

**Department of Mining Engineering,
Faculty of Engineering & Technology,
AKS, University, Satna, M.P.**



**Study and Evaluation Scheme
Of
Bachelor of Technology**

(Applicable w.e.f Academic Session July 2020 till revised)

**Department of Mining Engineering, Faculty of Engineering & Technology,
B. Tech. (Mining Engineering) (wef Session-2020)**

AKS University, Satna, has been imparting B. Tech in Mining Engineering since 2012. With over 25 qualified and experienced faculty members the department of Mining Engineering draws inspiration from Vice Chancellor of AKSU, Prof. P. K. Banik, an eminent Mining Professor (IIT-ISM & IIT-KGP) and formerly Director General of PDPU, and Director NIT (Silchar). The Department also enjoys full support from the management and Pro Chancellor Er. Anant K. Soni and Prof. G. K. Pradhan, Dean, Faculty of Engineering & Technology.

I am pleased to present the revised and updated edition of the approved Syllabus of the B.Tech(Mining Engineering). This will be implemented wef 2020 batch. Since 2012, we have constantly updated the syllabus.

Attempts have been made to incorporate the new Syllabus circulated by DGMS() which extends exemption Certificate of Second Class Mine Managers' Certificate of Competency to B. Tech Mining students after having one year experience and other necessary certificates (like Gas Testing to work in UG mines, First Aid, Experience & Medical certificate).*

I acknowledge the efforts of my colleagues. My thanks are due to the approving authorities of the University and for their guidance.

Dr. B. K. Mishra
Head of the Department
Mining Engineering

(*)Ref: The Gazette of India Part II, Section-3 sub-section (i) No. 672 dated 14 Sept 2018 under Regulation 12(1) & 12(4) of CMR 2017 & relevant Notification as under MMR 1961.

| Teaching and Examination Scheme B. Tech. Mining Engineering -III | | | | | | |
|---|--------------|--------------------------------------|----|----|----|--------|
| Sl. No. | Subject Code | Subject Name | L | T | P | Credit |
| Theory | | | | | | |
| 1 | 05GE301 | Mining Geology-I | 03 | 01 | | 04 |
| 2 | 05MI302 | Surface Mining | 03 | 01 | | 04 |
| 3 | 05MI303 | Mine Development & Drilling-Blasting | 03 | 01 | | 04 |
| 4 | 05MS304 | Engineering Mathematics - III | 03 | 01 | | 04 |
| 5 | 05MI305 | Under Ground Coal Mining | 03 | 01 | | 04 |
| 6 | 05ME306 | Strength of Materials | 03 | 01 | | 04 |
| Practical | | | | | | |
| 1 | 05GE351 | Mining Geology | | | 02 | 01 |
| 2 | 05MI352 | Surface Mining | | | 02 | 01 |
| 3 | 05MI353 | Mine Development & Drilling-Blasting | | | 02 | 01 |
| 4 | 05MI354 | Under Ground Coal Mining | | | 02 | 01 |
| 5 | 05ME355 | Strength of Materials | | | 02 | 01 |
| | | | 18 | 06 | 10 | 29 |
| Total Credit=29 | | | | | | |

| Teaching and Examination Scheme B. Tech. Mining Engineering-IV | | | | | | |
|---|--------------|--|----|----|----|--------|
| Sl. N. | Subject Code | Subject Name | L | T | P | Credit |
| Theory | | | | | | |
| 1 | 05GE401 | Geology-II | 03 | 01 | | 04 |
| 2 DE | 05CE402 | Mine Surveying-I | | | | |
| | | Rock Fragmentation & Reliability Engineering | 03 | 01 | | 04 |
| 3 | 05MI403 | Advanced Under Ground Coal Mining | 03 | 01 | | 04 |
| 4 | 05MI404 | Mine Ventilation Environment-I | 03 | 01 | | 04 |
| 5 | 05ME405 | Fluid Mechanics | 03 | 01 | | 04 |
| 6 | 05MS406 | Engineering Statistics and Probability | 03 | 01 | | 04 |
| Practical | | | | | | |
| 1 | 05GE451 | Geology-II | | | 02 | 01 |
| 2 | 05CE452 | Mine Surveying | | | 02 | 01 |
| 3 | 05MI453 | Mine Ventilation Environment-I | | | 02 | 01 |
| 4 | 05ME454 | Fluid Mechanics | | | 02 | 01 |
| | | | 18 | 06 | 08 | 28 |
| Total Credit=28 | | | | | | |

| Teaching and Examination Scheme B. Tech. Mining Engineering -V | | | | | | |
|---|--------------|----------------------------------|----|----|----|--------|
| Sl. N. | Subject Code | Subject Name | L | T | P | Credit |
| Theory | | | | | | |
| 1 | 05MI501 | Mining Machinery-I | 03 | 01 | | 04 |
| 2 | 05MI502-A | Advanced Mine Survey | 03 | 01 | | 04 |
| | 05MI502-B | Mine Automation | | | | |
| 3 | 05MI503 | Underground Metalliferous Mining | 03 | 01 | | 04 |
| 4 | 05MI504 | Rock Mechanics & Strata Control | 03 | 01 | | 04 |
| 5 | 05MI506 | Mine Electrical Engineering | 03 | 01 | | 04 |
| | 05ME505-B | Remote sensing & GIS | | | | |
| Practical | | | | | | |
| 1 | 05MI505 | Semester Break Training | | | | 04 |
| 2 | 05MI551 | Mine Electrical Engineering | | | 02 | 01 |
| 3 | 05MI552 | Mining Machinery I | | | 02 | 01 |
| 4 | 05MI553 | Underground Metalliferous Mining | | | 02 | 01 |
| 5 | 05MI554 | Advanced Mine Survey | | | 02 | 01 |
| 6 | 05MI555 | Rock Mechanics & Strata Control | | | 02 | 01 |
| | | | 15 | 05 | 10 | 29 |
| Total Credit=29 | | | | | | |

| Teaching and Examination Scheme B. Tech. Mining Engineering -VI | | | | | | |
|--|----------|--|----|----|----|--------|
| Sl. No. | Sub Code | Subject Name | L | T | P | Credit |
| Theory | | | | | | |
| 1 DE | 05EE601 | Innovative & Sustainable Mining | 03 | 01 | | 04 |
| | | Bulk Material Handling | | | | |
| 2 | 05MI602 | Mine Ventilation Environment-II | 03 | 01 | | 04 |
| 3 | 05MI603 | Advanced Rock Mechanics & Ground Control | 03 | 01 | | 04 |
| 4 | 05MI604 | Mining Machinery-II | 03 | 01 | | 04 |
| 5 | 05MI605 | Coal and Non Coal Mineral Processing | 03 | 01 | | 04 |
| Practical | | | | | | |
| 1 | 05MI651 | Advanced Rock Mechanics & Ground Control | | | 02 | 01 |
| 2 | 05MI552 | Mining Machinery –II | | | 02 | 01 |
| 3 | 05MI653 | Coal and Non Coal mineral Processing | | | 02 | 01 |
| 4 | 05MI654 | Mine Ventilation & Environment II | | | 02 | 01 |
| 5 | 05GE654 | Mini Project work on Innovative & Sustainable Mining | | | 02 | 01 |
| | | | 15 | 05 | 10 | 25 |
| Total Credit=25 | | | | | | |

| Teaching and Examination Scheme B. Tech. Mining Engineering -VII | | | | | | |
|---|----------|-----------------------------------|----|----|----|--------|
| Sl. No. | Sub Code | Subject Name | L | T | P | Credit |
| Theory | | | | | | |
| 1 | 05EE601 | Computer Application in Mining | 03 | 01 | | 04 |
| 2 | 05MI602 | Mine Management | 03 | 01 | | 04 |
| 3 | 05MI603 | General Safety & Mine Legislation | 03 | 01 | | 04 |
| 4 | 05MI604 | Mining Machinery III | 03 | 01 | | 04 |
| 5 | 05MI605 | Mineral Economics | 03 | 01 | | 04 |
| Practical | | | | | | |
| 1 | 05MI651 | Project | | | | 04 |
| 2 | 05MI654 | Mine Practical Tra. During Sem. | | | 02 | 01 |
| 3 | 05GE654 | Seminar & Report Writing | | | 02 | 01 |
| 4 | 05MI552 | Computer Application in Mining | | | 02 | 01 |
| 5 | 05MI653 | Mining Machinery III | | | 02 | 01 |
| | | | 15 | 05 | 08 | 28 |
| Total Credit=28 | | | | | | |

| Teaching and Examination Scheme B. Tech. Mining Engineering -VIII | | | | | | |
|--|----------|--|----|----|----|--------|
| Sl. No. | Sub Code | Subject Name | L | T | P | Credit |
| Theory | | | | | | |
| 1 DE | 05EE601 | Rock Excavation Engineering | 03 | 01 | | 04 |
| | | Eco-friendly Mining | | | | |
| 2 Elective I | 05MI602 | Mine Planning & Design | 03 | 01 | | 04 |
| | 05MI603 | Maintenance Management & Reliability Engineering | | | | |
| 3 Elective II | 05MI604 | Numerical Methods in Mining Engineering Applications | 03 | 01 | | 04 |
| | 05MI605 | Quantitative Decision Making | | | | |
| Practical | | | | | | |
| 4 | 05MI651 | Project | 03 | 01 | 10 | 08 |
| 5 | 05MI552 | Elective I Practical | | | 02 | 01 |
| 6 | 05MI653 | Rock Excavation Engineering | | | 02 | 01 |
| 7 | 05MI654 | Seminar & Viva | | | 06 | 04 |
| | | | 12 | 04 | 18 | 26 |
| Total Credit=26 | | | | | | |

05GE301 - III SEMESTER
B.Tech. (Mining Engineering)
GEOLOGY - I

Unit- I

The Scope and Purpose of Geology: Definition, Branches of Earth Science. Origin of Earth-various hypothesis. Age of earth - Various methods of age determinations, radioactive methods and their advantages.

Rock Genesis: Rock Cycle, Igneous, sedimentary and metamorphic rocks – origin, characteristics, classification, uses and mining importance. Significance of texture and structure of rocks.

