

Faculty of Engineering & Technology

Study and Evaluation Scheme

Of

Bachelor of Technology

B.Tech. (Mining Engineering)

(Applicable w.e.f Academic Session 2015-19, till revised)



AKS UNIVERSITY, SATNA

Study and Evaluation Scheme

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Faculty of Engineering & Technology
Department of Mining Engineering
B.Tech. (Mining Engg.)

(Session 2015)

Teaching and Examination Scheme B. Tech.-III						
S. N.	Subject Code	Subject Name	L	T	P	Credit
1	05GE301	Mining Geology-I	03	01		04
2	05MI303	Surface Mining	03	01		04
3	05MI306	Mine Development	03	01		04
4	05MS302	Engineering Mathematics - III	04			04
5	05EE304	Electrical & Energy Engineering	03	01		04
6	05ME307	Strength of Materials	03	01		04
1	05GE351	Mining Geology - LAB			02	01
2	05MI356	Surface Mining LAB			02	01
3	05MI353	Mine Development LAB			02	01
4	05EE354	Electrical Engineering & Energy - LAB			02	01
5	05ME355	Strength of Materials -LAB			02	01
			19	05	10	29
Total Credit=29						

Teaching and Examination Scheme B. Tech.-IV						
S. N.	Subject Code	Subject Name	L	T	P	Credit
1	05GE401	Geology-II	03	01		04
2	05MI407	Mine Surveying-I	03	01		04
3	05MI403	Mining Machinery-I	03	01		04
4	05MI404	Mine Ventilation Environment-I	03	01		04
5	05ME405	Fluid Mechanics	03	01		04
6	05MS406	Statistics and Probability	03	01		04
1	05GE451	Geology-II LAB			02	01
2	05MI456	Mine Surveying - Lab			02	01
3	05MI453	Mining Machinery-I LAB			02	01
4	05MI454	Mine Ventilation Environment-I LAB			02	01
5	05ME455	Fluid Mechanics LAB			02	01
			18	05	10	29
Total Credit=29						

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Teaching and Examination Scheme B. Tech.-V						
S. N.	Subject Code	Subject Name	L	T	P	Credit
1	05MI501	Underground Metalliferous Mining	03	01		04
2	05MI503	Mine Ventilation & Environment-II	03	01		04
3	05MI502	Mining Machinery-II	03	01		04
4	05MI504	Underground Coal Mining	03	01		04
5	05MI505	Rock Mechanics & Strata Control	03	01		04
1	05MI551	Semester Break Training*(4 Credit)				
2	05MI552	Rock Mechanics & Strata Control - LAB			02	01
3	05MI553	Mining Machinery-II-LAB			02	01
4	05MI554	Underground Coal Mining-LAB			02	01
5	05MI555	Underground Metalliferous Mining -LAB			02	01
6	05MI556	Mine Ventilation & Environment-II-LAB			02	01
			15	05	10	25
Total Credit=25						
* the result of Semester Break Training is publish with 8 th semester result.						

Teaching and Examination Scheme B. Tech.-VI						
S. N.	Subject Code	Subject Name	L	T	P	Credit
1	05EE601	Mine Electrical Technology	03	01		04
2	05MI602	Advanced Mine Surveying	03	01		04
3	05MI603	Advanced Rock Mechanics and Ground Control	03	01		04
4	05MI606	Innovative & Sustainable Mining	03	01		04
5	05MI605	Coal and Non Coal mineral Processing	03	01		04
1	05MI651	Advanced Rock Mechanics and Ground Control LAB			02	01
2	05EE652	Mine Electrical Technology LAB			02	01
3	05MI653	Coal and Non Coal mineral Processing LAB			02	01
4	05MI656	Mini project work on Innovative & Sustainable Mining			04	02
5	05MI655	Advanced Mine Surveying LAB			02	01
			15	05	12	26
Total Credit=26						

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Teaching and Examination Scheme B. Tech.-VII						
S. N.	Subject Code	Subject Name	L	T	P	Credit
1	05MI701	Mine Management Legislation & General Safety	03	01		04
2	05CA702	Computer application in Mining	03	01		04
3	05MI703	Mining Machinery III	03	01		04
4	05MI705	Mine and Mineral Economics	03	01		04
1	05MI751	Project				04
2	05MI752	Mine Practical Training during Semester break* (4 Credits)				
3	05MI753	Mining Machinery-III (Lab)			02	01
4	05MI754	Computer application in Mining (Lab)			02	01
5	05MI755	Seminar & Report Writing			06	03
			12	04	10	25
Total Credit=25						
* the result of Mine Practical Training during Semester break is publish with 8 th semester result.						

Teaching and Examination Scheme B. Tech.-VIII						
S. N.	Subject Code	Subject Name	L	T	P	Credit
1	05MI801	Mine Planning & Design	03	01		04
<i>Elective one to be selected-1</i>						
2	05MI802-A	Rock Excavation Engineering	03	01		04
	05MI802-B	Maintenance Management & Reliability Engineering				
<i>Elective one to be selected-2</i>						
3	05MI803-A	Numerical Methods in Mining Engineering Application	03	01		04
	05MI803-B	Quantitative Decision Making				
1	05MI851	Project				04
2	05MI852- A/B	Elective-1 related Practical			04	02
3	05MI853	Mine Planning & Design Lab			02	01
4	05MI854	Seminar and Viva				02
			9	03	06	21
Total Credit=21+8						

B.TECH. (Mining Engineering)
III SEMESTER
MINING GEOLOGY -I

Unit- I

Mineralogy and Crystallography

Classification of rock forming and ore forming minerals. Minerals – definition, Classification formation and occurrences. Identification – physical, chemical and optical properties of minerals. Silicate mineral structures. Introduction and terminology of Crystallography, Crystal systems.

Unit-II

Rock Genesis:

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

Unit- III

Structural Geology: Attitude of strata and their structures. Dip and Strike, Outcrop and incrop. Folds – genesis, classification, identification in field, impact on landscape, mineral deposits, mining and tunneling. Faults – mechanism of faulting, classification, impact of faulting on topography, significance of faults in mining engineering and tunneling. Joints – definition and characteristics, classification, occurrence of joints metamorphic rocks.

Unit- IV

Palaeontology:

Definition and terminology, fossils, elementary idea of mode and preservations. Morphology and geological correlation of some important fossils (ammonites, gastropods and bivalves) in Indian stratigraphy. Geological significance of microfossils (foraminifera).

Unit- V

Fundamentals of Economic Geology

Introduction and definition of Economic Geology. Ores and gangue – genesis, classification, distribution in India. Industrial uses and geological significance of metallic and non metallic ore minerals. Atomic mineral resources of India.

Practical:

1. Identification and description of Crystals.
2. Identification and description of 5 Igneous rock hand specimens.
3. Identification and description of 5 Metamorphic rock hand specimens.
4. Identification and description of 5 Sedimentary rock hand specimens.
5. Identification and description of common rock forming minerals.
6. Description of petrological microscope.
7. Optical properties of rock forming minerals in thin section.
8. Description of brunton compass.
9. Measurement of dip and strike with the help of brunton compass.
10. Measurement of dip and strike with the help of clinometers.
11. Preparation of structural cross sectional maps.

Text & Reference Books:

1. Engineering and Genaral Geology:- Parbin Singh
2. Structure Geology :- M.P. Billings
3. A text of geology :- G.B. Mahapatra
4. The Principles of Petrology :- G.W. Tyrell
5. Economic Geology:- Umeshwar Prasad
6. Rutley's Elements of Mineralogy:- H.H. Read
7. A Text Book of Geology:- P.K. Mukharjee
8. Engineering Geology : D.V. Reddy
9. Geology of India (Vol I &II) : R. Vaidyanadhan & M. Ramakrishnan
10. Principle of Engineering Geology: K M Bounger.

B.TECH. (Mining Engineering)
III SEMESTER
SURFACE MINING

Unit – I

Applicability : Applicability and limitations of surface mining, Classification, Surface Mine Design **Basic Parameters**: Size of mine area ; Pit depth; Annual production and life of mine; Bench height, width and slope, Pit slope; Cut-off grade; Stripping ratio
Opening of Benches : Factors influencing in location of mine openings, Opening of deposits, Trench, Ramp; Width and slope of entry trenches; Driving of entry and opening trenches; Formation of benches.

Unit – II

Surface Mine Planning : Role of geological investigation, ore reserve estimation, mining area delineation; Bench design (bench formation, height, width, slope), factors influencing in equipment selection, mine scheduling, production scheduling, operation scheduling, factors influencing in efficiency improvement during planning stage.

Overburden/waste removal – Equipment selection, bench parameter selection; Working with rippers, shovels, draglines, shovel-dragline combination; bucket wheel excavators, etc; Casting methods, Disposal of OB/waste material, Dump design,

Unit – III

Drilling/Blast hole drilling - Drilling mechanism, selection of drills for coal and other formations, drill maintenance and dust control, bit selection and bit life improvement etc.

Blasting - Explosives, Blasting accessories, Bulk explosives, Blasting Theory and Blast Design, Blast performance assessment, problems in blasting, environmental impact of blasting, Blasting safety & Accident analyses, Special techniques (for dragline bench blasting/casting, dimensional stone blasting, pre-splitting, smooth wall blasting), Computer assisted blasting and instrumentation in blast assessment.

Unit – IV

Methods of excavation & transportation – shovel-dumper combination, draglines, surface miner, bucket wheel excavator, Types of transport system – their selection, Deployment and application, Computerised truck dispatch system, Haul rod design and maintenance, etc.

Various surface mine layout study – Types of layouts in surface mines, layout problems and their solutions for six different layouts.

Unit – V

Special methods of mining – mining of coal from over developed galleries, placer mining, hydraulicking, dredging, leaching, steep angle conveying system, high angle conveying system, in-pit crushing and conveying, , highwall mining.

Mine production support systems : Mine lighting, dust control, drainage, slope management, manpower management in mines.

Practicals

1. Drawing of schematic diagram showing different types of surface mining methods adopted in Coal, Lignite and non-coal mineral mining.
2. Designing an approach road/ramp to open a deposit by surface mining.
3. Various techniques used in over cast from cost benefit point of view.
4. Designing various layouts for hilly deposits of vein and bedded formation.
5. Designing various types of layouts for deposits below the general ground level.
6. Designing of various types of layouts for placer deposits.
7. Designing a deposit by opencast mining, which has been partially excavated by underground mining.
8. Performance and choice of drilling equipment in surface mine working. (Mine visit to assess rate of drilling, blast hole drilling usage from drill movement to positioning and final hole completion stages).
9. Designing the blast hole charging, taking into consideration various parameters. (Field observation of a production mine blasting).
10. Measurement of blasting vibrations with Blastmate series III equipment and its analysis. Field observation and data recording.
11. Design of mine lighting and study of their illumination level

Text books

1. Surface Mining Technology, by Prof S.K.Das, Lovely Prakashan, Dhanbad
2. Surface Mining, by Dr T.N.Singh, Lovely Prakashan, Dhanbad
3. Surface Mining, by Prof G.B.Mishra, available at Lovely Prakashan, Dhanbad
4. Explosives & Blasting Techniques, by Prof G.K.Pradhan, Mintech Publication, Bhubaneswar.
5. Advanced Surface Mining, by Prof G.K.Pradhan & Manoj Pradhan, Mintech Publication, Bhubaneswar.

