

V Semester B. E. (Mining Engineering)

Course Code: **MNSMN501** V Semester B.E. (Mining Engineering)

Title of the Course: **Rock Mechanics**

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	3	3	10	10	80	100

Unit	Contents	Hours
I	<p>Rock Mechanics: Definition, significance and status.</p> <p>Rock & Rock Masses: Study of behavior; inherent complexities in Rock Mechanics</p> <p>Stresses & Strains: Fundamentals of stress and strain in two & three-dimensions, sign convention, stress-strain relationships in average types of rocks, types of Moduli 'I' of elasticity, principal stresses, Poisson's Ratio, Mohr's Circle, Types of Strengths of Rock</p> <p>Important Rock Mechanics Terminology: Types of stresses, Joints & joint sets, Hardness, Porosity & Permeability, Isotropy & Anisotropy, Brittleness & Ductility, Linear & Non-Linear Elasticity, Stiffness, Thermal Conductivity etc.</p>	9
II	<p>Laboratory Tests for Static Elastic</p> <p>Properties of Rocks: Determination of various physic-mechanical properties such as different types of strengths (compressive, tensile and shear), Tri-axial Compression Test & its applications, Brittle-Ductile Transition Pressure, Index Tests such as Protodyakonov Strength Index Test, Impact Strength Index Test, Slake Durability Index Test, Point Load Index Test etc., Measurement of porosity and permeability, Study of Post Failure Behaviour & its practical significance, significance of stiffness of Loading System.</p>	9
III	<p>Field or In-situ Measurements: Measurement of Pre-mining or in-situ states of stresses, Difficulties involved, Methods of determination e.g. Flat Jack Method, Over coring method and Hydro-fracturing method.</p> <p>In-situ Deformability & Strength Tests: Rock Deformability & its measurement in field, In-situ tests for determination of different types of strengths of rock masses.</p> <p>Dynamic Elastic Characteristics of Rocks: Dynamic properties and their difference from static properties, preparation of different types of elastic waves through rock bodies, Determination of dynamic elastic constants of rocks in laboratory.</p>	9
IV	<p>Time-Dependent Properties of Rocks:</p> <p>Effect of prolonged loading of rock masses on their deformation behavior, creep, Different stages of Creep, Measurement of creep of rocks, Rheology, Rheological Models, Relevance of study of rheological models to mining engg., study of different types of rheological models.</p> <p>Engineering Classification of Rock Masses:</p> <p>Introductory Concept & relevance of engineering classification of rock masses, some examples of single-criteria classification schemes.</p>	9
V	<p>Rock Failure Criteria & Theories: Concept of Failure, Definition & standard forms of failure criteria for rock masses, Coulomb Criterion, Mohr's Criterion, Griffith's Theory of Failure, other empirical criteria of failure including Hock & Brown's Criterion.</p> <p>Concepts of Soil Mechanics: Physico-mechanical properties of soils, Types of soils, Important index properties including consistency & gradation, engineering properties and classification of soils, soil properties of engineering significance, comparison of basic principles of Rock Mechanics & Soil Mechanics.</p>	9
Total		45

Text / Reference Book/s:

1. Rock Mechanics for Underground Mining – B.H.G. Brady and E.T. Brown, Pub. Chapman & Hall
2. Introduction to Rock Mechanics – R.E. Goodman, Wiley International
3. Handbook on Mechanical Properties of Rocks – R.D. Lama and V.S. Vutukuri, Trans Tech Publication
4. Engineering in Rocks for slopes, Foundations & Tunnels – T. Ramamurthy, PHI
5. Fundamentals of Rock Mechanics – J.C. Jaeger and N.G.W. Cook, Chapman & Hall

V Semester B. E. (Mining Engineering)