Unit-II Physical Geology

Erosion & Weathering: Type of Weathering. Foliation and Spheroidal weathering. **River:** Erosion, transport and deposition; Waterfalls, meanders, oxbow lakes, alluvial fans, flood plains, delta. Wind erosion, Transport and Deposition, Vent facts, Pedestal rocks, sand dunes, and loess.

Earthquake: Seismographs, Earthquake waves, Classification of earthquakes, Elastic rebound theory, Richter scale of earthquake intensity, Distribution of Earthquakes in India. **Volcano:** Types of volcanoes, volcanic products volcanic cones, Distribution of volcanoes.

Unit-III

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- IV

Geological Structure and Plate Tectonic

Dip and Strike, **Folds:** Elements of Folds, Type of folds. **Faults:** Fault Terminology, Type of Fault and its effects. **Unconformity:** Definition, types of unconformity. **Joints:** Definition, types of joints. Outlier and Inlier structure. Engineering considerations and treatments of discontinuities. **Plate Tectonics:** Plate motion, Types of boundaries.

Unit- V

Palaeontology & Hydrogeology

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

History of Hydrogeology, The Hydrological Cycle, Distribution of Water on the Earth Occurrences of ground water, Distribution of Water in the Subsurface, Groundwater Flow, Recharge and Discharge, Aquifers. Hydro geological properties of rocks, Hydro geological classification of rocks.

Text & Reference Books

1. Bangar, K.M., Principle of Engineering Geology:, Standard Publishers
2. Billings M.P. (1987), Structural Geology, 3rd ed., Prentice- Hall, Inc., Englewood cliffs, New Jersey.
3. Mahapatra, G.B. A Text Book of Geology, CBS Publishers Distributors
4. Mukherjee, P.K., A Text Book of Geology, Publisher: World Press Private Ltd, Kolkata.
5. Odisha State Bureau of Text Book Preparation and Production, Geology, Part I & II, 2011 Edition.
6. Park, R.G., Foundations of structural geology, Chapman & Hall, 3rd Edition, 1997.
7. Gribble, C.D., Rutley's elements of mineralogy, Unwin Hyman Ltd., 27th Edition, 1988.
8. Reddy, D.V., Engineering Geology Published by Vikas Publishing House, 2010 Edition.
9. Singh, Prabin, Engineering and General Geology, Published by M/s S.K. Kataria& Sons
10. Tyrrel G.W. (1998), The Principles of Petrology, B.I. Publications Pvt. Ltd.
11. Vaidyanadhan, R. & M. Ramakrishnan, Geology of India (Vol I &II), Published by GSI Publications, 2008 & 2010.

**05GE351 - III SEMESTER
B.Tech. (Mining Engineering)
GEOLOGY – I LAB**

Practical:

1. Identification and description of Crystals.
2. Identification and description of two Igneous rock hand specimens.
3. Identification and description of two Metamorphic rock hand specimens.
4. Identification and description of two 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. Preparation of structural cross sectional maps.
11. To Study of important two fossils.

05MI302 - III SEMESTER
B.Tech. (Mining Engineering)
SURFACE MINING

Unit - I

Application : Application 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 : 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; Selection and application of 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, dust control, bit selection and bit life improvement etc.

Explosives & Blasting in surface mines- Explosives and Blasting accessories used in surface mines - Bulk explosives, Blasting Theory and Blast Design, Blast performance assessment, problems in blasting, environmental impact of surface mine blasting and how to control, Surface mine Blasting safety & Accident analyses, Blasting in shovel & dragline bench blasting, Computer assisted blasting and instrumentation in blast assessment. Special techniques of Blasting in hot holes, protecting slopes etc.

Unit - IV

Methods of excavation & transportation – Factors influencing Selection and application of - shovel-dumper combination, draglines, surface miner, bucket wheel excavator, Types of transport system – their selection, Deployment and application, Computerized 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

Application and selection of 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.

Text books

1. Bhandari, S., Engineering Rock Blasting Operations. Pub: A.A.Balkema Publisher USA, 1997, p. 375.
2. Das, S.K., Surface Mining Technology, Lovely Prakashan, Dhanbad
3. Mishra, G.B., Surface Mining, Geominetech, Bhubaneswar
4. Kennedy, B.A.(Editor), 1990, Surface Mining, SME, USA, 2nd Edition, p. 1194.
5. Kole,C.M., □□□□ □□□ □□ □□□□□ (□□□□□), CMPDIL, Ranchi, 1992 Edition, p. 208 + XXVIII.
6. Pradhan, G.K., Explosives & Blasting Techniques, Mintech Publication, Bhubaneswar (An AKS University Initiative), 4th Edition, 2020, p. 572.
7. Pradhan, G.K. (2020) Introduction to Mining Technology, Vol. I & II, by Mintech Publication, Bhubaneswar(An AKS University Initiative).
8. Singh, T.N., Surface Mining, Lovely Prakashan, Dhanbad.

05MI352 - III SEMESTER
B.Tech. (Mining Engineering)
SURFACE MINING - LAB

Practical's

1. Drawing of schematic diagram showing different types of surface mining methods adopted in Coal, Lignite and non-coal mineral mining.
2. Designing various layouts for hilly deposits of vein and bedded formation.
3. Designing various types of layouts for deposits below the general ground level.
4. Designing of various types of layouts for placer deposits.
5. Designing a deposit by opencast mining, which has been partially excavated by underground mining.
6. 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).
7. Designing the blast hole charging, taking into consideration various parameters. (Field observation of a production mine blasting).
8. Measurement of blasting vibrations with Blastmate series III equipment and its analysis. Field observation and data recording.
9. Design of mine lighting and study/ measurement of their illumination level
10. Dragline bench layout

05MI303 - III SEMESTER
B.Tech. (Mining Engineering)
MINE DEVELOPMENT & DRILLING BLASTING

UNIT - I

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-II

Shaft Sinking - I - Mine Entries - Choice, location and size of mine entries, Access to seated deposits by Adit/Drifts/Incline-Introduction – Selection - Location - Preparatory work required - Sinking appliances, equipment and services - Sinking methods and procedure - Reaching up to the rock head - Pre-sink - Sinking through the rock-Shaft centering-Cycle (Drilling, Blasting, Lashing and mucking-Hoisting - Support or shaft lining - Auxiliary operations - Dewatering – Ventilation-Illumination)

UNIT - III

Shaft Sinking – II - Station construction and initial development(Cross-measure drifts and laterals) - Special methods of shaft sinking - Piling system-Caisson method-Sinking drum process-Forced drop-shaft method -Pneumatic caisson method - Special methods by temporary or permanent isolation of water -Cementation -Boring/Drilling-Cementation -Sinking and Walling - The freezing process - Drilling and lining of boreholes-Formation and maintenance of the ice column -Actual sinking operations - Thawing of ice wall - Freezing – Shafts - Shaft drilling and boring - Shaft drilling Shaft boring- Safety in sinking shafts & Statutory provisions as laid down under CMR, MMR & Circulars issued by DGMS.

UNIT - IV

Drilling – Introduction-selection-application-classification-construction of few drill machines – drill bits – operation & maintenance etc.

Explosives & Accessories used in Mines – Selection-Classification-Properties-Testing-Underground Coal Mines – Permitted & Non-Permitted Explosives-Explosives used in Quarries & Opencast Mines (details of selection, blast design, will be taught in Surface Mining) – Storage-Transport of explosives & accessories – Theories of Blasting – Environmental Impact due to Blasting – Safety during Blasting – Advances in Blasting

UNIT - V

Drifts/Drivages & Tunnels (Conventional Methods) - Introduction – Preparations for driving drivages/tunnels- Site investigations - Location of - Rocks and ground characterization-Size, shape, length and orientation (route) - function of drives and tunnels - Drivage techniques (for drives and tunnels) - Drivage techniques with blasting (Pattern of holes - Blasting off the solid in UG Gassy seams- Pattern of Holes-Charging and blasting the rounds - Placement of primer -Stemming - Depth

of round/hole - Charge density in cut-holes and rest of the face area - Smooth blasting). Post Blast Handling - Muck disposal and handling (mucking and transportation) - Ventilation during drivage/ tunneling - Working cycle (including auxiliary operations)-Driving large sized drives/tunnels in tough rocks.

Text Books/References

1. Bhandari, Sushil, Engineering Rock Blasting Operations, Published by A.A.Balkema Publisher Old post Road, Brook field, TO5036, USA, 1997, p. 375.
2. Deshmukh, D.J. Elements of Mining Technology, Vol. I, Published by Denett& Co., Nagpur.
3. Gokhale, B.V., Blasthole drilling Technology, Published by MultiFields, Bombay
4. Pradhan, G.K., (2020), Explosives & Blasting Techniques, Published by Mintech Publication, Bhubaneswar(An AKS University Initiative), 4th Edition, p. 572.
5. Pradhan, G.K. (2020) Introduction to Mining Technology, Vol. I, by Mintech Publication, Bhubaneswar (An AKS University Initiative).
6. Rao, K.U.M & Mishra, B., Principles of Rock Drilling, Oxford & IBH, 1999 Edition.
7. Singh, R.D., Principles & Practices of Modern Coal Mining, Published by New Age International Pvt. Ltd. New Delhi
8. Tatiya, R.R., Surface and Underground Excavations – Methods, Techniques & Equipment, Published by A.A. Balkema Publishers, 2005 Edition, p. 595.

References

9. Chugh, C.P., High Technology in Drilling and Exploration. Pub: Oxford & IBH Publishing Co. Pvt.Ltd. New Delhi.
10. Chugh, C.P.,Diamond Drilling. Pub: Oxford & IBH Publisher.
11. Howard, L.Hartman, Introductory Mining Engineering, Pub: John Willey & Sons
12. Indian Bureau of Mines, Minerals Year Book & other publications
13. 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), Ranchi
6. CMTM(Coal Mining Technology) Journal, IIMC Publication, Ranchi
7. Minerals & Metals Review, Mumbai.