B.TECH. (Mining Engineering)
III SEMESTER
MINE DEVELOPMENT

UNIT I : Overview Of Unit Operations in Surface And Underground Mines

Overview of unit operations in underground mines (both coal and non-coal mines). & surface mines (shovel-dumper, dragline – BWE operation – Special methods).

UNIT II :

Fundamentals of Prospecting and Exploration

Definitions - Reconnaissance; principles and methods of prospecting - pit, shaft, trench and boreholes; Methods of Exploration, Selection of sites for boreholes; Surface layout of boring; Details of equipment, Borehole logging; Maintenance of records; Deflection of boreholes; Difficulties in boring; Fishing tools and their uses; Methods of exploratory drilling for oil; Interpretation of borehole data.

UNIT III : Development of mineral Deposits

Mine Entries

Choice, location and size of mine entries. Shafts, inclines and adits – Access to seated deposits by Adit/Drifts/Incline/Shafts- merits and demerits, applicability. Cross-measure drifts and laterals.

UNIT IV :

Shaft Sinking

Selection of shaft 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.

UNIT V : Primary and Secondary Development Drivages in Underground Coal & Metal 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.

Practical

1. Sketch of a Buck Wheel Excavator Lignite Mining operation
2. Study of Drill Cores
3. Development lay out for Mines (UG, & Opencast)
4. Shaft sinking layout
5. Blasting Pattern adopted in shaft sinkin
6. Blasting pattern for drivages in rock

Text Books

1. D.J.Deshmukh, Elements oif Mining Technology, Vol. I, Denett & Co., Nagpur
2. Dr T.N.Singh, Surface Mining, Lovely Prakashan, Dhanbad
3. B.V.Gokhale, Blasthole drilling Technology, MultiFields, Bombay
4. Dr G.K.Pradhan, Explosives & Blasting Techniques, Mintech Publications, Bhubaneswar
5. Dr.Sushil Bhandari, Engineering Rock Blasting Operations. Pub: A.A.Balkema Publisher Old post Road, Brook field, TO5036, USA.
6. Dr S.K.Das, A Handbook on Surface Mining Technology, Lovely Prakashan, Dhanbad
7. R.D. Singh, Principles & Practices of Modern Coal Mining Pub:- New Age International Pvt.Ltd. New Delhi

References

1. Indian Bureau of Mines, Minerals Year Book & other publications
2. Dr C.M.Kole, Khuli Khan Ka Ayojan (Hindi), CMPDIL, Ranchi
3. Dr. Calvin Konya; "Rock Blasting and Overbreak Control" Precision Blasting Services, Montville, Ohio
4. C.P. Chugh, High Technology in Drilling and Exploration. Pub: Oxford & IBH Publishing Co. Pvt.Ltd. New Delhi.
5. C.P. Chugh, Diamond Drilling. Pub: Oxford & IBH Publisher. Howard, L.Hartman, Introductory Mining Engineering, Pub: John Willey & Sons
6. Web sites : mines.nic.in, GSI, CMPDI, Coal India, NMDC etc.

Reference Journals

1. Journal of Institution of Engineers(India)-Mining
2. Journal of Mines, Metals & Fuels, Kolkata
3. Indian Mining & Engineering Journal, Bhubaneswar
4. Journal of Mining Engineers, MEAI, Hyderabad
5. Minetech, CMPDIL(Quarterly)
6. CMTM(Coal Mining Technology) Journal, IIMC Publication, Ranchi
7. Minerals & Metals Review, Bombay

**B.TECH
III SEMESTER
ENGINEERING MATHEMATICS-III**

Unit – I: Function of Complex variable

Definition, derivatives of complex function, Analytic function. Cauchy-Riemann equations, in Cartesian form and polar form. Conjugate function, Harmonic function, Methods for finding the analytic function. Cauchy's integral theorem, Cauchy's integral formula for analytic function. Poles and singularities of analytic function, Residue theorem (without proof) and its application.

Unit – II: Numerical Techniques – I

Finite differences: Difference table [Forwarded Difference operator, Backward Difference operators and central Difference operator] Interpolation: Newton-Gregory forward and backward interpolation formula for equal intervals, Gauss's forward and backward interpolation formula for equal intervals, Gauss's central difference formula for equal intervals. Stirling's formula, Bessel's formula, Everett's formula for equal intervals.

Unit – III: Numerical Techniques – II

Numerical Differentiation : Newton's forward difference formula and Newton's backward difference formula for derivative, Gauss's forward difference formula for derivative, Newton's divide difference formula for derivative. Lagrange's interpolation formula for unequal intervals and Newton's divided difference interpolation for unequal intervals. Numerical integration: Trapezoidal rule, Simpson's one third rule, Simpson's three-eighth rules, and Weddle's rule.

Unit – IV Numerical Techniques –III

Numerical solution of algebraic and Transdantal equations: Bisection method, Secant method, Regular-falsi method, Newton-Raphson method and Graeffe's root squaring method. Numerical solution of ordinary differential equations: Taylor's series method, Euler's method, Euler's modified method, Picard's method, Runge- Kutta method. Solution of simultaneous algebraic equation: Gauss- Seidal method, Gauss elimination method, Guass-jordan method.

Unit – V Probability Distribution

Binomial Distribution: Hypothesis, characteristics, mean, variance and standard deviation and moments. Poisson distribution: Hypothesis, characteristics, condition for Poisson distribution, mean, variance and standard deviation. Normal Distribution: Standard normal distribution, properties of normal curve. Curve fitting: Method of least squares, Fitting of straight lines, and parabola of second degree.

Text Books:

1. D.C. Agrawal, Engineering Mathematics-III, Sai prakasan
2. H.K.Das, Basic Engineering Mathematics-III, S.Chand & company Ltd.
3. D. K. Jain., Engineering Mathematics-III
4. Sonendra Gupta, Engineering Mathematics-III, Dhanpat Rai Publishing Company(P) Ltd.

Reference Books:-

1. B.S.Grewal, Engineering Mathematics, Khanna Publishers, 2004.
 2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.
 3. Chandrika Prasad, Advanced Mathematic for Engineers, Prasad Mudranalaya,1996.
- B.V.Ramana, Higher Engineering mathematics, Tata Mcgraw-Hills Publishing Company Limited.

B.TECH. (Mining Engineering)
III SEMESTER
ELECTRICAL & ENERGY ENGINEERING

Unit-I: D.C. Machines

Characteristics curves of d. c. generators and motors. Application of motors for different uses, starting and speed control of motors.

Unit-II: Transformers

Phasor diagram and equivalent circuits, regulation efficiency and their determination, open circuit, short circuit and sumpeners's test.

Unit-III: Induction Motors

Poly phase induction motors- Starters, equivalent circuit, effect of rotor resistance, torque slip curves, speed control by rotor resistance, pole changing and cascading, use in industry; Single – phase induction motor- starting methods.

Unit-IV: Alternators

Elementary idea of armature winding- calculation of induced e. m. f. factors affecting generating e.m.f. open circuit, short circuit and load characteristics. Voltage regulation and its determinations by synchronous impedance methods, synchronizing. Synchronous Motors: Methods of starting, power angle characteristics of cylindrical rotor machine, operation of synchronizing motor as a condenser and as a reactor, Application in Industries.

Unit-V

Sources of Energy (Coal-Lignite, Oil, Nuclear), Global and Indian Energy scenario, Energy scenario in MP & CG, Conventional Energy (Thermal, Hydel, Nuclear etc), Non-Conventional Sources of Energy (Solar, Wind, Tidal etc), Energy Conservation efforts, Energy Conservation Act, Bureau of Energy Efficiency in India, Energy Audit.

Practical:

1. To study constructional detail of DC Machine.
2. To obtain Magnetization Characteristics of DC Generator.
3. To obtain Load Characteristics of DC Generator (Internal & External).
4. To study Constructional Detail of Transformer.
5. To obtain load Characteristics and Voltage Regulation of Transformer.
6. To perform OC & SC Test on transformer and determination of its efficiency.
7. To study constructional detail of Induction Machine.
8. To obtain Speed-Torque Characteristics of Induction Motor and Determination of Slip.
9. To perform the Speed Control of Induction Motor using Slip Ring.
10. Testing of Electrical Machines using Megger.

Text Books

1. Nagrath and Kothari. Electrical Machines
2. Ashfaq Hussain. Fundamentals of Electrical Engineering
3. Practical Guide to Energy Conservation : PCRA Publications (Unit V)
4. Electrical Engineering in Mines, by N.K.Datta

B.Tech. (Mining Engineering)
III SEMESTER
STRENGTH OF MATERIALS

UNIT – I: Introduction

Basic of stress & strain, Elastic constant, Stress-strain diagram, Hooke's law, Stresses in the components subjected to multi-axial forces, Temperature stresses, Statically indeterminate system.

UNIT – II: Bending of beams

Bending of beams with symmetric section, boundary condition, Pure bending, Bending equation, traverse shear stress distribution in circular, hollow circular, I & T section.

UNIT – III: Deflection of Beam

Relation between slope deflection and radius of curvature, solution of beam deflection, problem by Macaulay's method, Direct integration method, Method of super position, Moment Area Method.

UNIT –IV: Torsion

Deformation in circular shaft due to torsion, Basic assumption, Torsion equation, Stresses in elastic range, Angular deflection, hollow and stepped circular shaft. Spring: Closed and open coil helical spring subjected to axial load, spring in parallel & series.

UNIT – V: Principle stresses and strain

Transformation of plane stresses, Principle stresses, Maximum shear stresses, Mohr's circle for plane stresses, Plain strain and its Mohr's circle representation, Principle strains, Maximum shear strain. Combined Loading: Components subjected to bending, torsion & axial loads.

Practical:

Text Books:

1. Elements of strength of material – Timoshenko & young- EWP press
2. Mechanics of Solids – Beer & Johnson, Tata McGraw Hill Publications.

Reference Books:

1. Strength of material – Rider–ELBS
2. Introduction to Solid Mechanics – I.H.Shames–PHI
3. Strength of Materials – R.K. Rajput – Dhanpat Rai & Sons
4. Strength of Materials – Dr. Sadhu Singh – Khanna publication.

B.TECH. (Mining Engineering)
IV SEMESTER
Geology II

Unit I: Stratigraphy

Introduction-Definitions and Basic Principles of Stratigraphy – Units of Stratigraphy-correlation Criteria for Stratigraphic Classification. Standard Geological Time Scale.

Major Geomorphic Divisions of India. Descriptions of important India Geological formations – Dharwar, Archean cratons, Cuddapahs, Vindhyan, Gondwanas, Deccan traps and Tertiary.

Unit II: Hydrogeology

Introduction of hydrology and hydrogeology, Hydrological properties of rocks, Hydrological classification of rocks. Occurrences of ground water, Ground water movements, prospecting of ground water, Physical, Chemical Property of ground water. Types of streams, Types of well, Ground water recharge.

Unit III: Economic Geology (Metallic and organic minerals):

Mode of occurrence – origin – distribution and industrial uses of important metallic (Aluminum, Iron, Gold, Manganese, Copper, Lead and Zinc). Origin and distribution of coal, lignite and petroleum deposits of India.