Course Code: MN502
Title of the Course: Mine Climate Engineering

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	4	3	10	10	80	100

Unit	Contents	Hours
I	Composition of Mine Atmosphere: Mine gases – sources, properties, effects and detection; sampling and analysis of mine air, methane content; methane drainage; methane layering; flame safety lamp and its uses; methanometers; radon gas and its daughter products; continuous monitoring of gases.	9
II	Heat and humidity: Source of heat in mines; effects of heat and humidity; psychrometry, kata thermometer; heat stress, air-conditioning. Natural ventilation: Seasonal variations, calculation of NVP from air densities and thermodynamic principles.	9
III	Air Flow through Mine Openings: Laws of flow, resistance of air ways, equivalent orifice, distribution of air, flow control devices,; ventilation surveys, permissible air velocities in different types of workings, standard of ventilation.	9
IV	Mechanical Ventilation: Types of mine fans; theory; characteristics and suitability of fans; selection; fans in series and parallel; forcing and exhaust configurations, reversal of flow; fan drifts, diffusers, evasees, booster fan, Auxillary ventilation.	9
V	Ventilation planning: Planning of ventilation system and economic consideration; ventilation layout for mining of coal and ore deposits; calculation of air quantity of air required for ventilating a mine; calculation of total mine head; network analysis principles and computer applications, ventilation of deep mines-U/G & open pit, Ventilation cost calculation.	9
Total		45

Text / Reference Book/s:

1. Mine Environment and Ventilation by G B Mishra
2. Mine Ventilation by Prof S P Banerjee
3. Numericals on Mine Ventilation by L C Kaku

V Semester B. E. (Mining Engineering)

Course Code: MN503
Title of the Course: Drilling & Blasting Engineering

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	4	3	10	10	80	80

Unit	Contents	Hours
I	Drilling: Definition, need, classification, drillability and selection of drilling system, Percussive drilling - mechanics, required vertical thrust and RPM, Indexing, penetration rate etc. Rotary drilling - Mechanics, torque required and estimation of applied thrust, Rotary-percussive drilling - mechanics, torque required, applied axial thrust. Thermal drilling and other types of novel drilling methods with concepts. Factors affecting performance of drilling system, operating parameters etc. Bits: types of bits, construction and application, bit wear, Economics of drilling system.	9
II	Explosives: Definition, classification, composition, properties and various Tests on explosives Detonator: Need, classification, construction, Delay element, firing sequence, fuse, detonating cord, relay, nonel, shocktube, electronic detonators, Blasting accessories, exploders, circuit tester, etc.	9
III	Blasting: Mechanism of blasting- solid blasting, cut blasting and bench blasting, blasting pattern and design of blast round in underground coal mines, opencast, drifts, stopes, raise, winze, shaft, tunnel, etc. Secondary blasting methods.	9
IV	Bulk transportation of explosive, storage and explosives (magazine), blasting in fiery seam, blasting under special conditions, deep hole blasting, environmental effects of blasting and their preventive measures.	9
V	Characteristics of good blast, blast performance, evaluation technique, controlled blasting techniques, cast blasting, blast simulation studies, misfire, dealing with misfire, blownout shot, blowthrough shot.	9
Total		45

Text / Reference Book/s:

- Principles and Practices of Modern Coal Mining by R D Singh, New Age Int. (P) Ltd., New Delhi
- Surface Blast Design by C.J.Konya & E.J.Walter, Prentice Hall Publications
- Explosives and Blasting Practices in Mines by Dr S K Das, Lovely Prakashan, Dhanbad
- Principles of Rock Drilling by U.M.Rao Karanam and B.Misra, Oxford & IBH Co Pub. Ltd., New Delhi
- Surface Mining by G B Mishra, Dhanbad Publishers
- SME Mining Engineering Handbook by H.L.Hartman (Editor), Soc. For Mining, Metallurgy and Exploration Inc., Co.
- Rock Breakage by Blasting by M.I. Petrosyan, Overseas Books Syndicate, Dhanbad

V Semester B. E. (Mining Engineering)