05MI353 - III SEMESTER

B.Tech. (Mining Engineering)

MINE DEVELOPMENT - LAB

Practical

1. Study of Drill Cores
2. Development lay out for Mines (UG, & Opencast)
3. Shaft sinking layout
4. Blasting Pattern adopted in shaft sinking
5. Blasting pattern for drivages in rock
6. Use of Blast Vibration Monitor

7. Study of different types of Delay Detonators
8. Study of special methods of shaft sinking (any one type)

Mini Project

9. Study of use of explosives in UG/surface mines

05MS304 - IIIrd SEMESTER
B.Tech (Mining Engineering)
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. Agrawal, D.C., Engineering Mathematics-III, Saiprakashan
2. Das, H.K., Basic Engineering Mathematics-III, S.Chand& company Ltd.
3. Gupta, S. Engineering Mathematics-III, Dhanpat Rai Publishing Company(P) Ltd
4. Jain, D.K., Engineering Mathematics-III

Reference Books

1. Grewal, B.S., Engineering Mathematics, Khanna Publishers, 2004.
2. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 2005.

3. https://nptel.ac.in/content/syllabus_pdf/105105108.pdf - On Strength of Material
4. Prasad,C, Advanced Mathematic for Engineers, Prasad Mudranalaya,1996.
5. Ramana,B.V., Higher Engineering Mathematics,TataMcgraw-Hills Publishing Company Limited.

**05MI305 - III Semester
B.Tech. (Mining Engineering)
UNDERGROUND COAL MINING**

Unit - I

Trend of Underground coal mining,Development phase of Conventional Bord & Pillar mining Present status of UG coal mining in India.Necessity to change status quo and the importance in setting trend for UG coal mining in India.UG coal mining methods- cyclic and continuous mining methods. Choice/selection of UG method of mining and factors affecting the same.Development of coal seams by Bord & Pillar (B&P) method. Pillar size, pillar stability and statutes related to it in CMR, 2017.

Unit - II

Development –Developmentof mines by panel system and its merits. Factors affecting panel size. Layout of a B&P district with SDL/LHD with efficient ventilation, coal evacuation and strata control systems. Determination of RMR and support design in B&P development galleries.

Solid Blasting – Permitted Explosives – Accessories - Performance evaluation and safety while blasting – Special blasting techniques.

Provisions of CMR, 2017 related to development phase of B&P mining. Percentage extraction during development phase.

Unit - III

Continuous Miner Technology-Importance of Continuous Miner (CM) technology as a Mass Production Technology (MPT) in B&P method of mining- Its scope in Indian underground coal mines. Different machines as components of a CM equipment set and function of each machine. Suitable conditions for deployment of CM technology.

Development of a district with Continuous Miner- Typical layout of headings and configuration of the district for efficient use of CM equipment set. Operational cycle during development by CM. Ventilating system and work organization in a CM development district.Production, manpower & productivity during development by Continuous Miner.

Unit – IV

Depillaring by conventional B&P mining

Important technological terms related to depillaring operation. Preparation of panels for depillaring operation. Basic regulations under CMR, 2017 related to depillaring operation (Precautions against spontaneous heating, provisions for isolation of depillaring area and provisions for strata control during depillaring). Different methods of depillaring in conventional B&P mines- Split and rib method, stook method, depillaring with caving, depillaring with stowing; Lines of extraction and their applicability. Sequence of operation and strata control during operation.Judicious consideration for sizes of ribs and their partial extraction during

retreat. Area of exposure during depillaring. Percentage extraction of coal during depillaring of panels.

Unit – V

Depillaring (Contd.)

Continuous Miner- Different methods of depillaring by CM (Split & Fender, Nevid, Fishbone etc) and their applicability. Strata control during depillaring by CM- concept of Roof Bolt Breaker Line (RBBL), use of resin bolts, determination of anchorage points for bolting. Snook pillars, their design and dimensions during depillaring by CM. Instrumentation and monitoring of strata during depillaring with Continuous Miners.

Text books/References

1. Das, S.K., Modern Coal Mining Technology, Lovely Prakashan
2. Deshmukh, D.J., Elements of Mining Technology, Vol. I, Dennet & Co. Nagpur
3. Deshmukh, R.T. & Deshmukh, D.J, Winning and Working Coal, Vol 1& 2.
4. Mathur, S.P. & Singh, N.K. (Editors) Coal Mining & Management, Vol. I to IV.
5. Singh, R.D, Principles & practices of coal mining, New Age Intl. Pvt.Ltd, New Delhi
6. Singh, J.G.(2000) Underground Coal Mining Methods, Published by Braj-Kalpa Publishers, Varanasi.
7. Singh, T. N., Underground winning of Coal, Oxford and IBH New Delhi, 1992
8. SCCL, 2010, Procc. Volume of National Seminar on UG Mining, 28th Aug, 2010. (<https://scclmines.com/downloads/NationalSeminarSOUVENIR.pdf>).
9. An AKS University Initiative : Introduction to Mining Technology, Vol. II (Editor: DR G.K.Pradhan, Authors : S. Dasgupta, Prof S.Jayanthu & Dr B.K.Mishra), Mintech Publications, Bhubaneswar, 2020.

**05MI354 - IIIrd Semester
B.Tech. (Mining Engineering
UNDERGROUND COAL MINING - LAB**

PRACTICALS

1. Layout of a conventional Bord & Pillar development district giving details of a. Ventilation system b. coal evacuation system c. Material transportation system & d. Support system. Assume the following parameters: 1. Depth of working 2. Seam thickness 3. RMR of immediate roof 4. Gallery width.
2. Calculation of production parameters from a B & P development district and extraction % during development. Assume : 1. No. of headings 2. No of deployed machineries Blasting parameters – Calculate the powder factor and detonator factor.
3. Draw the organization chart for a large underground mine and organization chart for a mining company.
4. Optimum layout of a CM development district showing a. ventilation system b. equipment configuration,

5. Time cycle analysis of a CM developed district with the aim to optimize equipment efficiency and production parameters during development.
6. Strata control in continuous miner depillaring by use of roof bolting breaker line and snook pillar design.
7. Mine Visit.

05ME306 - III SEMESTER
B.Tech. (Mining Engineering)
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.

Text Books

1. Ferdinand P. Beer, F.P. et el, Mechanics of Materials, Publisher: McGraw-Hill Education; 7th edition, 2014, p. 896.
2. Kazimi, S.M.A., Solid Mechanics, Publisher: McGraw-Hill Education; 2017 edition, p. 450.
3. Timoshenko & Young, Elements of strength of material, East West Press, 2003.

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.

05ME355 - III SEMESTER
B.Tech. (Mining Engineering)
STRENGTH OF MATERIALS - LAB

Practical

1. Study of UTM
2. To perform the tensile strength of Mild steel on UTM and draw Stress-Strain Curve
3. To determine strength of wood on UTM - along the grain and across the grain
4. To determine the shear strength of Mild Steel on UTM
5. To study the Brinell Hardness Machine and to determine the Brinell Hardness of the given material.

6. To study the impact testing machine and test specimen of Izods and charpy
7. To study the fatigue testing machine and to find out the endurance limit of the given material.
8. To spring the testing machine
9. To study the Rockwell Hardness Testing machine.
10. To study the bucklling of column

05GE401 - IV SEMESTER
B.Tech. (Mining Engineering)
GEOLOGY II

Unit – I Stratigraphy

Introduction-Definitions and Basic Principles of Stratigraphy: Units of Stratigraphy -correlation Criteria for Stratigraphic Classification. Standard Geological Time Scale. Mineral resource distributions and economic importance of Archean, Paleozoic, Mesozoic and Cenozoic rocks of India.

Unit - II Economic Geology

Important terminology of Economic Geology. Ore forming process, mineral deposits formed from magmatic, hydrothermal and volcanic process: mechanical concentration, oxidation and supergene enrichment.

Unit - III Economic Indian Mineral Deposits

Metallic, non-metallic deposits, study of graphite, copper, zinc, lead, gold, iron, manganese, radioactive minerals, asbestos, mica, gemstone-origin, mode of occurrence and distribution in India. Origin and occurrence of industrial minerals-ceramic, refractory, abrasive, glass and paint industry.

Unit - IV Coal and Petroleum Geology

Origin, physical properties, processes, occurrence of coal and its types, petroleum deposits. Fossil fuel distribution in sedimentary basins of India.

Unit - V Geophysics, Remote Sensing and GIS

Geophysical prospecting methods – seismic, electrical, magnetic and gravity methods of mineral prospecting. Introduction to aerial and satellite remote sensing. Applications of remote sensing and GIS in geological mapping and mineral exploration.

Text Books

1. Kumar, R, Fundamentals of Historical Geology and Stratigraphy of India, New Age International Private Limited; Second edition (2020).
2. Krishnan, M.S., Geology of India and Burma, CBS; 6 Edition (2017)
3. Krishnan, M.S. & others, Economic Mineral Deposits, CBS Publishers & Distributors, 2006.
4. Todd, D.K., 1980, Ground-water hydrology (Second Edition): John Wiley and Sons

Reference Books

1. Araogyaswamy, R.N.P, Courses in Mining Geology, CBS Publishers And Distributors Pvt Ltd; Fourth Edition edition2018).
2. Marjoribanks, R., Geological Methods in Mineral Exploration and Mining, Springer Heidelberg Dordrecht London New York
3. Park, James; A Text book of Mining Geology, Charles Griffin &Co.Ltd (1918).
4. Reddy, D.V.Applied Geology, Vikas Publishing House Pvt Ltd; First edition (2010)
5. Reddy, D.V., Engineering Geology, Vikas (2016)
6. Vaidyanandhan, R. & M. Ramakrishnan, Geology of India (Vol. I & II), GSI Publication.