Unit IV: Economic Geology (Non-metallic minerals):

Mode of occurrence – origin – distribution and industrial uses of important Non-metallic ore minerals (Diamond, Mica, limestone, dolomite, gypsum, clays, talc, graphite, phosphorite). Precious and semi precious gem stones.

Unit V: Prospecting and exploration

Prospecting and exploration – application of Remote sensing, geological, geophysical, geochemical prospecting for ore deposits. sampling and sample analysis, Composition of exploration programme, Preparation of grade control maps, UNFC classification of mineral deposits and reserve; Methods of reserve estimation, advanced geostatistical method of geological exploration, Computer-aided deposit evaluation.

Practical's:

1. To determine the rank of coal on the basis of banded constituents.
2. To determine the specific gravity of metallic and non metallic minerals.
3. Identification of hand specimen of metallic minerals (Cu, Pb, Zn, Mn, Fe, Al)
4. Identification of hand specimen of non metallic minerals (Coal, Limestone, Dolomite, Zypsum, Mica, Talc)
5. To Study stratigraphy & geological map of Cuddapah, Gondwana, Vindhyan and Deccan Traps.
6. To Study of important two fossils.
7. Preparation of water table maps.
8. Reserve estimation of given ore deposit data.
9. Identification of natural and synthetic gem stones.

Text Books :

1. Ravindra Kumar, Fundamentals of Historical Geology and Stratigraphy of India
2. M.S.Krishnan, Geology of India and Burma
3. M.S.Krishnan & others, Economic Mineral Deposits
4. Todd, D.K., 1980, Ground-water hydrology (Second Edition): John Wiley and Sons, New York.

Reference Books :

1. Araogyaswamy : Courses in Mining
2. D.V.Reddy, Applied Geology
3. D.V.Reddy, Engineering Geology
4. R.Vaidyanandhan & M.Ramakrishnan, Geology of India (Vol. I & II)
5. Minerals Handbook of India, IBM, Nagpur

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IV SEMESTER

MINE SURVEYING – I

Unit-I: Chain Survey

Linear Measurements; Types of chains; Errors in chaining and corrections in linear measurements; Direct and indirect Ranging; Principles of chain surveying. Offsets, Limiting length of offsets; Booking field notes; Obstacles in chaining; Instruments for setting out right angle.

Unit II: Theodolite-I

PARTS - Terms used - Temporary adjustments - Tachometers. Measurements - such as ranging, establishing new station, horizontal angle, vertical angle, bearings, permanent adjustment.

Theodolite-II

Purpose of traversing first, second and third order traverse, closed closed and open traverse. Included and direct angles, Latitude, Departures, checks-corrections of the traverse- Bowdith rule and transit rule.

Unit-III:

Compass Survey (Traversing): Theory of Magnetism; Dip of Magnet needle; Prismatic Compass; Surveyor's Compass; Bearing; Designation of Bearing; Calculation of Included Angle; Local Attraction; Magnetic Declination. Construction, Use, Test and Adjustment of Miner's Dial.

Plane Table Surveying: Principle of Plane Tabling; Working operation; Methods of Plane Table Surveying; Radiation, Intersection, Resection, Traversing Method of Plane Table Surveying.

Unit-IV:

Definition of important term used in leveling; Development in leveling Instrument; Types and Constructional details of Dumpy Level, Auto Level; Temporary and Permanent Adjustments; Introduction and Different Method Of Leveling; Reciprocal Leveling; Longitudinal Sections; Trigonometric Leveling; Methods Of booking and reduction of levels; Plumbing measurement of depth of shaft and subsidence.

Unit V:

Dip strike problems: Determining the true and apparent dip and strike from bore hole data, Determining the deviation in the borehole drilling - Determining the throw of fault and length of drift to cross the fault, Finding out the bearings and dip of various mine working.

Practical:

1. To Determine the Pace Factor.
2. To study the Different types of chain used in Chain Surveying.
3. To Determine the Area by Cross Staff Survey.
4. To Study the Dumpy Level and Auto Level.
5. To Study the Theodolite.
6. To Study the various Survey Instruments used in chain surveying.
7. To Study the Prismatic Compass.
8. To Determine the fore bearing and back bearing by the use of Prismatics compass.
9. To Determine the area by Radiation method of plane table surveying.
10. To Determine the Height of an Object by using Theodolite.

Text Books:

1. Mines Surveying by S.Ghatak
2. Surveying & Leveling by B.C. Punamia
3. Surveying & Leveling by Kanetkar & Kulkarni

Reference:

1. Agor, R. 1998. Surveying and Leveling, Khanna Publishers, New Delhi.
2. Kochher, C.L. 1986. A Text book of surveying. Vol-I and Vol-II. Katson Publishing House, Ludhiana.

B.TECH. (Mining Engineering)
IV SEMESTER
Mining Machinery I

Unit – I

Air Compressors; types, construction, installation & maintenance; Transmission and distribution of compressed air; Calculations of main parameters; Comparison of compressed air with other forms of power. Compressed Air: Wire ropes used in mines- types and their construction, installation, maintenance and tests; Rope splicing and change of ropes, rope caps and process of capping

UNIT - II

Introduction to drilling systems; Mechanics of percussive, rotary and rotary-percussive drilling; Different types of drills – compressed & hydraulic, diesel and electric drills; Selection of drills; Jack hammers, sinkers, stoppers, drill; jumbos, wagon drills and other blast hole drills; Drill accessories and their working; Types of drill steels, Drill Bits and their uses, maintenance for better drilling bit life etc.

UNIT-III

Hydraulic Transmission: Fundamental of hydraulics compression. Hydraulic fluids, Hydraulic pumps, motor cylinder and accumulator, different type of valves, hydraulic coupling, torque converters and application in wires, Advantage of hydraulic transmission.

UNIT - IV

Surface Mine Machinery (HEMM-Heavy Earth Moving Mining Machinery) – HEMMs required for development and production support system like dozers, motor graders, pavers, scrappers, rippers;

UNIT - V

HEMM required for production method- shovels (rope or hydraulic), draglines, BWE(Bucket Wheel Excavators), Dumpers, Coal haulers, Surface Miners, Spreaders, Reclaimers, Back hoes; Rock breakers. In-pit crushing and conveying system.

Practical

1. Transmission and distribution of compressed air for surface and underground mines with pressure losses and remedial measures.
2. Construction of Jack Hammers
3. Different types of drill bits used in coal mines underground and in surface mines.
4. Different types of loading machineries used in surface mines.
5. Dragline application
6. Application of Bucket Wheel Excavators
7. Construction feature of draglines.

Suggested Readings

1. Surface Mining, by Dr. G.B. Mishra, Pub:Dhanbad Publisher
2. Heavy Earth Moving Machinery, by Prof. Amitosh Dey, Available at Lovely Prakashan, Dhanbad
3. Mine Hoisting, by Prof M.A. Ramlu, Pub: Oxford & IBH Publishing Co. Pvt.Ltd. New Delhi.
4. Mine Transport. Karelin, Pub:- Orient Longmans Ltd. New Delhi.
5. High Technology in Drilling and Exploration, by C. P. Chug; Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
6. Principles & Practices of Modern Coal Mining, Prof R.D.Singh, New Age International Pvt.Ltd. New Delhi.
7. Mining Machinery Maintenance and Capacity Utilization, by Prof Khanindra Pathak, Published by Cygnus Publication, Kolkata

B.TECH. (Mining Engineering)
IV SEMESTER
MINE VENTILATION & ENVIROINMENT I

Unit-I

Introduction to underground mine ventilation. Why ventilation is required in underground Coal and Metal mines ? Mine Gases: Occurrence, properties, detection, measurement and monitoring; Methane layering; Methane drainage. Influence of mine gases in general mine environment. Heat and Humidity: Sources; Effect and control of heat and humidity in mines; Conditions of comfort; Cooling power of mine air; Air conditioning.

Unit-II

Air Flow in Mine Workings: Standards of ventilation; Reynold's number; Laminar and turbulent flow; Pressure losses due to friction and shock resistances; Pressure across the mine; Equivalent orifice of the mine; Resistances in series and parallel; Air quantity requirements; Leakages; Homotropical and Antitropical ventilation; Central and boundary ventilation. Network analysis.

Unit-III

Natural Ventilation: Mechanism; Estimation and measurement of natural ventilation pressure; Characteristic curves. Ventilation Survey: Purpose, instruments, procedure, tabulation and calculation, Preparation and interpretation of ventilation plans.

Unit-IV

Mechanical Ventilation: Centrifugal and axial flow fans- Construction, pressure developed, characteristic curves, series and parallel operations; Installation and testing; Forcing and exhaust ventilation; Fan drifts and evasees; Reversal of air flow. Auxiliary Ventilation: Longitudinal air curtains and brattices; Forcing, exhausting and forcing cum exhausting ventilation systems; Dust extraction; Auxiliary fans- Types, construction, characteristics, location and installation; Air ducts; Risk of re-circulation.

Unit-V

Ventilation Devices: Stopping, doors, air locks, air crossings and regulators; Regulators and boosters for the regulation of air flow - Construction, location and installation and their effect on the air flow in the panel and the entire mine; Risk of re-circulation; Controlled recirculation for ventilating extensive mine workings.

Practical:

1. Different gases found in coalmines, metal mines and their permitted limits as per the mining regulations. Effect of these gases when found in excess.
2. Various types of Methanometers used in mines and their selection criteria.
3. Measurement of relative humidity with the help of various types of hygrometer.
4. Various air circuits with resistance in series and parallel.
5. Calculation for the installation of main ventilation fan and its reversal arrangement.
6. Designing auxiliary ventilation system and their comparative performance.
7. Measurement of air velocity with the help of anemometer, velometer etc, measurement of temperature, pressure etc.
8. Ventilation survey problem.
9. Auxiliary fan problem.
10. Networking problems

Text Books/References

1. G.B. Mishra. Mine Environmental Engineering. Pub: Dhanbad Publisher, Dhanbad
2. L.C. Kaku. Numerical Problems on Mine Ventilation. Pub: Punam Publisher
3. Howard, L.Hartman. Introductory Mining Engineering, Pub: John Willey & Sons
4. Mutmansky & Weng. Mine ventilation & Air conditioning. Pub: John Willey & Sons
5. Prof. S. P. Banerjee. "Mine Ventilation" Lovely Prakashan, Dhanbad

B.TECH. (Mining Engineering)
IV SEMESTER
FLUID MECHANICS

Unit-I

Properties of fluid: Fluid, ideal and real fluid, Properties of fluid: Mass density, Weight density, Specific volume, Specific gravity, Viscosity, Surface tension, Capillarity Vapour pressure, Compressibility and bulk modulus. Newtonian and non-Newtonian fluids.

Fluid statics: Pressure, Pascal's law, Hydrostatic law, Pressure measurement, Hydrostatic force on submerged plane and curved surface, Buoyancy and Flotation, Liquid in relative equilibrium.

Unit-II

Fluid kinematics: Description of fluid motion, Lagrangian and Eulerian approach, Type of fluid flow, Type of flow lines-path line, Streak line, Stream line, Stream tube, Continuity equation, Acceleration of a fluid particle, Motion of fluid particle along curved path, Normal and tangential acceleration, Rotational flow, Rotation and Vorticity, Circulation, Stream and potential function, Flow net, Its characteristics and utilities, Vortex motion .