Course Code: MN504
Title of the Course: Mine Surveying - II

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	3	3	10	10	80	100

Unit	Contents	Hours
I	Control Surveys: Triangulation; classification; reconnaissance, measurement, procedure for angles and base-line; trilateration; introduction to GPS and its application in mine surveying.	9
II	Correlation: Methods of correlation-direct traversing in inclined shaft, correlation in vertical, single and two shafts	9
III	Development surveys: Setting a point of known coordinate, control of direction and gradients in drifts, tunnels, raises and winzes; application of lasers Problems of underground traversing Stope surveying: Purpose, methods of survey in moderately and steeply inclined ore bodies, flat and vertical ore bodies/seams.	9
IV	Photogrammetry: Principles of photogrammetry and its elements, orientation of photographs, finding height and distance of ground points from photographs, scale of vertical photographs, photographs versus maps, application of photogrammetry in mining.	9
V	Introduction of errors and its theory, identifications of errors, their prevention and elimination; method of least squares and its applications; probable error of single observation; most probable value, weights, weighted observation and their probable errors, adjustment of observations. General legislative requirements as to mine plans in India, preparation and preservation of plans and sections.	9
Total		45

Text Books:

1. Surveying Volume II, III by Dr. B. C. Punmia, Laxmi Pub. Pvt. Ltd., New Delhi
2. Surveying Volume II by Dr T. P. Kanetkar and Kulkarni, Vidyarthi Griha Prakashan, Pune
3. Surveying Volume III by P B Shahani
4. Manual on Colliery Survey, Publishers CMPDIL, Ranchi
5. Modern Concepts of Mine Surveying. Vol-II by Alam Chand, News Sketch Press, Dhanbad

Reference Book:

1. Metalliferous Mine Surveying by Frederick Winniberg, John Wright & Sons Ltd., UK

V Semester B. E. (Mining Engineering)

Course Code: MN505
Title of the Course: Mining Machinery-II

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	4	3	10	10	80	100

Unit	Contents	Hours
I	Classification, application & construction features of drilling machines used in underground coal mines, rock drills, jumbo drills, rock bolting machines. Small and large diameter surface blast hole drills, their construction, application, selection and operation.	9
II	Coal cutting machines, shearers, coal plow, lump breakers, road headers, TBMs, raise and shaft borers, continuous miners, stage loaders; their main features and applicability.	9
III	Loading machines – rocker shovel, SDL, LHD, gathering arm loader, shuttle car, LPDTs, scraper; their main features, applicability, selection and estimation of production capacities.	9
IV	Opencast Machinery – Shovels, draglines, dumpers, wheel loaders; their main features, applicability, selection and production capacities; rippers, scrapers, Road graders, Dozers.	9
V	Continuous surface mining equipment – bucket wheel excavators, stacker & reclaimer, continuous surface miners, spreaders, dredging equipment; their main features, applicability, selection and estimation of production capacities Signalling and communication; signalling and communication systems used in underground and surface mines.	9
Total		45

Text / Reference Book/s:

1. Elements of Mining Technology Volume III by D J Deshmukh
2. Coal Mining Technology by Dr S K Das
3. Surface Mining Technology by Dr S K Das
4. Heavy Earth Moving Machinery by Amitosh De

V Semester B. E. (Mining Engineering)

Course Code: MN506
Title of the Course: Mine Supports

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods/week	Credits	Duration of paper, hrs	MSE	IE	ESE	Total
3	1	0	4	4	3	10	10	80	100

Unit	Contents	Hours
I	Principle of strata support and strata reinforcement: Need of action of support, terminology, weak strata, strong strata, support reaction curve, classification of mine support, load coming on face support, bord and pillar, Narrow excavation-bord and pillar, longwall, load estimation rock load on face support, bord and pillar.	9
II	Timber support: merits and demerits, various types of prop, crossbar, chock, load bearing capacity of timber supports, steel support, shaft tubing, steel lining, steel props, and steel chocks, steel arches, friction props, hydraulic props, power support.	9
III	Concrete shaft lining-plain of reinforced, supporting of gate roads in advancing longwall face, short creating of guniting, concrete slab or concrete support, pillar support-factors affecting load on pillar and estimation of pillar stress, stabilization of weak pillar.	9
IV	Requirements of stowing, characteristics of stowing material, various types of stowing with merits and demerits, details of hydraulic stowing, theory of slurry transport, sand water requirements, design of hydraulic stowing system.	9
V	Pre-reinforcement materials and techniques; rock bolts and dowels – different types and uses ; mechanics of bolting Anchored rock bolts – Slot and wedge type, expansion shell type, grouted point anchor type. Full column anchors, wooden and fibre glass dowels, mechanical full column anchors, split sets/friction rock stabilizers, full column grouted rock bolts, installation and testing of rock bolts. Cable bolting – its installation and applications.	9
Total		45