**05GE451 - IV SEMESTER
B.Tech. (Mining Engineering)
GEOLOGY II - LAB**

Practical's

1. To determine the rank of coal on the basis of banded constituents.
2. To determine the specific gravity of metallic minerals.
3. To determine the specific gravity of non metallic minerals
4. Identification of hand specimen of metallic minerals (Cu, Pb, Zn, Mn, Fe, Al)
5. Identification of hand specimen of non metallic minerals (Limestone, Dolomite, Zypsum, Mica, Talc)
6. To Study stratigraphy & geological map of Post Cambrian.
7. To Study stratigraphy & geological map of Pre Cambrian.
8. Reserve estimation of given ore deposit data.
9. Identification of natural and synthetic gem stones.
10. Field Visit

05CE402 - IV SEMESTER
B.Tech. (Mining Engineering)
MINE SURVEYING – I

Unit - I

Linear Measurement and Angular Measurement (Theodolite)

Introduction of Surveying, Linear Measurement Ranging etc. PARTS - Terms used - Temporary adjustments - - such as ranging, stablishing new station, horizontal angle, vertical angle, bearings, permanent adjustment.: bearing & type of bearing of lines. Traversing – continuous Azimuth, double fore sight methods – computation of bearings of traverses

Unit - II

Theodolite- Purpose of traversing first, second and third order traverse, closed and open traverse. Included and direct angles, Latitude, Departures, checks-corrections of the traverse-Bowditch rule and transit rule. problems on rectangular coordinates – calculation of areas

Unit-III

Compass Survey (Traversing): Theory of Magnetism; Dip of Magnet needle; Prismatic Compass; Surveyor's Compass; Calculation of Included Angle; Local Attraction; Magnetic Declination. Tachometry. Measurements.

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.

Unit - V

Curve and its type and setting of curves. 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.

Text Books:

1. Ghatak, S., Mines Surveying, Published by Lovely Prakashan, Dhanbad
2. Kanetkar, T.P. & Kulkarni, S.V., 2010, Surveying & Levelling, Part I & II, New Central

- Book Agency.
3. Punmia, B.C., Surveying Vol. I, Published by Firewall Media, 2005
 4. Punmia, B.C., Surveying, Vol. II, Laxmi Publications, 2005.

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.

**05CE452 - IV SEMESTER
B.Tech. (Mining Engineering)
MINE SURVEYING – I - LAB**

Practical:

1. Make a Theodolite traverse
2. Determine the tachometry constant in field.
3. To Determine the distance from tachometry
4. To Study the Dumpy Level and Auto Level.
5. To Study the Theodolite.
6. To Study the various Survey Instruments total station
7. To Study the Prismatic Compass.
8. To Determine the fore bearing and back bearing by the use of Prismatic compass.
9. To Determine the area by Co ordinate method.
10. To Determine the Height of an Object by using Theodolite.

IV SEMESTER
B.Tech. (Mining Engineering)
ROCK FRAGMENTATION & RELIABILITY ENGINEERING (DE)

Unit-I

General theories of rock cutting, Design of cutting tools for optimum penetration and wear characteristics, Mechanics of Rotary and percussive drilling, Mechanics of coal cutting tools,

Unit-II

Drillability and machinability characteristics of rocks. Advances in rock cutting techniques. Mechanics of rock breakage in blasting.

Unit-III Reliability Engineering

Introduction to reliability concepts, Unit and system reliability – forward models, Density and distribution functions

Unit-IV

Fault tree analysis, HAZOP analysis, Risk and criticality analysis, maintainability analysis,

Unit-V

Calculations of maintainability parameters, Availability calculations, and maintenance management

Textbook

1. Bhandari, Sushil, Engineering Rock Blasting Operations. Pub: A.A.Balkema Publisher USA, 1997, p. 375.
2. Dhillon, Balbir S., Mining Equipment Reliability, Maintainability, and Safety, Published by Springer-Verlag London, 2008 Edition, p. 201 + XVIII.
3. Kumar, U., Ahmadi, A., Verma, A.K., Varde, P. (Eds.), Current Trends in Reliability, Availability, Maintainability and Safety An Industry Perspective, Procc. of ICRESH-ARMS 2015 conference in Lulea, Sweden, Published by Springer International Publishing, 2016, p. 738+XV.
4. Pradhan, G.K., Explosives & Blasting Techniques, An AKS University Initiative - Mintech Publications, 4th Edition, 2020, p. 572.
5. Singh, P.K. et el (Editors), Rock Blasting Techniques – Challenges & Opportunities, Procc. of RBT-2018, CIMFR, 23-24 Nov, 2018, p. 401.

05MI403 -IVth Semester
B.Tech (Mining Engineering)
ADVANCED UNDERGROUND COAL MINING

Unit - I

Mass Production Technologies Continuous Miner (CM) technology-Mass Production Technology in B&P method of mining-Different machines as components of a CM equipment set and function of each machine. Suitable conditions for deployment of CM technology. Development of a district with Continuous Miner- Typical layout of headings and configuration of the district for efficient use of CM equipment set. Operational cycle during development by CM. Ventilating system and work organization in a CM development district. Production, manpower & productivity during development by Continuous Miner.

Unit - II

Depillaring by Continuous Miner- Different methods of depillaring by CM (Split & Fender, Nevid, Fishboneetc) and their applicability. Strata control during depillaring by CM- concept of Roof Bolt Breaker Line (RBBL), use of resin bolts, determination of anchorage points for bolting. Snook pillars, their design and dimensions during depillaring by CM. Instrumentation and monitoring of strata during depillaring with Continuous Miners.

Unit III

Longwall - Technology-Concept of Longwall mining- formation of large coal blocks. Geomining conditions suitable for Longwall mining-Development of Longwall panels- machines for gate road (Long headings) development and their operations. Ventilation, supporting, coal evacuation and other auxiliary systems during development of Longwall panels-Powered support Longwall equipment set and its component machinery. Function of each machine of the powered support Longwall (PSLW) set.

Unit IV

Longwall (contd.) - Types of Longwall methods of mining- Advancing and Retreating Longwall. Applicability of both these methods of Longwall mining. Layout of advancing Longwall with detail of supporting the gate roads and packwalls. Process of pack-walling - Layout of Longwall retreating Longwall system with caving. Longwall geometry- panel dimensions, face length, extraction height, cutting web. Cycle of operation at Longwall face-production, manpower and productivity. Monitoring of strata at Longwall face and in gate roads.

Unit V

Thick seam mining - Special methods of mining. Definition of thick seam. Challenges associated with thick seam mining. Different methods of mining of thick seams. Thick seam mining with B&P system-Cable bolting method, horizontal and inclined slicing with caving and stowing, Multi-section system.

Multi-slice Longwall caving, Integrated Longwall caving. Sub-level caving method. Special methods of mining- Jankowise method of mining (Method practiced at Sudamdih mine). Shield method adopted in thick seams with high inclination of seams. Hydraulic mining- conditions for its applicability – Punch Longwall Method (case study of Adriyala Longwall Project of SCCL).

Text books

1. Das, S.K., Modern Coal Mining Technology, Lovely Prakashan
2. Deshmukh, R.T. & Deshmukh, D.J, Winning and Working Coal, Vol 1 & 2
3. Jha, G.K. & Prasad, N. An Experience of Longwall Mining In India-A Practitioners' Handbook & Approach, Lovely Prakashan, Dhanbad.
4. Mathur, S.P. & Singh, N.K. (Editors) Coal Mining & Management, Vol. I to IV,
5. Mukherjee, S.N., 1993, Longwall Machinery and Mechanisation, Published by A.M. Publishers.
6. Singh, R.D, Principles & practices of coal mining, New Age Intl. Pvt. Ltd, New Delhi
7. Singh, J.G. (2000) Underground Coal Mining Methods, Published by Braj-Kalpa Publishers, Varanasi.
8. Singh, T. N., Underground winning of Coal, Oxford and IBH New Delhi, 1992
9. SCCL, 2010, Procc. Volume of National Seminar on UG Mining, 28th Aug, 2010. (<https://scclmines.com/downloads/NationalSeminarSOUVENIR.pdf>).
10. An AKS University Initiative : Introduction to Mining Technology, Vol. II (Editor: Dr G.K. Pradhan, Authors : S. Dasgupta, Prof S. Jayanthu & Dr B.K. Mishra), Mintech Publications, Bhubaneswar, 2020.

05MI404 - IV SEMESTER
B.Tech. (Mining Engineering)
MINE VENTILATION & ENVIRONMENT 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; 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, Mine Dust – sources, prevention and control, standard of dustiness, dust survey and measurement.

Text Books/References

1. Banerjee, S.P., Mine Ventilation, Lovely Prakashan, Dhanbad
2. Hartman, Howard, L. Introductory Mining Engineering, Pub: John Willey & Sons
3. Hartman, Howard L., et al, Mine Ventilation and Air Conditioning, Published by John Willey & Sons
4. Kaku, L.C., Numerical Problems on Mine Ventilation. Pub: Punam Publisher
5. Mishra, G.B., Mine Environmental Engineering. Pub: Dhanbad Publisher, Dhanbad
6. An AKS University Initiative : Introduction to Mining Technology, Vol. II (Editor: Dr G.K.Pradhan, Authors : V.S.Ram), Mintech Publications, Bhubaneswar, 2020.

05MI453 - IV SEMESTER**B.Tech. (Mining Engineering)****MINE VENTILATION & ENVIRONMENT I - LAB****Practical:**

1. Different gases found in coal mines, 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, velometeretc, measurement of temperature, pressure etc.
8. Ventilation survey problem.
9. Auxiliary fan problem.
10. Networking problems

05ME405 - IV SEMESTER
B.Tech. (Mining Engineering)
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.

Test Books

1. Bansal, R.K, A Textbook of Fluid Mechanics and Hydraulic Machines Paperback – 1 2018, Laxmi Publications, New Delhi.
2. Bamanker, G.B., TaralYantrikiAvum Machinery (Hindi), Published by Deepak Prakashan, Gwalior.
3. Khurmi, R.S., and Khurmi, N. Hydraulics, Fluid Mechanics and Hydraulic Machines Published by S.Chand, New Delhi.
4. Lal, Jagdish, Hydraulics & Hydraulic Machines, Published by Metropolitan.
5. Manohar, M., and Krishnamachar, P., Fluid Mechanics Volume 1: 2013, Strategic Book Publishing

**05ME454 - IV SEMESTER
B.Tech. (Mining Engineering)
FLUID MECHANICS - LAB**

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.

05MS406 - IV SEMESTER
B.Tech. (Mining Engineering)
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.

Text Books

1. Gupta, S.C., & Kapoor, V.K., Fundamental of Applied Statistics, S. Chand & Sons,1996
2. Ray, M. & others, Mathematical Statistics, Ram Prasas Publications; First Edition 2017, p. 896.
3. Sharma, H.L., Practicals in Statistics, Agrotech Publishing Academy, Udaipur, 2007 Edition.