Unit-III

Fluid dynamics: Euler's Equation, Bernoulli's equation and its practical application, Venturimeter, Orifice meter, Nozzle, Pitot tube, Impulse momentum equation, Momentum of Momentum equation, Kinetic energy and Momentum correction factor. Reynold's transport theorem.

Unit-IV

Laminar & Turbulent flow: Reynold's experiment, Shear stress and pressure gradient relationship, Flow of viscous fluids in circular pipe and between two parallel plates, Couette flow, Shear stress & velocity distribution for turbulent. **Flow through pipes:** Loss of energy in pipes, Hydraulic gradient and total energy line, pipe in series and parallel, Equivalent pipe power transmission through pipe, Water hammer in pipes.

Unit-V

Internal flows: Friction factor, Darcy-Weisbach friction factor, Moody's diagram, Boundary Layer theory, Boundary layer equation, Laminar and turbulent boundary layer and its growth over flat plate. Momentum boundary layer and its solutions, separation of boundary layer and its control.

Dimensional analysis: Methods of dimensional analysis, Rayleigh's method, Buckingham's theorem, Limitations, Model analysis, Dimensionless number and their significance, model laws, Reynold's model law, Fraude's model law, Euler's model law, Weber's model law, Mach's Model law.

Experiments to be performed (minimum ten numbers)

1. To determine the meta-centric height of a ship model.
2. To verify Bernoulli's Theorem.
3. To verify Impulse Momentum Principle.
4. To calibrate a Venturimeter and study the variation of coefficient of discharge.
5. To calibrate an orifice-meter.
6. Experimental determination of critical velocity in pipe.
7. To determine of head loss in various pipe fittings.
8. Flow measurement using Pitot tube.
9. To study the transition from laminar to turbulent flow and to determine the lower critical Reynold's number.
10. To determine the hydraulic coefficients (C_c , C_d and C_v) of an orifice.
11. To determine the coefficient of discharge of a mouth piece.
12. To obtain the surface profile and the total head distribution of a forced vortex.
13. To study the velocity distribution in pipe and to compute the discharge by integrating Velocity profile.
14. To study the variation of friction factor for pipe flow.
15. To determine the roughness coefficient of an open channel.

Reference books

1. Fluid Machines by M. Manohar
2. Hydraulics & Hydraulic Machines by Dr. Jagdish lal (Metropolitan)
3. Hydraulics & Hydraulic Machines by Priyani.
4. Fluid Machines With Engineering Applications by R.L. Draught lery & A.C. Jugersoll. (McGraw Hills)
5. Journal of experiments in Hydraulic Laboratory by V. N. Rao & Husan New Heights. 27

TEXT BOOKS

1. Fluid Mechanics by Dr. M.L. Mathur (Std. Publications).
2. Taral Yantriki Avum Machinery (Hindi) by G.B. Bamanker. (Deepak Prakashan, Gwalior).
3. A text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines. By Khurmi (S. Chand & Co.)

B.TECH. (Mining Engineering)
IV SEMESTER
Engineering Statistics and Probability

Unit-I

Measures of Central Tendency: Arithmetic mean ,methods of calculating Arithmetic mean, properties, Median, Computation of median, properties of median, mode, methods of computing mode, properties of mode. Relationship between mean, median and mode.

Unit-II

Measures of Dispersion: Measures of dispersion, Range, quartile deviation, Percentile, mean deviation, properties of Mean Deviation, standard deviation, properties of standard deviation, variation, properties of variation.

Unit-III

Random Variable: Discrete random variable, Continuous random variable, Probability function of a discrete random variable, Probability distribution of a discrete random variable.

Sampling: Introduction ,Types of sampling , random sampling, simple sampling, sample mean, Sampling distribution, Sampling distribution of mean .

Unit-IV

Probability: Elementary probability theory, Mathematical definition of probability, Various types of events, Additive law of probability, Multiplicative law of probability, Compound probability, conditional probability.

Unit-V

Correlation: Introduction, Karl Pearson's coefficient of correlation. Short-cut method, Step deviation method for coefficient of correlation. **Regression:** Coefficient of Regression, equation to the lines of regression, properties of regression Coefficient, angle between two regression lines.

Reference Books:

1. H.L.Sharma, Agrotech Publishing Academy, Udaipur.
2. Fundamental of Applied Statistics,S.C. Gupta,V.K.Kapoor,Sultan Chand &sons,1996
3. Mathematical Statistics, M. Ray and Har Swarup Sharma, Ram Prasad &

B.TECH. (Mining Engineering)
V SEMESTER
UNDERGROUND METALLIFEROUS MINING

Unit-I

Metalliferous Mining in India and World - Historical development; Trend of mining non-coal deposit in India during the last ten years; Geographical distribution of important economic non-coal mineral in India. Underground metal mining for Gold, Uranium, Chromite, Manganese, Pb & Zinc, Copper etc in India and their status.

Unit-II

Overview of various stoping Methods: Factors influencing selection of stoping methods; Classification of different stoping methods. Stope layouts and stope preparation work for different stoping methods.

Unit-III

Open stoping methods: Stull mining; Breast stoping; Room and Pillar; Sub-level; Shrinkage; Blast hole; VCR stoping and their variations.

Unit-IV

Supported stoping methods: Post pillar; Cut and fill and their variations; Square set; Different types of support used.

Unit-V

Caving stoping methods: Top slicing; Sub-level caving; Block caving and their variations. Stoping of superimposed veins and parallel ore bodies; Combined methods; Extraction of underground pillar. Special method of mining for deep deposit and difficult mining conditions. Ore mining by Leaching.

Practical

1. Various terms, factors influencing selection of method of work and classification of underground methods.
2. Designing sub-level stoping for a ore body width varying 10-15 mts.
3. Application of blast hole stoping and its comparison with sub-level open stoping.
4. Cut and fill methods used in different Indian deposits.
5. Application of Vertical crater retreat method of mining in moderate strength of wall rocks.
6. Sub-level caving and block caving methods for deeper deposits.
7. Square-set stoping for excavation of manganese ore deposit.
8. Application of leaching technique in ore mining.
9. Stopping techniques used in excavation of gold deposit at deeper depth.
10. Designing an under ground metalliferous mine on given geological physico-mechanical properties of rock.
11. Design of Post pillar method
12. Design of Shrinkage method.
13. Problem for mining for greater depth.
14. Design of block caving.
15. Design Sub level top slicing
16. Visit to Underground Metal Mines in Rajastshan, Odisha and MP

Text Books/References

1. Howard, L.Hartman. Introductory Mining Engineering, Pub: John Willey & Sons.
2. Cummins & Givens. SME Mining Engineering Handbook, Vol. I & II, Pub: A.I.M.M. New-York.
3. Ramlu et al, Computer in mineral industry. Pub: Oxford & IBH, New-Delhi.
4. W.A. Hustrulid. Underground mining methods handbook, Pub: Society of mining engineers of the American Institute of Mining Metallurgical and Petroleum Engineers, Inc. New-York.

B.Tech. (Mining Engineering)
V SEMESTER
MINE VENTILATION & ENVIROINMENT II

Unit – I

Mine Fires: Classification of fires; Causes, detection, monitoring and control of surface and underground fires; Preventive measures; Fire fighting and inertization; Monitoring of atmosphere behind sealed- off areas; Reopening of sealed- off areas; Case histories.

Unit – II

Spontaneous Heating: Mechanism, causes, detection, monitoring and control of spontaneous heating in underground mines, on surface and in coal stacks and dumps; Incubation period; Preventive measures.

Unit – III

Mine Explosions: Types, causes and mechanism of firedamp and coal dust explosions; Preventive measures; Water spraying- Stone dusting, stone dust and water barriers; Investigations after an explosion; Case histories.

Unit – IV

Mine Rescue and Recovery work: Different types of rescue equipment; Test on rescue apparatus; Rescue stations; Recovery and first-aid appliances; Training of personnel and organization of rescue station; Rescue and recovery work in connection with mine fire, explosions and other conditions. Safety chamber

Unit – V

Mine Inundation: Causes; Precautionary measures; Precautions to be taken while approaching old workings; Burnside boring apparatus; Design and construction of water dams; Recovery of flooded mines; Dewatering of old working; Water blast: dangers and precautions.

Practical

1. Monitoring of sealed off areas and goaf fires.
2. Soda ash fire extinguishers and its application
3. CO₂ snow fire extinguishers and its application
4. Dry chemical fire extinguishers and its application
5. Reasons of spontaneous heating, its preventive measures etc in underground and at surface.
6. Designing of stone dust barrier & water barrier in underground mines
7. Study of flame safety lamp
8. Testing of methane with the flame safety lamp and estimation of the percentage.
9. Design of lamp room layout for a mine of 5000 tonnes production per day.
10. Maintenance of mine camp lamp in the laboratory.
11. Exercise with self contained breathing apparatus
12. Exercise with Filter type breathing apparatus
13. Designing of rescue stations for different conditions
14. Exercise on Illumination survey.
15. Exercise on rescuecitation.

Suggested Readings

1. G.B. Mishra, Mine Environmental Engineering. Pub: Dhanbad Publisher, Dhanbad
2. Donald Mitchell; "Mine Fires, Prevention, Detection fighting" ISEE Publication Cleveland, Ohio
3. Ramlu M. R.; "Mine Fires, Explosion, Recovery & Innundation", Dhnbad Publisher, Dhanbad
4. David Stone; "Minefill 2001" Proceedings of the International Symposium on Mining with Backfill" SME Publication 2001

B. Tech. (Mining Engineering)
V SEMESTER
MINE MACHINERY – II

Unit-I

Underground Mining : Winding: Winding system-Drum & friction winding; Mechanical and electrical braking; Ward Leonard control; Automatic winding; Winding drums- types, their construction and duty cycles; Detaching hooks, cages, skips, suspension gear, rigid and rope guides; Methods of counterbalancing loads; Multi rope winding, Winding from different horizons. Shaft fittings and head gear design;

Unit-II

Underground Mining - Design calculation for different types of winding systems; Safety devices- depth indicators, over speed and overwind preventors, slow banking and other safety devices.

Rope Haulage: Different types- their construction, operation, maintenance and design calculations. Slushers, scrapers etc.

UNIT - III

Machinery for underground mining: Loaders: SDL, LHD, LPDT; Cutter loaders: SERDS, DERDS, Coal Plough, Continuous miner, Road headers, Cable bolting machine - Transport: Track and trackless; Mine cars; Haulage track-its laying and maintenance; Gauge selection; Mine tubs and cars-their constructional details and attachment. Low profile dumpers and shuttle cars, their construction, operation and maintenance

Underground Mine Locomotives: Diesel, battery and electric trolley wire types-their construction, operation and application; Calculations for locomotive haulage; Man riding systems in underground coal and metal mines mines; Mono rails; Underground loco shed layout.

Unit-IV

Conveyor Haulage: different types, their construction, installation, maintenance and design calculations; Steep angle belt conveyor, Armoured face conveyor

Aerial Ropeway - different types, their construction, installation, operation and maintenance, their layouts including rope tensioning arrangement; Loading, unloading and angle stations.