Text / Reference Book/s:

1. Ground Mechanics in Hard Rock Mining by M L Jeremic, Oxford Publishers
2. Design of Supports in Mines by Cemal Biron and Ergin Arioglu, John Wiley and Sons
3. SME Mining Engineering Handbook by H.L.Hartman (Editor), Soc. For Mining, Metallurgy and Exploration Inc., Co.

V Semester B. E. (Mining Engineering)

Course Code: MN507
Title of the Course: Rock Mechanics Laboratory

Course Scheme					Evaluation Scheme (Laboratory)		
Lecture	Tutorial	Practical	Periods/week	Credits	TW	POE	Total
0	1	2	3	2	25	25	50

Sr. No.	List of Practical's
1	Determination of Protodyakonov Strength Index.
2	Determination of Impact Strength Index.
3	Determination of Slake Durability Index.
4	Preparation of Rock Specimen by core-drilling, cutting & polishing for compression & Tension Tests.
5	Determination of Uniaxial Compressive Strength.
6	Brazilian Tensile Test.
7	Determination of Point Load Strength Test.
8	Introduction to Triaxial Compression Test.
9	Determination of Shear strength (Double shear of Punch Shear)

V Semester B. E. (Mining Engineering)

Course Code: MN508
Title of the Course: Mine Climate Engineering Laboratory

Course Scheme					Evaluation Scheme (Laboratory)		
Lecture	Tutorial	Practical	Periods/week	Credits	TW	POE	Total
0	1	2	3	2	25	25	50

Sr. No.	List of Practical's
1	Detection of CO by MSA CO-detector pump apparatus.
2	To study MSA Methanometer and Testing of CH ₄ by MSA Methanometer.
3	To Study Flame safety lamp & Testing of CH ₄ by Flame Safety Lamp.
4	Determination of Relative Humidity (R.H.) of mine air by Whirling Hygrometer.
5	Determination of Cooling Power of mine air by Kata Thermometer.
6	To study different Ventilation Devices.
7	Measurement of Air Velocity by Anemometer and determination of Air Quantity.
8	To study operation of Fans in series.
9	To study operation of Fans in parallel.

V Semester B. E. (Mining Engineering)

Course Code: MN509
Title of the Course: Mine Surveying-II Laboratory

Course Scheme					Evaluation Scheme (Laboratory)		
Lecture	Tutorial	Practical	Periods/week	Credits	TW	POE	Total
0	1	2	3	2	25	25	50

Sr. No.	List of Practical's
1	Theodolite traversing by horizontal angle measurement.
2	To determine the most probable value of the included angles of a given triangle by method of least squares.
3	Correlation survey by alignment/co-planning method.
4	Correlation survey by weiss-bach triangle method.
5	Correlation survey by weiss-quadrilateral method.
6	Study of mirror stereoscope.
7	Study of Gyro theodolite.
8	Study of photo theodolite.
9	Study of automatic level.
10	Study of micro-optic theodolite.
11	Study of clinometer compass.
12	Study of Electromagnetic distance measuring equipment.
13	Determination of true north by observing circumpolar star, at equal altitude.

V Semester B. E. (Mining Engineering)

Course Code: MN510

Title of the Course: Mining Machinery-II Laboratory

Course Scheme					Evaluation Scheme (Laboratory)		
Lecture	Tutorial	Practical	Periods/week	Credits	TW	POE	Total
0	1	2	3	2	25	25	50

Sr. No.	List of Practical's
1	Study of Coal Drill.
2	Study of Excavators.
3	Study of Front End Loader.
4	Study of Scrapper.
5	Study of Dozer.
6	Study of Bucket Wheel Excavator.
7	Study of Road Graders.
8	Study of Road Headers – Rotary and Milling type.