05MI501 - V SEMESTER
B.Tech. (Mining Engineering)
MINING MACHINERY - I

Unit 1 General and Mechanical transmission of power

Basic concepts of SI units, Laws of motion & their implications, Coplaner forces, Moments of inertia, Work, energy & Power, Radius of gyration.

Mechanical Transmission of power- Levers, Classes of levers, compound levers: Pulleys, shafts for transmission of powers, Couplings & their types, clutches, Toothed gears, simple train & compound train of gears. Belt drives & V-Belt drives, Use of diesel and lubricants for UG and surface mines.

Unit – II Compressed air system

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:

Unit III

Introduction to drilling systems; Different types of drills and their construction features – compressed & hydraulic, diesel and electric 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,

UNIT-IV

Hydraulics - 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 - V

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

HEMM required for production method- Constructional features of 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(IPCC).

Text Books/References

1. Chugh, C.P., High Technology in Drilling and Exploration, Published by Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Dey, Amitosh, Heavy Earth Moving Machinery, Lovely Prakashan, Dhanbad
3. Karelin, N.T., Mine Transport, Published by Orient Longmans Ltd. New Delhi.
4. Mishra, G.B., Surface Mining, Published by Dhanbad Publisher
5. Pathak, Khanindra, Mining Machinery Maintenance and Capacity Utilization, Published by Cygnus Publication, Kolkata 3. Ramlu, M.A., Mine Hoisting, Published Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
6. Singh, R.D., Principles & Practices of Modern Coal Mining, New Age International Pvt. Ltd. New Delhi.
7. An AKS University Initiative : Introduction to Mining Technology, Vol. III (Editor: Dr G.K.Pradhan, Authors : Ajeet Mehra, Diwakar Dubey & S.Dasgupta), Mintech Publications, Bhubaneswar, 2020.

05MI552 - V SEMESTER
B.Tech. (Mining Engineering)
MINING MACHINERY I - LAB

Practical

1. Layout for Transmission and distribution of compressed air for surface and underground mines
2. Shop floor method for leakage quantification for compressed air system
3. Construction of Jack Hammers
4. Application of closed centre hydraulic circuit
5. Construction of TCR bit used in surface mine drilling
6. Constructional features of Electric rope shovels
7. Constructional features Application of Bucket Wheel Excavators
8. Construction feature of draglines.
9. Study of surface miner
10. Study of rock breaker

05MI502A - V SEMESTER
B.Tech. (Mining Engineering)
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, Problems related to Correlation .

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

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. DGMS Notification number GSR973(E) 1st October 2018, Specifications of Limits of Errors to be studied.

Unit - IV

National grid map projection cassini lamberts polyconic and universal transfer of Mercator: Theodolite in stope surveying; Tape triangulation; Survey of flat moderately and steeply inclined and vertical workings traversing along steep working with or without axially telescope. Surveying of OB dump slope and instruments used. Photogrammetry.

Unit - V

Application of computer in surveying DGPS. Statutory provision related to surveying planes and section under CMR 2017 and MMR 1961 (Proposed amended volume of MMR). Use care testing calibration surveying instruments. Reserve calculation. Field Astronomy: Important definitions; Determination of Azimuth by observation of star. Application of laser / Scanners in surveying; Electronic distance measuring equipment; Total station.

Text Books/References

1. Ghatak, S., Mine Surveying and Levelling – Vol I, II & III, Coal Field Publishers, Asansol,
2. Kanetkar, D.K. Surveying & Levelling, Vol I & II, Published by Pune Vidyarthi Griha Prakashan, Pune.
3. Punmia, .B.C. Surveying Vol. I, II & III, Pub: Laxmi Publication, New-Delhi.

05MI554 - V SEMESTER**B.Tech. (Mining Engineering)****ADVANCED MINE SURVEYING-FIELD WORK/LAB****Practical**

1. Various methods of correlation and its practical applicability assuming the underground mining conditions.
2. Measurement of Base-line for triangulation survey in difficult ground conditions.
3. Planimeter and calculation of areas with its help.
4. Study of surface plan underground plan and ventilation plan.
5. Determination / Calculation of α on dip-strike by construction/calculation method,
6. Determine the area by total station
7. Total station traverse survey.
8. Exercise with the help of GPS, and other latest instruments
9. Exercise of triangulation in flat & large area.
10. Preparation and preservation of plans

05MI502–B - V SEMESTER
B. Tech. (Mining Engineering)
MINE AUTOMATION (DE)

Unit-I

Scope and role of automation in mining operation and human related factors. System engineering approach and use of operational data from mining equipment and its use the mining process.

Unit-II

Data communication and modern computerized control systems. Data formats and IREDES, mine process data, AGV technology Basic foundations for automation of mining equipment. navigation, surface navigation and GNSS (satellite navigation), mine planning tools, etc

Unit-III

Automation of drilling and drill rig, drilling process. Automation of underground loading and transportation systems. Automation in tunneling projects.

Unit-IV

Automation in monitoring of environments in longwall and continuous mining system
Automation of transportation system in surface mining.

Unit-V

Use of robotics in mining for production and disaster management purpose Drones.

Text Books

1. O'Shea, J. and Polis, M. (Editors), Automation in Mining, Mineral and Metal Processing
1st Edition, Proceedings of The 3Rd Ifac Symposium, Montreal, Canada 18-20 August 1980.

05MI503 - V SEMESTER
B.Tech. (Mining Engineering)
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.

Text Books/References

1. Cummins & Givens. SME Mining Engineering Handbook, Vol. I & II, Pub: A.I.M.M. NY.
2. Howard, L.Hartman. Introductory Mining Engineering, Pub: John Willey & Sons.
3. 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.

4 An AKS University Initiative : Introduction to Mining Technology, Vol. II [Editor: Dr G.K.Pradhan, Author : P.K.Palit, Dy. DGMS (Retd.)], Mintech Publications, Bhubaneswar, 2020.

05MI5553 - V SEMESTER
B.Tech. (Mining Engineering)
UNDERGROUND METALLIFEROUS MINING - LAB

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 underground 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 MP & Rajasthan, Odisha and MP

05MI504 - V SEMESTER
B.Tech. (Mining Engineering)
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(PSI), 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.

Text Books/References

1. Deb, Debasis & Verma, A.K., Fundamentals and Applications of Rock Mechanics, PHI Learning Private Ltd, 2016, p. 473.
2. Jaeger, Charles, Rock Mechanics & Engineering. Pub: Cambridge University Press, Cambridge London, 2009, p. 536

3. John Jaeger, J, Cook, N.G., & Robert Zimmerman, Robert, Fundamentals of Rock Mechanics, Pub: Chapman & hall, London, 2007, p. 499.
4. Leonard Obert, Leonard, & Duvall, Wilbur I., Rock Mechanics and design of structures in rock., Pub: John Willey & Sons, 1967, p. 650.
5. Peng, Syd S., Advances in Coal Mine Ground Control. Pub: John Willey & Sons , 2017, p.462.
6. Verma,B.S. Elements of Mechanics of Mining Ground. Pub., Tuhin & Co., E-1898(MIG) Rajajipuram, Lucknow, U.P.
7. Vutukuri V.S. & Lama, R.D., Handbook of Mechanical properties of rock, Vol. I & II. Pub: Transtech, Germany.
8. An AKS University Initiative : Introduction to Mining Technology, Vol. II (Editor: Dr G.K.Pradhan, Authors : S. Dasgupta), Mintech Publications, Bhubaneswar, 2020.

05MI555 - V SEMESTER

B.Tech. (Mining Engineering)

ROCK MECHANICS & STRATA CONTROL - LAB

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.

05ME505-B - V SEMESTER
B.Tech. (Mining Engineering)
REMOTE SENSING & GIS (OC)

Unit-I

Real property boundary determination, aerial and digital mapping, Geodesy and geodetic surveying, GPS, Basics of photogrammetry.

Unit-II

Introduction to remote sensing: sensors, present status of remote sensing satellites, Digital image processing techniques; introduction to digital terrain modelling;

Unit-III

Environmental resource mapping, Geomatics application programming. Introduction to Land and Geographic Information Systems; Different coordinate system, working principle of GIS,

Unit-IV

Database associated with GIS, Applications of GIS in surface mining, Applications of GIS in land development, road construction, etc.

Unit-IV

Hands on exercise on Image processing and GIS packages

Textbooks/References

1. Bhatta, B. Remote Sensing and GIS Published by Oxford; Second edition, 2011, p. 752.
2. Sahu, K.C., Textbook of Remote Sensing and Geographical Information Systems, 2018, p. 521.

05MI506 – V Semester
B.Tech (Mining Engineering)
MINE ELECTRICAL TECHNOLOGY

Unit I

DC Machines: Construction, working (Generator and Motor), EMF Equation, Classification, Magnetizing Characteristics and Load Characteristics DC Generator, Starting of DC Motor, Speed/Current/Torque Characteristics of DC Series Motor, Speed Control Methods.

Unit II

Induction Motors: Construction (Squirrel Cage and Slip Ring), Working, Starters, Equivalent Diagram, Concept of Slip and Torque-Slip Characteristics .Basic Concept of Single Phase Induction Motor.

Synchronous Machine: Alternator: Construction, working , EMF Equation, Voltage Regulation, Concept of Synchronization. Synchronous Motor: Working, application as a condenser and as a reactor.

Unit III

Electrical Drives and Power Semiconductor Controller: Introduction to power semiconductor devices, basic principles of operation of thyristor controlled variable speed mine electrical drives, Selection of motors and starters for mining applications, Electrical braking.

Signaling and Communication: Haulage and Coal face signaling systems for underground coal mines, basic concept of underground mine communication.

Unit IV

Power Distribution in Mines: Radial and Ring–main distribution systems, substation arrangements for opencast and underground mines, Distribution of electrical power in mines, Mining type cable and its testing.

Mining type Switchgears and Protective Devices: Types of Electrical Fault, Types of circuit breakers, Gate end box, Drill panel, Thermal and induction disc type overload relays; mining type earth fault relay.

Power Economics: Types of industrial tariffs, power factor improvement in mines.