Unit V

Study of Underground Coal Mining machinery deployed at Narwapahar Uranium Mines of UCIL, one Chromite Mines of Sukinda Valley(Odisha), One Manganese mine of MP, and one Copper or Lead/Zinc mine of Rajasthan. Case studies will be discussed alongwith visit to some of the mines.

Practical

1. Process of changing of winding rope and its requirement as per regulation.
2. Designing direct rope haulage system in moderately dipping coal seam.
3. Endless rope haulage and its designing aspects.
4. Application of Mono cable and Bi-cable rope way & its designing parameters.
5. Diesel locomotives and comparative application.
6. Battery locomotives and comparative application.
7. Trolley wire locomotives and comparative application.
8. Suspension gear arrangement of the shaft.
9. Different types of winding system and their comparative application.
10. Application of various types of detaching hooks.
11. Various types of guides in winding.
12. Belt conveyors with their design parameters used in mines.
13. Scraper chain conveyors with their design parameters used in mines.
14. Shaker conveyors with their design parameters used in mines.
15. Exhaust conditioner

Text Books/References

1. M.A. Ramlu. Mine Hoisting. Pub: Oxford & IBH Publishing Co. Pvt.Ltd. New Delhi.
2. Kerelin. Mine Transport. Pub:- Orient Longmans Ltd. New Delhi.

B.Tech. (Mining Engineering)
V SEMESTER
Underground Coal Mining

Unit-I:

Trend of underground coal mining in India-Underground Mining method: choice / selection of method of mining coal seam and factors affecting the same; statutory provision.

Unit-II:

Application- merit – demerit – different term – stage of development – depillaring stage
Applicability of panel system – type of panel – factor influencing the size of panel system –
General consideration – factor influencing the no of opening panel – merit and demerit of panel
system- factor governing the selection of development method – factor govern while opening of a
district - panel develop with heading and different method of development system along dip,
along Strike , crosscut steeply dipping seam , loader belt conveyer, load haul dumper , chain
conveyer , Road header – arrangement for ventilation

Board and pillar method – depillaring – important term – classification – panel preparation
arrangement – sequence of operation – pillar extraction under weak roof condition – mechanized
method of pillar extraction by LHD, SDL, scraper chain , conveyer system - size , shape of pillar
, ribs. Local fall, main fall- air blast , dangers, precaution –method of stowing condition required
for. Adopting stowing – preparation arrangement for stowing – layout of panel with stowing –
danger. And precaution while working below goaved area – contiguous seam extraction –
precaution against. Fire during and after depillaring

Unit-III

Long wall advancing method: Longwall - related term - applicability , merit , demerits,
limitation, classification long wall advancing indicating its applicability – comparison between
long wall advancing and long wall Retreating – development of gate road – machinery
employed on a machines long wall face Continuous mining method - different factor governing
long wall face – layout of mechanised long wall face Advancing with caving - layout of
mechanizes long wall face advancing with stowing

Unit-IV

Long wall retreating method – long wall retreating and its application layout of mechanizes long
wall face retreating with stowing - layout of mechanizes long wall face face retreating with
caving - lay out of long wall face equipped with shearer – single unit and double unit layout –
cutting method of shearer in lonwall mining – method of sumping in long wall face extraction –
method of push – sumping in long wall face extraction . Communication and tele – monitoring

Unit-V

Thick seam mining – board and pillar and long wall mining in multi section , multi slice method , incline slicing , horizontal slicing and cross slicing in ascending and descending order , under winning method , sub level caving , integral caving – horizontal slicing with caving / stowing – blasting gallery. Method – sub level caving with mechanizes long wall .horizon mining – merit – demerit – application & limitation. Modern method – applicable condition of plough , method of working by plough , unidirectional ploughing method , bi – directional ploughing method over passing hydraulic mining merit & demerit applicable condition of underground gasification of coal merit , demerit of gasification of coal , method of extraction of gasification & contiguous seam.

05MI554-Underground Coal Mining (Lab)

PRACTICALS:

1.0 Know the Drawing of layouts of underground mine

Draw a pit-top & pit Bottom layouts of shaft- layout of Board and pillar showing development work and ventilation network, transport network- layout of Board and pillar showing method depillaring and ventilation network, transport network- layout of longwall mining method locate important areas of working and ventilation network and transportation network- layout of BG panel.

2.0 Know the calculation of output for underground mine

Calculate output for 3 heading, 5 heading faces-Calculate percentage of extraction for Bord and pillar development work assuming the gallery dimensions-Calculate the percentage of extraction for depillaring work-Calculate the percentage of extraction in longwall mining method.-Calculate percentage of extraction in Blasting Gallery method - Calculation of Quantity of Explosive require for given out put with reference Bord & Pillar and Blasting Gallery Method.

3.0 Know the organization charts.

Draw the Organization charts for a large Underground Mine-Organization charts of a Mining Industry.

4.0. Know the method of drawing layouts with Auto Cad

Draw the following plans-a) District ventilation plan b) District working plan c) Pit top and pit bottom layouts

Text book

Element of mining : D.J Deshmuk vol 1 , bennet & co. Nagpur

1. Winning and working coal : R.T Deshmuk & D.J Deshmuk vol 1& 2
2. Long wall mining : Smair Kumar Das , lovely prakashan Dhanbad
3. Modern coal mining technology : lovely prakashan dhanbad, smair kumar das
4. Principles & practices of coal mining : R.D. Singh ,New Age Intl. Pvt.Ltd, New Delhi

REFERENCE BOOKS

Coal mining & Management : S.P Mathur & N.K singh

Coal mining Practice : lovely prakash

B.Tech. (Mining Engineering)
V SEMESTER
ROCK MECHANICS & STRATA CONTROL

Unit - I

Status of Rock Mechanics: Role and status of rock mechanics in mining engineering; Definitions & terms used in Rock Mechanics. Stresses and Strains: Stresses in two and three dimensions; Stress tensors; Principal stresses; Stress invariants; Displacements and strains; Stress-Strain relations; Equilibrium and compatibility equations.

Unit -II

Geological Investigation of Rock mass: Classification, identification and survey of joints; Basic geological description of rock mass; Graphical representation of joint systems; Geophysical investigation of rock mass.

Unit -III

Rock mass classification-RQD, RSR, RMR, Q-system Rock Indices: Specific gravity, hardness, porosity, moisture content, permeability, swell index, slake durability, thermal conductivity, point load strength index, protodyakonov strength index, impact strength index.

Unit – IV

Mechanical Properties of Rocks: Compressive, tensile and shear strengths; Modulus of elasticity; Poisson's ratio and tri-axial strength; Field and laboratory determination. Determination of in-situ strength and in situ stresses – methods and instrumentation.

Unit – V

Theories of rock failure. Elastic and time dependent properties of rocks, Dynamic properties, Post-failure phenomenon; Soil Mechanics: Classification of soils; Strength, consolidation and seepage of soils; Stability of waste dumps, factors affecting, monitoring and control measures.

Practical

1. Preparation of core samples as per ISRM standards.
2. Determination of compressive strength and point load index of given rock samples.
3. Measurement of Schmidt rebound hardness and its application.
4. Determination of slake durability index of given rock samples.
5. Determination of elastic properties of given rock samples.
6. Determination of tensile strength of given rock samples of by Brazilian test.
7. Determination of shear strength and triaxial properties of rock
8. Measurement of core recovery and RQD from the various data collected.
9. Determination of RMR of given field data
10. Determination of Protodykonov index of given rocks
11. Determination of Schmidt hammer rebound number of various rocks.
- 12 Determination of moisture contents of various rocks.

Suggested Readings

1. Obert & Duall, Rock Mechanics and design of structures in rock., Pub: John Willey & Sons
2. Railey & Dalley, Experimental stress analysis. Pub: McGraw Hill Book Company
3. B.S. Verma, Elements of Mechanics of Mining Ground. Pub., Tuhin & Co., E-1898(MIG) Rajajipuram, Lucknow, U.P.
4. Vutukuri & lama, Handbook of Mechanical properties of rock, Vol.I&II. Pub: Transtech, Germany
5. Syd.S.Peng, Coal Mine Ground Control. Pub: John Willey & Sons
6. J.C. Jeager & NGW Cook, Fundamentals of Rock Mechanics, Pub: Chapman & hall, Londaon
7. Charles Jaeger, Rock Mechanics & Engineering. Pub: Cambridge University Press, Cambridge London
8. Manual on Rock Mechanics, Prepared by Central Soil & Materials, Research Station, New Delhi, Add: Central Board of Irrigation and Power Malcha Marg, Chanakyapuri, New-Delhi- 110021
9. Vail, CO; "Rock Mechanics for Industry"Proceeding of the 37th Symposium on Rock Mechanics Vol. 1-2, ISEE Publication, Cleveland, Ohio

B.TECH. (Mining Engineering)
VI SEMESTER
MINE ELECTRICAL TECHNOLOGY

Unit I

Transmission and Distribution of Electrical Power in Mines: Performance of short transmission lines; radial and ring–main distribution systems, substation arrangements for opencast and underground mines, distribution of electrical power in mines, mining type cable.

Unit II

Mining type switchgears and protective devices: Types of circuit breakers, Gate end box, Drill panel, and Tran switch, Field Switch. Symmetrical faults and circuit breaker rating calculation.

Unit III

Protective relays: Thermal and induction disc type overload relays; mining type earth fault relay. Signaling and communication: Haulage and Coal face signaling systems for underground coal mines, basic concept of underground mine communication.

Unit IV

Power Economics: Types of industrial tariffs, power factor improvement in mines. Electrical drives and Power Semiconductor Controller: Selection of motors and starters for mining applications; introduction to power semiconductor devices, basic principles of operation of thyristor controlled variable speed mine electrical drives, electrical braking.

Unit V

Electrical Safety in Mines: Neutral Grounding and Equipment earthing practice in mines, principles of flameproof enclosure, intrinsic safety, Indian Electricity Rules as applied to mines – main provisions. Mine lighting system.

PRACTICAL:

1. Study of Gate-end-box.
2. Study of Drill Panel.
3. Determination of CBT characteristics and study of electromagnetic earth fault relay.
4. Determination of IDMT characteristics of induction disc type overload relay.
5. Determination of characteristics of thermal overload relay.
6. Study of power factor improvement by static condenser.
7. Study of mining type electric cable.
8. Study of Electrical layout in an Underground Coal Mine

Text Books / References:

1. Electricity in U/G Mines, Dr P.K.Chakravorti, CMPDIL Publication
2. Electrical Engineering in Mines, Nil K. Datta, New Central Book Agency(P) Ltd
3. A Text Book on Power System Engineering, Soni, Gupta, Bhatnagar, Chakrabarti.
4. Coal Mining Practice [Vol – III], Statham
5. Electrical Equipment in Mines, H. Cotton.
6. Electrical Drives, G. K. Dubey.
7. Indian Electricity Act & Rules
8. DGMS Circulars

B.TECH. (Mining Engineering)
VI SEMESTER
ADVANCED MINE SURVEYING

Unit - I

Correlation: Methods of correlation of surface and underground surveys- Through mine openings; Correlation by magnetic needle; Precautions and accuracy. Surveying for tunnels and open pits.

