoping methods.

Special Mining Situations

Special problems in deep mines. Solution mining. Leaching methods. Bacterial leaching. Sea-bed Mining.

Orebody and Host rock

Salient features, dilutions, type of dilutions, methods of dilution assessment, computation of net smelter returns of mine, economic considerations for selection of stoping methods.

Pillar Recovery Methods

MN4202: MINE LEGISLATIONS (4 Credits)

Development of Mining Legislations in India. Provisions of Mines Act and Mines rules. Coal Mines Regulations and Metalliferous Mines Regulations.

General provisions of Mines and Minerals (Development and Regulation) Act, Mineral Concession Rules, Coal Mines (Conservation and Development) Act, Workmen's Compensations Act and Industrial Disputes Act.

Relevant provisions of Indian Electricity Rules, Indian Explosives Acts and Rules.

MN4203: MINE PLANNING (3 Credits)

Basic Concepts

Objectives of mine planning. Characteristics of planning process. Planning stages – long, intermediate and short range planning. Technical, economical and environmental information required for mine planning.

Preparation of Feasibility and Project Report

Techno-economics of opencast versus underground mining operations. Determination of optimum size of mines. Design of mine entry systems. Analysis of geological data. Marketability of the mineral safety aspects. Economic evaluation of the mining projects.

Production Planning and Scheduling

Mine Closure Planning

Mine Plans

Electives (any one)

MN4204: OPERATIONS RESEARCH IN MINING (3 Credits)

Introduction to Operations Research

Linear Programming & Dynamic Programming

Transportation – problems in mining, supply of coal from various mines to various destinations, cost optimisations and optimisations tools.

Network Analysis

CPM and PERT Analysis.

Inventory Models

Definition, deterministic models, probabilistic models and their applications to mining.

Non-linear Programming

Unconstrained and constrained external problems. Programming methods – separable, quadratic, stochastic, geometric.

MN4205: MINING INDUCED SUBSIDENCE ENGINEERING (3 Credits)

Causes – Effect of depth, width of excavation, seam thickness and angle of draw.
Types of subsidence – non-effective width, sub-critical, super-critical width.
Theories of subsidence, sub-surface subsidence due to mining.
Rock kinematics, Extent of movement in the overlying beds.
Special Methods of Mining to control subsidence.
Prediction and nomograms of subsidence.

MN4206: FUNDAMENTALS OF DRILLING TECHNOLOGY (3 Credits)

Drilling Methods

Classification, factors affecting drilling of rock – thrust, rotation, flushing, feed, rock type, alignment and deviation, flushing and suction drilling. Drillability of rocks. Basis for choice of methods - diameter, depth, and rock types. Ergonomics of drilling.

Principles of Drilling

Drilling mechanics, factors affecting rock drilling, alignment and deviation.

Exploratory Drilling

Diamond drilling – types, rocks, barrels, bits and wire line system.

Production Drilling

Percussive drilling – mechanism, types and methods. Constructional features, specifications, merits and limitations of various types of percussive drills machines.

Rotary blast hole drilling – classification, characteristics, performance and applications of rotary cutting and rotary crushing drilling techniques.

Miscellaneous Drilling Techniques

Water-jet assisted drilling, fire jet drill, drilling for coal field degassification and horizontal and directional drilling.

**MN4207: FUNDAMENTALS OF ROCK MECHANICS INSTRUMENTATION
(3 Credits)**

Basic Concepts

Sensitivity, range, reproducibility and accuracy, drift, absolute and relative measurements, error, environmental factors and planning for instrumentation.

Operating Principles

Mechanical, pneumatic, optical, vibrating wire, piezoelectric, electrical and thermal.

Field Instruments

Load cells, MPBX, tape extensor meters, convergence recorders.

Laboratory Instruments

Load, stress, deformation, strain measuring instruments.

Applications in Mining

Coal mining – bord and pillar development, depillaring and Longwall.
Metal mining applications