Unit V

Energy Conservation: Energy Conservation efforts, Energy Conservation Act, Bureau of Energy Efficiency in India, Energy Audit.

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.

Text Books

1. Chakravorti, P.K., Electricity in Underground Mines, CMPDIL Publication.
2. Chakrabarti, A. et al, Text Book on Power System Engineering, Dhanpat Rai Publishing Company (P) Ltd., 2008.
3. Cotton, H. Electrical Equipment in Mines, Publisher: George Newnes Ltd England, first edition 1955, p.456 .
4. Datta, N.K., Electrical Engineering in Mines, New Central Book Agency(P) Ltd, 2007, p. 254.
5. Dubey, G.K., Electrical Drives, Published by Narosa, Second Edition 2010, p. 408.
6. Hussain.A., Fundamentals of Electrical Engineering, Publisher: Dhanpat Rai & Co. (P) Limited; Fourth edition, 2016, p.944.
7. Nagrath, I.J. and Kothari, D.P.. Electrical Machines, Publisher: McGraw Hill Education; Fifth edition (23 June 2017), p. 1000.
8. Statham, I.C.F, Coal Mining Practice [Vol – III], The Caxton Publishing Co., 1958 edition.
9. PCRA : Practical Guide to Energy Conservation : PCRA Publications (Unit V).
10. Electrical Engineering in Mines, by N.K.Datta
11. Indian Electricity Act & Rules
12. DGMS Circulars.
13. An AKS University Initiative : Introduction to Mining Technology, Vol. III (Editor: Dr G.K.Pradhan, Authors : Ajeet Mehra, Diwakar Dubey & S.Dasgupta), Mintech Publications, Bhubaneswar, 2020.

05MI551 – V Semester

B.Tech (Mining Engineering)

MINE ELECTRICAL TECHNOLOGY - LAB

List of Practical's

1. Demonstration of DC Machine Parts.
2. Magnetizing Characteristics of DC shunt Generator.
3. Load Characteristics of DC compound/Shunt Generator.
4. Load Characteristics of Alternator and Calculation of Voltage Regulation at various Loads.
5. Demonstration of different types of Induction Machine and its various parts.
6. Study the operation of DOL, Star-Delta and Slip Ring Starter.
7. Performing Load Test on 3- Φ Induction Motor and Obtaining slip-torque Characteristics.
8. Study the constructional detail and Testing of Underground Cable.
9. Understanding the working of Earth Fault Relay.
10. Understanding the biasing of Semiconductor Device (Diode) and drawing the V-I Characteristics.
11. Observing the variation in speed of Motor using Power Electronic Devices.

05EE601 - VI SEMESTER
B.Tech. (Mining Engineering)
INNOVATIVE & SUSTAINABLE MINING

Unit I

Legislative measures for Sustainable Development – MMDR Act 2015 – Star Rating of Indian Mines (Coal & non-coal Mines) 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 – Hydrogen as fuel for 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. Artificial intelligence in the mining industries.

Text Books/Reference

1. Annual Report of Ministry of Coal, Ministry of Mines, MoEF & Climate Change.
2. Joseph Hirschi, Joseph (Editor), Advances in Productive, Safe, and Responsible Coal Mining, Published by Elsevier Ltd, 2019, p.324.
3. Procc. of S D Miner 2014 – National Seminar on Sustainable Development in Mineral & Earth Resources, New Delhi, Published by The Indian Mining & Engineering Journal, Bhubaneswar & AKS University, Satna.
4. HZL Publication (CEO: Akhilesh Joshi) : Journey Towards a Greener Zinc, p.48.
5. Mukherjee, Saumitra, Capacity building in Geosciences and Sustainable Development, Min. of Mines (Govt. of India) web site.

6. An AKS University Initiative : Introduction to Mining Technology, Vol. III [Editor: Dr G.K.Pradhan, Author : S.Dasgupta & P.K.Palit] Mintech Publications, Bhubaneswar, 2020.

05GE654 - VI SEMESTER
B.Tech. (Mining Engineering)
INNOVATIVE & SUSTAINABLE MINING

MINI PROJECT

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

VI SEMESTER
B.TECH. (Mining Engineering)
BULK MATERIAL HANDLING (OC)

Unit I

Properties of bulk material vis-a-vis different bulk handling operations; Classification of bulk material transportation systems,

Unit II

Mine hoist: Drum and koepe winders, constructional features, kinematics, torque and power calculation, speed control, safety contrivances, selection of mine winders, cages, skip, suspension gears, headgear structures, cage guides, pit top and pit bottom circuits and layouts

Unit III

Conveyors: Belt conveyor, chain conveyor, cable belt conveyor, shaker conveyor, vibratory conveyor, constructional features and power calculations, selection and application

Unit IV

Aerial Ropeway: Mono-cable, bi-cable, twin-cable ropeway, constructional features and power calculations, selection and application Scraper Haulage: Constructional features, applicability, advantages and disadvantages

Unit V

Men and material transportation: Cutting and loading machines for coal/ore, special men and materials transport in mines, men riding systems in mines. Hydraulic and pneumatic conveying; Stacking, blending and reclaiming of bulk materials; Automation and online monitoring of bulk material handling system. Design of storage system: Silos, bins and bunkers; Rapid loading system, Merry-go-round system

Textbooks/References

1. Alexandrov, M. P. Material handling equipment, MIR , 1st Ed

2. N. Mukherjee, Materials Handling in Mines, Vol- XI, Technology mining society IIT Kharagpur , 1st Ed.
3. Peter Darling, SME Mining Engineering Handbook, Vol. 1, Society for Mining, Metallurgy, and Exploration Inc. (US) , 3rd Ed

05MI602 - VI SEMESTER
B.Tech. (Mining Engineering)
MINE VENTILATION & ENVIRONMENT 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.

Text books/References

1. Donald Mitchell; “Mine Fires, Prevention, Detection fighting” ISEE Publication Cleveland, Ohio.
2. Mishra, G.B. Mine Environmental Engineering. Pub: Dhanbad Publisher, Dhanbad.
3. Ramlu, M. R. “Mine Fires, Explosion, Recovery & Inundation”, Dhanbad Publisher, Dhanbad.
4. SCCL, (Patron : R.H.Khwaja), Mines Rescue Services Manual, 2005, p. 221.
5. Stone, D. “Minefill 2001” Proceedings of the International Symposium on Mining with Backfill” SME Publication 2001.

05MI654 - VI SEMESTER
B.Tech. (Mining Engineering)
MINE VENTILATION & ENVIRONMENT II - LAB

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 resuscitation.

05MI603 - VI SEMESTER
B.Tech. (Mining Engineering)
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; Shot creting & 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.

Text books/References

1. Bieniawski, Z.T., Rock Mechanics Design in Mining and Tunneling, Pub: A.A. Balkema, P.O. Box 1675, 3000 BR Rotterdam, Netherlands, 1984 P. 274.
2. Brady, Barry H.G., Brown, E.T., Rock Mechanics For underground mining, 2006, p. XVIII+628.
3. Brown, E.T., Rock characterization, testing and monitoring – ISRM suggested method, Pergamon Press, Oxford, 1981 P. 281.
4. Hoek E. and Brown, E.T. Underground excavations in Rock, Institutions of Mining and Metallurgy, London, 1980 P 280.
5. Hoek, E. & Bray, J.D., Rock Slope Engineering, Taylor & Francis, Taylor & Francis, 1981, p. 364.
6. Indian Bureau of Mines, Application of Rock Mechanics in Surface and Underground Mining, 2014, p. 165.
7. Sarkar, S.K., Ground Control in Mining, Oxford & IBH, 1997 Edition, p. 186.
7. Ulusay, R. (Editor), The ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 2007-2014, Springer International Publishing, 2015, p. XIII+293.
8. Verma, B.S., Elements of Mechanics of Mining Ground. Pub. Tuhin& Co., E-1898 (MIG) Rajajipuram, Lucknow, U.P., 2012, 832.

05MI651 - VI SEMESTER

B.Tech. (Mining Engineering)

ADVANCED ROCK MECHANICS & 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

05MI604 - VI SEMESTER

B. Tech. (Mining Engineering)

MINING MACHINERY – II

Unit-I

Wire ropes Uses in mines- types and their construction, installation, maintenance, tests and safety features; Rope splicing and change of ropes, rope cappings and process of capping

Unit-II

Winders & winding systems 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.

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

UNIT – III

Face equipment in UG mines Construction, operation, maintenance and design calculations, safety devices for - Face Machinery - Slushers, scrapers etc. Loaders: SDL, LHD, LPDT, shuttle cars; Cutter loaders: Shearer, Coal Plough, Continuous miner, Bolter miner Road headers, Cable bolting machine. Constructional details of Powered Support

Unit-IV

UG Conveying system Construction, operation, maintenance and design calculations, safety devices for - Rope Haulage - Transport: Track and trackless; Mine tubs and Mine cars; Haulage track-laying and maintenance; Gauge selection.

Unit-V

UG Conveying system (contd.) Construction, operation, maintenance and design calculations, safety devices for - 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; Mono rails.

Conveyor Haulage: different types, their construction, installation, maintenance and design calculations; Armoured Face Conveyor, Longwall auxiliary machineries.

Text Books/References

1. Kerelin. Mine Transport. Published Orient Longmans Ltd. New Delhi.
2. Rosenblatt, Joseph., Bancroft Library Regional Oral History, Wayne Dowdey, Wayne, Eimco, Pioneer in Underground Mining Machinery and Process Equipment, 1926-1963: Oral History Transcript, Creative Media Partners, LLC, 12-Oct-2018 - 256 pages.
3. Ramlu, M.A., Mine Hoisting, Published by Oxford & IBH Publishing Co. Pvt. Ltd., New Delh, 2015 P. 550.

05MI552 - VI SEMESTER
B. Tech. (Mining Engineering)
MINING MACHINERY – II - LAB

Practical

1. Constructional features of winding rope
2. Constructional features of Detaching hook
3. Process of changing of winding rope and its requirement as per regulation.
4. Designing direct rope haulage system in moderately dipping coal seam.
5. Endless rope haulage and its designing aspects.
6. Suspension gear arrangement of the shaft.
7. Constructional details of Powered Support
8. Belt conveyors with their design parameters used in mines.
9. Layout of pit bottom with skip arrangement
10. Constructional features of Continuous Miner
11. Constructional features of Different types of winding system Constructional features of

05MI605 - VI SEMESTER
B.Tech. (Mining Engineering)
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 settling 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.