Unit - II

Triangulation Surveying: Definition; Reconnaissance; Selection of signals and stations; Triangulation system with primary, secondary and tertiary orders; Measurement of base line and angles; Booking of observations; Auxiliary stations; Satellite stations; Computation; Calculation of coordinates; Errors and their distribution and plotting.

Unit - III

Stope and face surveying: Theodolite in stope surveying; Tape triangulation; Traversing; Radiation and other methods. Plans and Sections: Legal requirements as to mine plans in India and symbols used; Preparation and preservation of plans and section; Enlargement of plans; Use of ediograph, pantograph and planimeter.

Unit IV

Errors: Sources, classification, propagation and growth; Treatment of nonsystematic errors by the method of least squares; Probable errors; Most probable value; Probable error and weight; Limits of errors in drift surveys.

Unit - V

Photogrammetry and Aerial Surveying: Terrestrial photogrammetry; Phototheodolite & its construction; Method of field work and plotting from horizontal photographs with determination of elevations; Elementary perspective as applied to aerial photographic surveying. Field Astronomy: Important definitions; Determination of Azimuth by observation of star. Application of laser in surveying; Electronic distance measuring equipment; Total station. GPS.

Practical

1. Various methods of correlation and its practical applicability assuming the underground mining conditions.
2. Gyroscope and its use in correlation.
3. Measurement of Base-line for triangulation survey in difficult ground conditions.
4. Triangulation of a hilly terrain.
5. Various stope surveying methods.
6. Planimeter and calculation of areas with its help.
7. Determination of elevation from aerial photographs.
8. Determination of azimuth by observation star at equal altitude.
9. Problems on dip-strike, bore-hole, faults & drifts.
10. Exercise with the help of EDM, Total station.
11. Exercise with the help of GPS, and other latest instruments
12. Exercise of triangulation in flat & large area.
13. Study and problem with Pentograph.
14. Preparation and preservation of plans
15. Problems related to errors.

Text Books/References

1. Dr. B.C.Punmia, Surveying Vol. I,II & III, Pub: Laxmi Publication New-Delhi.
2. Kanetkar, Surveying & Levelling, Vol I & II, Geeta book store Dhanbad.
3. D.K. Jain, Mine Surveyors Competency Examination, Geeta book store, Dhanbad.
4. Winiberg, Metalliferous Mine Surveying.

ADVANCED ROCK MECHANICS & GROUND CONTROL

Unit – I

Stress State: Stress Fields, Stress Equations, In-situ and induced stresses, Stress distribution around narrow and wide openings (single and multiple).

Rock reinforcement: Introduction to local and mass support system, Design of support systems in shafts, systematic supports in headings, junctions, depillaring areas, gates, longwall faces and stopes; Bolting; Shotcreting & Guniting. Cable bolting, filling & pillar as mass support system, pressure on supports.

Unit – II

Stress and Deformation related instrumentation: Measurement of rock movements and interpretation of data; Load cells, convergence recorders, borehole extensometers and borehole cameras. Measurements of in-situ and induced stresses.

Unit – III

Subsidence: Factor controlling magnitude and extent of surface subsidence-prevention/control of damage to surface facilities-method of prediction of mining subsidence-subsidence measurement techniques.

Rock Bursts: Rock bursts and bumps; Mechanism of occurrence, prediction and control. Design of shaft pillar, Tunnels and Caverns.

Unit – IV

Caving: Mechanics of caving; Cavability of rocks; Caving height.

Slopes in Excavations and in Dumps/Waste: Types of slope failure; Analysis of slope failure; Factors affecting slope stability; Drainage and reinforcement of slopes; Monitoring of slopes, Slope stability radar.

Unit – V

Numerical techniques in Rock Engineering: Introduction, Computational methods, Numerical methods of modeling rock masses, Application of numerical analysis in Geo-mechanics.

05MI651-Advanced Rock Mechanics and Ground Control LAB

Practical

1. Borehole extensometer and measurement of displacement with its help.
2. Measurement of strain by tape extensometer.
3. Load cell and measurement of convergence.
4. Flat jack method and measurement of in situ stress.
5. Determination of ground vibrations with seismograph, and its effect on design of slopes.
6. Factors influencing the stability of slope. Design for maintaining slope in adverse conditions.
7. Mechanism of rock burst and bumps and factors influencing it
8. Shotcreting method of support - principle, application etc.
9. Design of support system.
10. Application of numerical methods in geo-mechanics

Text books

1. B.S. Verma, Elements of Mechanics of Mining Ground. Pub. Tuhin & Co., E-1898(MIG) Rajajipuram, Lucknow, U.P.
2. Obert & Duall, Rock Mechanics and design of structures in rock. Pub: John Willey & Sons
3. T. Ramamurthy, Engineering in Rocks for Slopes, Foundations and Tunnels.
4. Alfreds R Jumikis, Rock Mechanics, Trans Tech Publication (1982).

References

1. Railey & Dalley, Experimental stress analysis. Pub: McGraw Hill Book Company
2. Vutukuri & lama, Handbook of Mechanical properties of rock Vol.I&II. Pub: Transtech, Germany
3. S.S.Peng, Coal Mine Ground Control. Pub: John Willey & Sons 6. J.C. Jeager & NGW Cook, Fundamentals of Rock Mechanics. Pub: Chapman & hall, London
4. Z.T. Bieniawski, Rock Mechanics Design in Mining and Tunneling, Pub: A.A. Balkema, P.O. Box 1675, 3000 BR Rotterdam, Netherlands.
5. Hoek E. and Brown, E.T. Underground excavations in Rock, Institutions of Mining and Metallurgy, London
6. Brown, E.T., Rock characterization, testing and monitoring – ISRM suggested method, Pergamon Press, Oxford.
7. William A. Hustrulid (Editor), Slope Stability in Surface Mining
8. Hoek and Bray, Rock Slope Engineering, Taylor & Francis, Taylor & Francis.

B.Tech. (Mining Engineering)
VI SEMESTER
INNOVATIVE & SUSTAINABLE MINING

Unit I

Legislative measures for Sustainable Development – MMDR Act 2015 – Star Rating of Indian Mines (non-coal) Sustainable Mining - Integrated Management System - Environment Responsibility – CSR - Organisational Structure For Mine as well as Environmental Management

Unit-II

Climate Change- Energy : Electrical Energy consumption in Mining - Energy Conservation - Measures Taken for energy conservation - Carbon Footprint – CO₂ Sequestration - Reducing Emissions through Technology

Unit III

Coal Bed Methane – Coal Mine Methane - CNG - PNG - LNG - Alternative Fuel use in HEMM

Unit-IV

Mine Water - Water Conservation Initiatives in Mines - Underground mine water- Water Pollution Control Measures and Waste Management-Mine Air Quality (excl. UG) - Noise Pollution & Control- Biodiversity: Land Reclamation and Plantation - Mine Closure - Environmental Budget & Expenditure planning.

Unit-V

Innovative Techniques used in Mining with reference to the above areas of Mining.

Reference

1. Annual Report of Ministry of Coal, Ministry of Mines, MoEF & Climate Change
2. MMDR Act 2015 & Amendments made thereto
3. Procc. of SDMiner 2014 – National Seminar on Sustainable Development in Mineral & Earth Resources, New Delhi, Published by The Indian Mining & Engineering Journal, Bhubaneswar

MINI PROJECT

Based on study of some major Coal or Non-Coal Mines with special reference to Innovative techniques and Sustainable Development.

B.TECH. (Mining Engineering)
VI SEMESTER
COAL & NON-COAL MINERAL PROCESSING

Unit-I

Introduction - Scope, object and limitations of Mineral Dressing; Role of microscopic study. Sampling: Importance and methods used in ore-dressing.

Unit-II

Comminution and Liberation: Theory and practice of crushing & grinding; Conventional units used-their fields of application and limitation. Sizing and Classification: Laws of setting of solids in fluid; Laboratory methods of sizing and interpretation of sizing data; Industrial sizing by screens; Types of classifiers; Classification as means of sizing by screens.

Unit-III

Gravity concentration Methods- Jigging, Flowing film concentration like spirals and shaking table, Heavy Media separation; Theory, applications and limitations of each method; Introductory Froth Flotation, physicochemical, principles underlying flotation-reagents, flotation machines; Flotation of sulphides, oxides and non-metals.

Unit-IV

Electrical Methods of Concentration: Electrostatic and magnetic methods, their principles of operation, fields of application and limitations. Dewatering and drying: Thickening, filtration and drying. Coal Processing : Dry and Wet processing of coal, Coal washing for coking and non-coking coal coal, coal washability, crushing, sizing and cleaning of coal.

Unit-V

Simplified Flow Sheets: Beneficiation of coal and simple ores of gold, iron, manganese, bauxite, lead-zinc with reference to Indian deposits.

Practicals

1. Determination of angle of repose & bulk density.
2. Study of specifications & function of Roll crushers.
3. Study of Gyratory crushers and their application.
4. Study of the ball mill and its application.
5. Study of various types of classifiers.
6. Determination of various sized product with sieve shaker.
7. Concept and apparatus of froth flotation.
8. Study of Wilfrey table its specifications and application.
9. Study of Filter press its specifications and application

Text Books/References

1. V.V.R.Murty, Operational Handbook of Mineral Processing, Dennet & Co., Nagpur.
2. M.A. Gaudin, Mineral Dressing.
2. S.K. Jain, Mineral Processing, CBS Publishers & Distributors, Delhi.
3. T.C.Rao, Mineral Dressing.
4. H.G. Vijendra, Hand book on Mineral Dressing. Pub: Vikas Publishing House, 576, Masjid Road, Jangpura New-Delhi 110014

B.Tech. (Mining Engineering)
VII SEMESTER
Mine Management - Legislation and General Safety

Unit I

Mine Management: Introduction: Evolution of management; theory and practice; principles of scientific management; elements of management function; planning; organisation and control; structure and design of organisation for mining enterprises. Personal Management: Selection; training and development of human resources for mining enterprises; leadership; study of traditional leader behaviour; autocratic; democratic and Laissez-Faire behaviours. Production Management: Determination of norms and standards of operations by work study; analysis of mine capacities and capability; production planning; scheduling and control; short term and long term planning; productivity; concepts and measurements; application of Ergonomics in mine operation. Financial Management: Capital budgeting; techniques for mining project; project evaluation; pay back period and IRR; methods of cost analysis and cost control; break-even charts; working capital management.

Unit II

Mining Environment: EIA (Environment Impact Assessment), EMP (Environment Management Plan), ETP (Effluent Treatment Plant), STP (Sewerage Treatment Plant) threat to environment from underground and surface mining, means of - 5 - mitigation, treatment of pollutants, monitoring systems, water management; mine closure plan; R&R (rehabilitation and resettlement). Socio-Economic Impact of Mining: Economics of mining, effect on community – before, during and after mining Materials Management for mining sector - Behavioural Sciences for Management: Conflict management; conflict in organisation; sources of conflict; dealing with conflict; organising for conflict resolution; conflict and growth; Individual motivation; two way personal communication. Industrial Accident: Study of human factors of industrial accidents; their causes and remedies.