Text Books/References

1. Jain, S.K. Mineral Processing, CBS Publishers & Distributors, Delhi, 2018, P 518.
2. Mahapatra, C., Fundamentals of Mineral Dressing A Concise Basic Course, J.J.Technical publishers, Bhubaneswar, 3rd Edition 2015, p. 184.
3. Murty, V.V.R. Operational Handbook of Mineral Processing, Dennet & Co., Nagpur. Gaudin,M.A. Mineral Dressing, 2014.
4. Rao, DVS, Textbook of Mineral Processing, Published by Scientific Publishers (India), 2017, p. 350.
4. Sarkar, G.G., An introduction to coal preparation practice, Oxford & IBH, 1986 edition.
4. Vijendra, H.G. Hand book on Mineral Dressing. Pub: Vikas Publishing House, 576, Masjid Road, Jangpura New-Delhi, 2014, P 266.

05MI653 - VI SEMESTER

B.Tech. (Mining Engineering)

COAL & NON-COAL MINERAL PROCESSING - LAB

Practical's

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

05EE601 - VII SEMESTER
B.Tech. (Mining Engineering)
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. IoT, Big data Machine Learning, Artificial Intelligence, Robotics.

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,

VENT etc.

Text Books/References

1. Bandopadhyay, S. Application of the Computers and Operation Research in the Mineral Industry” Proceedings of the 30th international Symposium SME Publication 2002.
2. Manuals of different software’s
3. Mozumdar, B.K., Ramani, R.V. and Samaddar, A.B. (Editors), Computers in Mineral Industry, Published by CRC Press, 1st Edition, 1994, p.366.

05MI552 - VII SEMESTER

B.Tech. (Mining Engineering)

COMPUTER APPLICATION IN MINING- LAB

Practical

1. Introduction to different hardware application related to mining.
2. Introduction to Mine planning by DATAMINE
3. Introduction to Mine planning SURPAC
4. Introduction to BLASTWARE software.
5. Calculation of production tonnage of an opencast mine for contractual billing with Total station & Datamine
6. Introduction of "VENT" software of simulation of ventilation network of a mine.
7. Introduction to "FRAGLYST 4.0" software.
8. Introduction to "FLAC/ FLAC 3D software
9. Introduction to “GALENA” software related to slope stability.
10. Introduction to “Solid works” software

**05MI602 - VIIth Semester
B.Tech Mining Engineering
MINE MANAGEMENT**

Unit – I

Management: Principles of Scientific Management; Organization, Planning and control. Forms of Business Organization: Private and public enterprises with special reference to mining of minerals.

Unit – II

Basic Principles of Trade unionism, Trade union activities w.r.t. mining in India, Major trade union bodies Disputes: Types of disputes between contractors and owners, between workers and owners; Methods of avoiding and resolving disputes.

Unit – III

Behavioral Sciences for Management: Conflict management; conflict in organisation; sources of conflict; dealing with conflict; organizing for conflict resolution; conflict and growth; Industrial dispute act Individual motivation; two way personal communication. Industrial Accident: Study of human factors of industrial accidents; their causes and remedies,

Unit IV

Inventory: Systems of inventory control; Methods of minimizing inventory. Purchasing and Tendering: Purchase procedures in public sector; Preparation of tender documents; Tender completion formalities; Consideration of bids and finalization of purchase order.

Case studies on Project Monitoring: Monitoring techniques; Management Information Systems (MIS).

Unit – V

Socio-Economic Impact of Mining: Economics of mining, effect on community - before, during and after mining

Textbooks/References

1. Banga & Sharma: Engineering Economics and Industrial Organisation. Pub: Khana Publishers, New-Delhi, 2006, p-1364.
2. Jain, S.P. Industrial & Labour laws. Pub: M/s Dhanpatrai & Sons, Delhi Khana, O.P., A text book of Work Study. Pub: M/S Dhanpatrai & Sons, Delhi, 2018.
3. Mote, V.L. Samuel, P and Gupta, G.S.. Managerial Economics, Concepts and Cases, 2017, P 512.

05MI603 - VII SEMESTER
B.Tech. (Mining Engineering)
GENERAL SAFETY & MINE LEGISLATION

Unit I

Overview of Mines Safety in India - 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; 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 II

Mine Legislation: Health and Safety Laws: The Mines Act, 1952; Mines Rules, 1955; CMR 2017, Metalliferous Mine Regulation, 1961; Mines Rescue Rules, 1985; provisions of Indian Electricity Rules, 1956 applicable to mines;

Unit III

Mining Laws (continued) 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;

Unit IV

SMP(Safety Management Plan) - 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 -. Occupational Health and safety in mines - conferences of safety in mines

Text Books/Referenc

1. DGMS Circulars Upto June 2017, p. 1340. & Other Circulars issued after June 2017.
2. Rakesh & Prasad, Legislation in Indian Mines, Vol. I &II., Pub. Asha Lata, Classified Mine Circulars issued by DGMS. Varanasi.
3. Kejriwal, B. K. Safety in Mines, Lovely Publishers, Dhanbad, 2002, P. 394.
4. Pradhan, G.K., Introduction to Mining Technology, An AKS University Publication, Vol. I, Mintech Publication, Bhubaneswar.
5. Sinha, A.K., Handbook Development of Safety Management Plan for Indian Coal & Metal Mines, Lovely Prakashan, Dhanbad.

05MI604 - VII SEMESTER B.Tech. (Mining Engineering) 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 Surface Conveying system

Construction, operation, maintenance and design calculations, safety devices for - Conveyor – Belt, cable belt, Pipe, Steep angle belt conveyor. Aerial Ropeway - different types, their construction, installation, operation and maintenance, their layouts including rope tensioning arrangement; Loading, unloading and angle stations.

Unit – III

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, EOT cranes, hydraulic lifters, tyre handler.

Unit – IV

Maintenance: Preventative and predictive maintenance; Condition monitoring ; Workshops. Automation and remote control of mining equipment. Signaling: Safety regulations and different signaling systems in mines. Methods of assessing efficiency of HEMM and other machineries, standards laid by CMPDI and other organizations for availability and utilization.

Unit – V

Advances in Mining Machineries, Energy Conservation efforts in Mining Machinery : Air

Compressors, Pumps, Conveyors, High HP engines, etc for underground and surface mine applications, Equipments for Under Sea mining and space mining technology.

Text Books/References

1. Mishra, R.C. & Pathak, K., Maintenance Engineering and Management, PHI Learning Private Ltd, New Delhi, 2012, p312.
2. PCRA Handbook & other published literature
3. Rakesh & Lele, Water problem in mines. Pub: Dhanbad Publisher.
4. Rakesh & Lele, Selection, Installation and Maintenance of mine pumps. Pub: Dhanbad Publisher.
5. Ramlu, M.A., Mine Hoisting. Pub: Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, 2015, p 550.
6. Web sites of Bureau of Energy Efficiency (BEE) & PCRA.

**05MI653 - VII SEMESTER
B.Tech. (Mining Engineering)
MINING MACHINERY – III - LAB**

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. Design of mine sumps and their selection of site in mines.
7. Planning and scheduling of maintenance of machinery used in mines.
8. Layout of muck movement through ore passes bunkers, u/g crusher and shaft. Railway siding layout.
9. Exercise on Illumination survey.
10. Design of lamp room layout for a mine of 2000 tonnes production per day.

05MI605 - VII SEMESTER
B.Tech. (Mining Engineering)
MINERAL ECONOMICS

Unit 1:

General considerations: Economic importance of the mineral industry; risky nature of the mining industry; definition and scope of mineral economics; major mineral resource issues; economics of depletable resources; consumption, substitution and conservation of minerals; secondary supply of minerals; global view on availability of mineral resources; land resources; marine mineral resources; law of the sea.

Unit 2:

Mineral resources concept and classification systems; Mine sampling: Dynamic conceptual frame work for reserves and resources; Indian classification of mineral resources; JORC and UNFC classifications; uneconomic occurrence and mineral occurrence; concept of marginal reserves; reserve estimation techniques. Mine Sampling - definition, purpose and scope, Preparation of samples, methods and practices; application of statistical methods in sampling; sample preparations; errors in sampling.

Unit 3:

Mine valuation and mine finance: Basic concepts; earlier approaches to valuation; recent approaches to valuation; concept of cash flow and time value of money; nominal and effective interest rates; inflation; mine investment analysis; various DCF and non DCF analysis techniques for appraisal; feasibility study. Various sources of financing; cost of capital; costing and cost accounting; depreciation; depletion; amortization; budget and budgetary control.

Unit 4:

Mineral taxation, markets and trade: Concept of taxation; principles of mine taxation; mining taxation structure; mineral sector taxation methods and tax incentives; mineral taxation in India; role of taxes; taxes affecting mineral sector; Market structure; market analysis; export of minerals; International mineral study groups, associations and cartels; pricing of minerals, factors affecting minerals price.

Unit 5:

Small Mines and NMP: Concept of small mines; socio economic significance of small mines; problems of small mines; concept of small deposit; infrastructures in mining areas; co products and by products in mining; objectives and elements of NMP of a nation; salient features of NMP 2019,

effective implementation of NMP; EXIM policy of India; environmental hazards and their protection measures; mineral information systems in India and abroad.

Text Books/References

1. Chatterjee, K.K, An Introduction to Mineral Economics, New Age International Publishers, New Delhi, 2012, P204.
2. Deshmukh, R. T., Mineral and Mine Economics, Myra Publications; 1st edition (1986).
3. Ray, S.C, and Sinha, I. N, Mine and Mineral Economics, PHI Learning Pvt. Ltd, 2016, P264.

05MI651 - VII SEMESTER B.TECH. (Mining Engineering) PROJECT WORK

Every student who had deposited semester fees has to identify two topics on which he will undertake project work during VIIth and VIIIth Semester. Within 15 days of commencement of the semester he/she has to enroll for Project as per University norms. Within 30 days on topic along with 4 other class mates the group will be made and faculty member to Guide will be shortlisted. HoD-Mining will finalise the list in consultation with other senior faculty members the modalities of undertaking the 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

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.

**05EE601 -VIII SEMESTER
B.Tech. (Mining Engineering)
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

Advances in Rock Drilling : Novel methods 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; Drill Monitors and computer assisted drilling.

Advances in Explosives & Blasting - Fragmentation assessment and monitoring, Instrumentation and software - application for design of blast round, monitoring and assessment of rock fragmentation. Special techniques adopted in Dragline bench blasting, Hot hole blasting, Stemming plug.

Blasting damages –Micro and macro level damages due to blasting; Wall control, Blast casting; Demolition blasting, Nuclear blasting; De-stress blasting.

Unit – III

Advances in Drivages and Tunnels - Full face driving/tunneling-Pilot heading technique-Heading and bench method - Conventional tunneling methods: tunneling through the soft ground and soft rocks - Supports for tunnels and mine openings during drivages-Tunneling by Roadheaders - Procedure of driving by the heading machines - Auxiliary operations

Unit – IV

Blast-Free Mining – Definition – Application - Selection –Hydraulic Rock Breakers - Use of Splitters - Rock Breaking Compounds etc. Plasma blasting Techniques.

Unit – V

Blast-Free Mining (contd.) – Continuous Surface Miner & Highwall Miner – selection – application – planning – factors influencing operation & productivity – safety – Case studies.

Test Books/Reference Books

1. Bhandari, S. Engineering Rock Blasting Operations. Pub: A. A. Balkema USA., 1997, p.

- 375.
2. Chugh, C.P., High Technology in Drilling and Exploration, Pub: Oxford & IBH, New Delhi, 1002, p. 782.
 3. Gokhale, B.V., Rotary Drilling and Blasting in Large Surface Mines, Published by CRC Press, 2011, p. 736.
 4. Indian Explosive Act and Rules and PESO Notifications issued from time to time..
 5. Konya, C.J. Surface Blast Design, Published by Prentice Hall; First Edition 1990, p. 303.
 6. Langefors, U., and Kihlstrom, B., Modern Techniques of Rock Blasting, Published by John Wiley & Sons Inc; 2nd edition (June 1968), p. 406.
 7. Pal Roy, P.Pal, Rock Blasting : Effects & Operations, Oxford & IBH, New Delhi, p. 360. 2005, p. 360.
 8. John Loui Porathur, J.L., Pal Roy, P. et el, Highwall Mining: Applicability, Design & Safety, CRC Press, 2017Edition, p.348.
 9. Pradhan G.K., Explosives and Blasting Techniques, Mintech Publications, An AKS University Initiative, 4th Edition, 2020. p. 572.
 10. Thote, N.R. & Pradhan, G.K. Surface Blast Evaluation, Mintech Publications, 2012.

05MI653 - VIII SEMESTER
B.Tech. (Mining Engineering)
ROCK EXCAVATION ENGINEERING- LAB

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 Tata Steel-West Bokaro Coal Mines. 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.

05MI605 - VIII SEMESTER
B.Tech. (Mining Engineering)
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 Method, Problem related to Graphical solution; Simplex method, Problems related to 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), Problems related to CPM and, Programme evaluation review technique (PERT), Problems related to 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 modeling and solution algorithms, application to mining engineering. Basic queuing models with constant arrival and service rates.

Text Books

1. Gupta, P. K. & Hira, D. S. Operation research Published by S Chand Fifth edition 1976, p.1922.
2. Swarup, K.; Gupta, P.K. & Mohan, M. Operation research published by S. Chand (2010).
3. Sharma, J. K. Operation research Theory & Application published by Macmillan India Limited, 2006.

VIII SEMESTER

B.Tech. (Mining Engineering)

ECO-FRIENDLY MINING (OPEN CAST)

Unit-I

What is Green Mining, Mining India Sustainability for Growth, Future Green Mining, Health and safety and environmental aspects in future deep mining, Schematic mine cycle
Main awaited impacts

Unit-II

Impact Management, Atmosphere : Gas emission, Airborne dust, Heat and humidity.
Mine water: Fresh water consumption, improving mine implantation, Reusing and recycling water, Using raw or saline water, Water economy, Hydro-geological study, Managing surface discharge, Acid mine drainage, Metal removal, Mine rehabilitation, Water treatment, Other pollution sources, Geothermal use, Hydroelectricity.

Unit-III

Mining waste Plan for closure, Promote public audience, Promote public audience, Characterisation and location phases, Slope stability design, Record and review, Hydraulic stability, Hazardous substances management, Limitation of the mining waste production, Recycle/Reuse of mining wastes, Wood and vegetal wastes

Unit-IV

Subsidence Shaft treatment - Plug, Shaft treatment - Backfilling., Shaft treatment injection techniques, Shallow workings treatment - Reinforcement., Shallow workings treatment - Backfill., Deep workings treatment.

Unit-V

Environment Social impact, Heritage preservation, Airborne dust, Wind erosion management, Noise and vibrations, Revegetation, Landscape integration, Landscape protection.

Textbook/References

1. Bhattacharya, Jayanta, Project Environmental Clearance, Wide Publishing, Kolkata, 2016, p. 549.
2. Dhar. B. B. Environmental Management of Mining Operations. Published by Ashish Publishing House 2000, p 450.
3. FIMI, Law and Procedures for Environmental Clearance of Mining Projects (IIIrd edition) as on 2018.
4. Jain, R. Environmental Impact of Mining and Mineral Processing: Management, Monitoring, and Auditing Strategies, Published by Butterworth-Heinemann; 1 2015, p310.
5. Stone, D. "Minefill 2001, Proceedings of the International Symposium on Mining with Backfill, SME Publication 2001, p 428.

05MI602 - VIII SEMESTER B.Tech. (Mining Engineering) MINE PLANNING & DESIGN

Unit 1:

Fundamentals of mine planning: Phases of mine life; mine planning and its importance; mining revenues and costs - calculation of FW, PV, NPV, IRR, payback period, depreciation by different methods, cash flow and ACFC; mine planning components, planning steps and planning inputs; factors affecting mine planning; mine planning requirements; mineral inventory estimates; preparing plan reports.

Unit 2:

Techno economics and Production planning: Systems requirements in mine planning; techno economic decisions; concepts and techniques of mine optimization; building various models; mine optimization soft ware; economic decision making for mine accesses (shaft or incline); determination of optimum mine size and Taylor's mine life rule; Sequencing by nested pits; Cash flow calculations; Mine and mill plant sizing, Lanes algorithm for estimation of optimum mill cut-off grade.

Unit 3:

Mine Infrastructure Planning: Facility location and optimisation thereof; planning and design of surface layout; classification of surface layout; Mine access design of shaft systems; detailed design of its various elements; planning for power requirement; planning of mineral handling plants; planning and design of filling and stowing plants; future mine planning – issues and challenges; design of drainage system in surface mines. Selection of mining system vis-à-vis equipment system.

Unit 4:

Planning for mine sub systems: Matching of shovel dumper at production planning; design of haul roads; Concept of stripping ratio; types of stripping ratios and their significance; choice between surface and underground mining; basic bench geometry; Pit layouts; development of economic block model; pit cut-off grade and its estimation; ultimate pit configuration and its determination – hand method, floating cone technique & other methods.

Unit 5:

Project Planning & Environmental Management: Concept of PERT, CPM and CCPM; CCPM vs traditional project management; project characteristics and scheduling; project sanctioning and monitoring process; MOUs and rehabilitation of PAPs; project planning issues; project success factors and volad's relationship improvement model; Feasibility reports; planning for mine closure. Environmental control measures in mine planning.

Text Books/References

1. Bhattacharya, J, Principles of Mine Planning, Allied Publishers Pvt. Ltd, 2003, p. 520.
2. Deshmukh, R.T., Mine Economics, Myra Publications; 1st edition 1986, p 558.
3. Hustrulid, W.A. & Richard C. Bullock Underground Mining Methods: Engineering Fundamentals and International Case Studies, SME, USA, 2001, p 728.
4. Kapur, P.K., Kumar, U, Verma, A.K. Quality, IT and Business Operations: Modeling and Optimization, Springer Proceedings in Business & Economics, 2018, p 464.
5. Ray, S.C. and Sinha, I.N., Mine and Mineral Economics, PHI Learning Pvt. Ltd. 2016, p 264.
6. Rudenno, V., The Mining Valuation Handbook: Mining and Energy Valuation for Investors and Management, 4th Edition, 2012, p 624.
7. Rendu, J.M., An Introduction to Geo-statistical Methods of Mineral Evaluation. South African Institute of Mining and Metallurgy; 2nd Revised edition, 1981, p 92.

Practical

- 1) Estimation of ore reserve based on borehole data of limestone deposit.
- 2) Choice of mining systems based on techno economics.
- 3) Design of haul roads and statutory requirements.
- 4) Shovel dumper combinations: applicability, advantages and disadvantages.
- 5) Design of optimum blast in open cast mines.
- 6) Design of shaft in lead zinc mine.
- 7) Design of box cut in an open cast mine.
- 8) Designing the length of long wall face.
- 9) Estimation of ore reserve based on bore hole data of iron ore deposit.
- 10) Slope stability of pit or dump and protective measures.

05MI603 - VIII SEMESTER
B.Tech. (Mining Engineering)
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. Higgings, L.T. Morrow, L.C. Maintenance Engineering Handbook, McGraw Hill 1967, p.1667.
2. Mishra, R.C. & K. Pathak, Maintenance Engineering and Management, PHI Learning Private Limited, New Delhi, 2012, p.312.
3. Daya, M.B. Kumar, U. D. N. Prabhakar, M. Introduction to Maintenance Engineering: Modelling, Optimization and Management, 2016, p. 684.

05MI604 - VIII SEMESTER B.Tech. (Mining Engineering) 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 geo-mechanics; 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

- Riehokl Co., New York, 1972, P480.
2. Brown, E.T. (Ed) Analytical and Computational Methods in Engineering and Rock Mechanics, Allen and Unwin, London, 1987, p 259.

**05MI651 - VIII SEMESTER
B.TECH. (Mining Engineering)
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

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.