Unit III

Mine Legislation: Health and Safety Laws: The Mines Act, 1952; Mines Rules, 1955; Metalliferous Mine Regulation, 1961; Mines Rescue Rules, 1985; provisions of Indian Electricity Rules, 1956 applicable to mines; Mine Vocational Training Rules, 1966; other rules and legislation applicable to metalliferous mines. General Safety in Mines: Safety in Mines: Duty of care; occupational hazards of mining; causes and prevention; accidents and their classification; accident statistics; frequency rate and severity rates; cause-wise analysis; basic causes of accident occurrence; investigations into accidents and accident reports; in-depth study into various causes of accidents; measures for improving safety in mines; TRAP (take responsibility in accident prevention); cost of accident; safety management system; contribution of human elements in mine safety; workers participation in safety management; ISO and safety audit; safety conferences; tripartite and bipartite committees; role of information technology in safety management.

Unit IV

Risk Management: Theory and application, baseline, continuous and issue based risk assessment, how they are applied to technical areas, risk management techniques, means of managing (minimizing or eliminating) risk, computer application and simulations,

manager's role in risk management, due diligence, application of risk assessment and risk management with reference to due diligence.

Unit V

Disaster management- Emergency services, equipments and procedures, emergency control rooms, rescue and recovery; procedure and responsibilities, safety of persons engaged in emergency response, investigations and reports; assessment of damage, mine rescue; mine gases and their physiological effects; rescue equipments; resuscitation and reviving apparatus; selection and training for rescue work. First aid and ambulance work. Occupational Health - Notified and occupational diseases; silicosis and pneumoconiosis; physiological aspects of breathing in dust laden atmosphere; dust sampling and sampling instruments; methods of counting and analysis; other mines diseases and their symptoms; prevention and treatment. Statutory norms for Lighting: general principles of artificial lighting; lighting standards and their assessment. Sanitation and health in mines. Safety related issues in mineral beneficiation and transport.

Text Books/Reference

1. Rakesh & Prasad, Legislation in Indian Mines, Vol. I & II., Pub. Asha Lata, Varanasi
2. B.K.Kejriwal, Safety in Mines, Lovely Publishers, Dhanbad.
3. Classified Mine Circulars issued by DGMS.
4. Relevant Act, Rules and Regulations, Published by Govt. of India.

B.Tech. (Mining Engineering)
VII SEMESTER
COMPUTER APPLICATION IN MINING

Unit - I

Importance of computer application in mining, Different areas of application. Introduction to Computers and hardware for application in mining industry. Programming with 'C' computer language for mining related problems.

Unit - II

Basic Introduction for application of Computers in areas of : Exploration- Data generation, collection and analysis through computers for exploration and reserve estimation Surface Mining- Bench geometry design, Haul road design, Drainage, Waste dump design and monitoring. Mine Planning & Design- Introduction of mine planning concept through mining software. Introduction to numerical methods in Mining.

Unit - III

Basic Introduction for application of Computers in areas of : Environmental Engineering Basic concept of data generation, collection and analysis through computers for environment management. Relevant software application

Unit - IV

Mine Surveying : Introduction to mapping, Estimation of area and volume, Preparation of plans & sections, Tonnage/ Volume calculation for contractual billing and relevant software application. Project Monitoring : Systems & tools of monitoring of different mining operations, data collection, analysis and online monitoring. Inventory control and management.

Unit - V

Mine Planning Software : Basic introduction, salient features, planning by different mining software like DATAMINE, SURPAC Software for various applications : Basic introduction, salient features and application of software like BLASTWARE, FRAGLYST, GALENA, FLAC, VENTetc.

Practical

1. Computer programming for mining problem with C++.
2. Introduction to different hardware application related to mining.
3. Introduction to Mine planning by DATAMINE
4. Introduction to Mine planning SURPAC
5. Introduction to BLASTWARE software.
6. Calculation of production tonnage of an opencast mine for contractual billing with Total station & Datamine
7. Introduction of "VENT" software of simulation of ventilation network of a mine.
8. Introduction to "FRAGLYST 2.0" software.
9. Introduction to "SINET" software of design of U/g mine ventilation system.
10. Introduction to "PSYCHRO" software.
11. Introduction to "AWQEFA" software.
12. Introduction to "FLAC/ FLAC 3D software
13. Introduction to "N-Fold" software.
14. Introduction to "GALENA" software related to slope stability.
15. Introduction to "Solid works" software

Text Books/References

1. Sukumar Bandopadhyay; "Application of the Computers and Operation Research in the Mineral Industry" Proceedings of the 30th international Symposium SME Publication 2002
2. Manuals of different softwares

B.Tech. (Mining Engineering)
VII SEMESTER
MINING MACHINERY – III

Unit – I

Pumps and Pumping: Principal types, construction, operation and characteristics; Calculation of size and efficiency; Installation, operation care and maintenance; Frictional resistance; Installation in shafts and roadways; Damage due to corrosion and abrasion, and precaution; Cleaning and replacement of pipes; location and design of mine sumps.

Unit – II

Mineral Handling: Layouts of pit-top and pit-bottom; Details of banking; Mineral handling and screening equipment; Creepers; Tipplers; Layouts of railway siding of mines; Storage bunker. Pit bottom installations and circuit with cage and skip systems.

Unit – III

Maintenance: Preventative and predictive maintenance; Condition monitoring; Workshops. Automation and remote control of mining equipment. Signaling: Safety regulations and different signaling systems in mines. Jumbo drill machine, simbha drill machine stopper, low profile dump truck, high wall machinery.

Unit – IV

Advances in Mining Machineries – Robotics, **Energy Conservation efforts** in Mining Machinery : including Air Compressors, Pumps, Conveyors, High HP engines, etc for underground and surface mine applications.

Unit – V

Methods of assessing efficiency of HEMM and other machineries, standards laid by CMPDI and other organizations for availability and utilization.

Practical

1. Turbine pump with constructional details and characteristic curves.
2. Design of mine pump with its installation, care and maintenance.
3. Types of signaling systems used in mines for modern system of hoisting.
4. Pit-top layout with shaft for handling 2000 tonnes production per day.
5. Pit-top layout with direct rope haulage.
6. Designing of various pit-bottom layouts.
7. Application of creeper and tippler in mineral handling.
8. Design of mine sumps and their selection of site in mines.
9. Planning and scheduling of maintenance of machinery used in mines.
10. Layout of muck movement through ore passes bunkers, u/g crusher and shaft.
11. Railway siding layout.
12. Automation in mineral handling.

13. Exercise on Illumination survey.
14. Study of flame safety lamp and Testing of methane
15. Design of lamp room layout for a mine of 2000 tonnes production per day.

Text Books/References

1. Rakesh & Lele, Water problem in mines. Pub: Dhanbad Publisher.
2. Rakesh & Lele, Selection, Installation and Maintenance of mine pumps. Pub: Dhanbad Publisher
- 3 M.A. Ramlu, Mine Hoisting. Pub: Oxford & IBH Publishing Co. Pvt.Ltd. New Delhi
4. R.C.Mishra & K.Pathak, Maintenance Engineering and Management, PHI Learning Private Ltd, New Delhi.
5. PCRA Handbook & other published literature
6. Web sites of Bureau of Energy Efficiency(BEE) & PCRA

B.Tech. (Mining Engineering)
VII SEMESTER
MINE AND MINERAL ECONOMICS

Unit – I

Minerals and the Economy: Scope and definition, Major Mineral Resource Issues, Economics of Depletable Resources, Indian Economy and The Mineral Industry.

Minerals availability – Global view: Land Resources, Mineral Resources and the Law of the Sea, Secondary Supply of Minerals, Conservation of Mineral Resources.

Unit – II

Reserve – Resource Dynamics: Definition, Dynamic Conceptual Framework for Reserves and Resources, JORC Classification System, United Nations Framework Classification, Uneconomic occurrence, Mineral Occurrence, Concept of Marginal Reserves, Reserve Estimation Techniques.

Mine sampling: Theory of Sampling, Common Methods of Sampling, Selection of Sampling Procedure, Size and Spacing of Samples, Sample Preparation, Errors in Sampling.

Unit – III

Valuation of Mineral properties and Project Evaluation: Principles and Methods of Valuation, Concepts of Cash Flow and Time Value of Money, Nominal and Effective Interest Rates, Inflation, Project Evaluation Techniques, Discounted Cash-Flow Methods, Feasibility Study, Due Diligence.

Mine Finance and Accounting: Different Sources of Finance, Equity and Debt Capital, Preference Shares, Term Loans, Cost of Capital, Costing and Cost Accounting, Cost-Volume – Profit Analysis, Depreciation, Depletion, Amortization, Budget and Budgetary Control, Wages and Incentives.

Unit – IV:

Mine Taxation: Meaning of Taxation, Objectives of Taxation, Principles of Mines Taxation, Mining Taxation Structure, Mineral Sector Taxation Methods, Rationale for Mining Specific Taxation, Mineral Taxation in India and Abroad.

Mineral Markets and Trade: Market Structure, Market Analysis, International Mineral Study Groups, Associations and Cartels, Pricing of Minerals.

Unit – V

National Mineral Policy: Objectives of National Mineral Policy, Elements of National Mineral Policy, Mineral Export-Import Policy of India, Mineral Policies of a few Countries, Implementation of Mineral Policy.

Mineral Industry and the Environment: Sustainability Issues, Appropriate Environmental Strategies, National Conservation Strategies, Policy Statement for Abatement of Pollution, National Forest Policy, National Environmental Policy, Regulatory Reforms, Legislative Measures, Economics of Mine Closure and Reclamation.

Text Books/References

1. R.T. Deshmukh, Mine Economics.
2. S.C.Ray and I.N.Sinha, Mine and Mineral Economics, PHI Learning Pvt. Ltd
3. Park , A text book of Mine Valuation..
4. W.A. Hustrulid, Underground Mining Methods Handbook.
5. Rendu, An Introduction to Geostatistical Methods of Mineral Evaluation.
6. R.T. Deshmukh, Mine Economics.

**B.TECH. (Mining Engineering)
VII SEMESTER**

PROJECT WORK

COURSE CONTENTS

Identification of the Project- Collection of data- Organisation of the data- Design of Project elements - Preparation of drawings- Schedules and sequence of operations- Preparation of charts and models- Preparation of report

Note:

OBJECTIVES

- Identify different works to be carried out in the project.
- Collect data relevant to the project.
- Arrive at efficient method from the available choices based on preliminary investigation.
- Design the required elements of the project as per standard practices.
- Prepare working drawing for the project.
- Prepare schedule of time and sequence of operations.
- Prepare charts or models for each project.
- Prepare project report.
- Students shall be divided into groups of three and each group shall be assigned a problem that calls for application of the knowledge. Project work will be allotted by the concerned Head of the department and assign a faculty member (from within or from Civil or Cement Technology or Mechanical Engineering) as guide at the beginning of VII semester. The students are exposed to the mine workings for collecting information or relevant data from respective areas during the entire VII semester, to collect information after the institutional working hours or during holidays
– second Saturdays / Sundays/ Winter/ holidays and prepare project report under the supervision of the guide.
- Project Report will be assessed at the end of VIII Semester for final examination.

Project may be selected from among the following suggested topics or any other topics recommended by the proposed Guide and approved by the HOD-Mining.

Underground mining (coal)

Bord and pillar mining method Longwall mining method.

Blasting gallery method.

Stoping methods for non-coal mining Mechanised stoping methods for non-coal mining

Opencast mining

Pillars extracting by open cast method (coal) Mechanized opencast mining.

In Pit crushing technology Surface mining technology

Blasting technology

Other topics

Blast-Free Mining

Energy Conservation in Mining

B.TECH. (Mining Engineering)
VIII SEMESTER
MINE PLANNING AND DESIGN

Unit – I

Mine Planning Concept and Stages: Approaches to decision making, Mining industry vis-à-vis other industries, Pre-feasibility and Feasibility Plans, Intermediate and Short-range plans, Day to day plans, Strategic mine planning, Mineral inventory estimates, Preparation of Plan Reports.

Unit – II

Techno-Economics: Factors affecting the choice of Mining Methods, Steps of Techno-Economic decisions, Determination of Technical Factors in Mine Planning, Basics of Mine Investment, Empirical methods to estimate mine output and life of a mine, System requirement in Mine Planning.

Unit – III

Mine Parameters Optimization: Optimization techniques in Mine Planning, Model building – Ore body models, Mine models and Financial models, Mine optimization, Matching of Shovel – dumper at production planning, Infrastructure planning, Planning of mining facilities, Economic decision making - Vertical shaft vs. Incline.

Unit IV

Mine sub-systems Planning & Design: Mine Access Design, Size of Longwall panels and faces, Environmental control measures in Mine Planning, Selection of machines, Haul Road design, Openpit blast design, Stowing plant design, Mine Closure Planning.

Unit - V

Project Scheduling and monitoring: Project planning issues and parameters, Mine Project scheduling, Project monitoring – issues, parameters and challenges, Mine planning softwares, Mine Planning in the future – issues and challenges.

05MI853-Mine Planning & Design

Practical

Each practical is computer based.

1. Estimation of ore reserve based on bore hole data of limestone deposit.
2. Estimation of ore reserve based on bore hole data of Iron ore deposit
3. Estimation of ore reserve based on bore hole data of Bauxite deposit
4. Estimation of ore reserve based on bore hole data of Lead zinc deposit
5. Design of drive in a lead zinc mine.
6. Design of Raise/ winge in a metal mine.
7. Design of shaft in a lead zinc mine.
8. Design of box cut in an o/c mine.
9. Design of haul road.

10. Problem related to ultimate slope in o/c mine.
11. Problem for shovel dumper combination.
12. Design of length of long wall face.
13. Problem related to scheduling
14. Optimum blast design for o/c mine.
15. Optimum blast design for u/g mine.

Text Books/References

1. W.Hustrulid & Kuchta, Open Pit Mine Planning and Design Vol & I. Pub: A.A. Balkema
2. W.A. Hustrulid, Underground Mining Methods Handbook
3. Cummins and Gievens; SME Handbook.Pub: Society of Mining Engineers of the American Institute of Mining , Metallurgical, and Petroleum Engineers, Inc New York
4. Bhattacharya, J., Principles of Mine Planning, Allied Publishers.
5. S.P.Mathur, Mine Planning.

B.TECH. (Mining Engineering)
VIII SEMESTER
ROCK EXCAVATION ENGINEERING

Unit – I

Present status of rock excavation in engineering. Rock excavation with and without blasting – classification, selection, case studies etc.

Unit – II

Rock Excavation with drilling & blasting : Methods of drilling; Different types of machines; Hydraulic drills; Long hole drilling; Novel methods of drilling; Choice of drills. Variables in drilling; Machines of drilling; Drillability of rocks. Study of bit life, cost of drilling, hole diameter, pull down weight, joints etc. in relation to BHD and rock characteristic; Trouble shooting; Diagnosis of problems in drilling.

Unit - III

Blast round design & influence of controllable and non controllable parameters on blasting, Fragmentation assessment and monitoring, Instrumentation and software application for design of blast round, monitoring and assessment of rock fragmentation. Deep hole blasting, Hot hole blasting, Stemming plug.

Unit – IV

Blasting damages –Micro and macro level damages due to blasting; Wall control, Blast casting; Demolition blasting, Nuclear blasting; De-stress blasting; Safety & Accident analysis for blasting, Environmental issues in Blasting - Blast induced ground vibration, its measurement, prediction and control, Noise, its measurements and control, Fly rock its causes and control, Controlled Blasting Techniques.

Unit – V

Rock Excavation engineering without drilling & blasting. Blast-free Mining – Definition-Why required ?, Continuous Surface Miner, Hydraulic Rock Breaker, Highwall Miner, etc. Other methods in mining and civil engineering applications like, Tunnel Boring Machine – selection, use and case study.

Practicals

1. Measurement of ground vibration by seismograph
2. Development of predictor equation from the recorded data
3. Measurement of VOD by VOD mate and its analysis
4. Study of various fragmentation assessment techniques
5. Handling of WIPFRAG software
6. Study of Surface Miners

7. Field visit to Highwall Mining working face at Sharda Mines, Sohagpur Area, SECL. Or Write brief description on Highwall Miners use in coal mining.
8. Design of blast for bench blasting
9. Study of various blasting tools
10. Study of working of Hydraulic Rock Breaker.

Text Books/References

1. Dr. Sushil Bhandari, Engineering Rock Blasting Operations. Pub: A.A.Balkema Publisher USA.
2. C.P. Chugh, High Technology in Drilling and Exploration, Pub: Oxford & IBH, New Delhi.
3. C.J. Konya. Surface Blast Design
4. Dr G.K. Pradhan , Explosives and Blasting Techniques, Mintech Publications.
5. U. Langefors and B. Kihlstrom, Modern Techniques of Rock Blasting
6. Indian Explosive Act and Rules.
8. Dr N. R. Thote & G.K. Pradhan, Surface Blast Evaluation, Mintech Publications
9. Dr P. Pal Roy, Rock Blasting : Effects & Operations, Oxford & IBH, New Delhi.

**B.TECH. (Mining Engineering)
VIII SEMESTER
Elective – II**

MAINTENANCE MANAGEMENT & RELIABILITY ENGINEERING

Unit-I

Introduction: General objectives, Functions; Organization and administration of maintenance systems; Requirements, Concepts and structure of suitable organizations for maintenance systems.

Failure Analysis: Analysis for source identification, classification and selectivity of failure; Statistical and reliability concepts and models for failure analysis.

Unit-II

Classification of maintenance systems; Basis and models for various maintenance systems. Cost management for maintenance: cost estimates- recording, summarizing and distributing cost data, maintenance budget.

Unit-III

Decision models for maintenance planning; Operation and control, optimum level of maintenance; replacement aspects of breakdown and preventive types, group and individual types, obsolete facility, deteriorating and completely failing facilities, replacement vs. reconditioning, economics of overhaul, addition replacement model additive damage case, zero memory case, partially observed situation, planning horizon procedure. Spare planning and control: static spares, insurance spares with and without salvage value, low moving spares; man power planning-crew size , allocation etc. stand by machines; economical and operational aspects; scheduling planning of activities, monitoring and updating, resource allocation, Assigning priorities.

Unit-IV

Other relevant topics: work measurement for maintenance, maintenance control indices, maintenance service contract, preventive maintenance management-guidelines, procedure, general management of lubrication system, organizing preventive maintenance program using vibration signature analysis-some basic ideas, management of records for maintenance, computerization of maintenance activities, major plant shut-down procedures.

Unit-V

RELIABILITY ENGINEERING & ITS APPLICATION IN MINING

Introduction-Classification-Application-Application in Mining-Role in Productivity improvement-Case studies related to application of Reliability Engineering.

Text Books/References

1. L.T. Higging, L.C. Morrow. Maintenance Engineering Handbook, McGraw Hill (1977).
2. B.T. Newbrought. Effective maintenance management, McGraw Hill (1967).
3. R.C.Mishra & K.Pathak, Maintenance Engineering and Management, PHI Learning Private Limited, New Delhi.
4. Reliability Engineering related papers authored by Prof Uday Kumar (can be down loaded from web site of University of Lulea Technical University, Sweden).

Numerical Methods in Mining Engineering Application

Unit – I

Introduction to elastic and plastic models, Fundamentals, elastic, plastic, homogeneous iso-tropic and non-linear elasto-plastic models.

UNIT-II

FINITE DIFFERENCE METHODS

Concept, formation of mesh element, finite difference patterns, solutions, application to mining.

UNIT-III

FINITE ELEMENT METHODS

Concept, discretisation, element configuration, element stiffness, assemblage and solutions, two and three dimensional solutions, linear and non-linear analysis, applications
in geomechanics; simulation of joints in strata

UNIT-IV

BOUNDARY ELEMENT METHOD

Concept, discretisation, different methods of solution for isotropic and infinite media.

UNIT-V

PRACTICAL APPLICATIONS IN MINING AND ROCK MECHANICS

Practical Applications in stress analysis, slope stability, subsidence prediction, pillar design, rock burst, etc.

Introduction to ANN- ANN has capability of learning, evoking and generalizing from the given patterns . Its high performance in solving complicated problems has made this technique popular in mining applications. Various applications of the ANN method in rock engineering

Reference Books:

1. Desai, C.S. and Abel, J.F. Introduction to the finite Element Method, Van Nostrand Riehkol Co., New York, 1983
2. Zienkiewicz, O.C. The Finite Element Method in Engineering Science, Tata McGraw Hill.
3. Segerlind, L.J., Applied Finite Element Analysis, John Wiley and Sons, New York, 1987

4. Mukhopadyay, M. Matrix Finite Element – Computer and Structural Analysis, Oxford and IBH Publishing co., 1984
5. Brown, E.T. (Ed) Analytical and Computational Methods in Engineering and Rock Mechanics, Allen and Unwin, London, 1987.
6. Kenji Suzuki (Editor), Artificial Neural Networks, Methodological Advances & Biomedical Applications, (http://www.ltfe.org/wpcontent/uploads/2011/04/Artificial_Neural_Networks_Methodological_Advances_and_Biomedical_Applications.pdf)
Published by InTech, Janeza Trdine 9, 51000 Rijeka, Croatia.

B.TECH. (Mining Engineering)
VIII SEMESTER
QUANTITATIVE DECISION MAKING

UNIT I

Introduction :

Concept of system, component and system environment; classification of system; system analysis. Decision making, Decision problems: model formulation ; decision analysis based on expected monetary value and utility value.

UNIT II

Linear programming

Concept ; graphical solution; simplex method; primal dual models. Sensitivity analysis; case examples from mining engineering.

UNIT III

Network analysis

Determination of the shortest path; critical path method (CPM) and, programme evaluation review technique (PERT), case example from mining engineering. Dynamic programming : dynamic programming and stagecoach problem.

UNIT IV

Simulation

Introduction, concept, scope and limitation; montecarlo simulation, simulation of equipment maintenance and introduction to inventory systems in mines.

UNIT V

Transportation and assignment problems.

Mathematical modelling and solution algorithms, application to mining engineering. Basic queuing models with constant arrival and service rates.

Reference books :

- i. Operation research by kanti swarup, p.k. gupta, manmohan.
- ii. Operation research by prem kumar gupta, d.s.hira.
- iii. Operation research theory & application by j.k.sharma.