



SARDAR PATEL UNIVERSITY, BALAGHAT (MP)

School of Engineering and Technology

Syllabus

Course: B.Tech

Semester: VII

Branch: Mining Engineering

Academic Session: 2024-25

SUBJECT – MINE ECONOMICS

SUBJECT CODE – BMI071

Course Objective

The objective of this course is to introduce students to the economic principles and practices involved in the mining industry. Students will learn how to assess the economic viability of mineral resources, compute reserves, and understand financial management in mining operations.

Unit 1:

Sampling- Methods of sampling, errors in sampling, analysis of samples, estimation grade and reserves, salting and precautions against salting. Different types of reserves.

Unit 2:

Mine Valuation - Different methods, depreciation, amortization and redemption of capital, life and present value of a mine.

Unit 3:

Financial Management - Methods of framing and financing industrial enterprises, memorandum and articles of association, shares, debentures, dividends and interest.

Break even chart and inventory control.

Unit 4:

Investment Decisions - discounted cash flow methods, non-discounted cash flow methods, advantages and disadvantages of them, Internal rate of return, Net Present Value.

Unit 5:

Book Keeping, Preparation of Balance sheet, Profit and Loss Account.



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Course Outcomes

- CO1** Identify the role of important mineral based industry in national economy viz-a-viz country's national mineral policy.
- CO2** Carry out the computation and classification of reserve and grade estimation.
- CO3** Identify methods of sampling for different types of deposits and recognize salting
- CO4** Calculate the value of mineral properties and estimate the depreciation.
- CO5** Identify book keeping system and ore dressing.

Textbooks:

1. Mineral Economics by R.T. Deshmukh
2. SME Handbook Vol. I
3. Mineral Economics by Sinha and Sharma



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SUBJECT – MINE SURVEYING – III

SUBJECT CODE – BMI072

Course Objective

The objective of this course is to provide students with advanced knowledge and skills in mine surveying techniques, with an emphasis on precision and accuracy in both surface and underground surveys. Students will learn how to apply triangulation, correlation methods, and electronic surveying tools to enhance mine mapping and planning.

Unit 1: Triangulation

Principles forming network of triangles; Selection of sites of triangulation stations; Base and Check base lines; Measurement and adjustment of angles by simple methods; Calculation of Co-ordinates.

Unit 2: Correlation Survey

Methods of correlation of surface and underground surveys through adits, inclines, and shafts; Use of magnetic needle and Gyro theodolites; Different methods of Stope surveying and open pit surveying;

Unit 3: Astronomical Survey

Definitions of important terms; Determination of azimuth by astronomical observations.

Unit 4: Photographic Surveying

General Principles; Phototheodolite; Stereo photographic Surveying; Aerial Surveying - Field of application; Vertical and oblique photographs; Aerial photography; Preparation of photographic maps by simple methods;

Unit 5: Modern Surveying Techniques

Electronic distance measuring equipment; Geodimeter, Tellurometer, Total Station, Distomat, Softwares



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Course Outcomes

- CO1** Apply triangulation principles to establish a network of triangles for accurate mine site mapping, including the measurement and adjustment of angles and calculation of coordinates.
- CO2** Implement correlation methods to integrate surface and underground surveys using adits, inclines, and shafts, and utilize tools like magnetic needles and gyro theodolites for accurate stope and open-pit surveying.
- CO3** Determine azimuths through astronomical observations, applying fundamental surveying terms and methods to enhance directional accuracy in mine planning.
- CO4** Utilize photographic and aerial surveying techniques, including phototheodolites and stereo photography, to create detailed mine maps and enhance spatial data accuracy.
- CO5** Use electronic distance measurement equipment like Geodimeter, Tellurometer, Total Station, and software tools for precise mine surveying and data analysis.

Textbooks:

1. Mine surveying by S. Ghatak
2. Surveying & Levelling by B. C. Punmia
3. Surveying & Levelling by Kanetkar & Kulkarni
4. Mine surveying by Winniberg



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ELECTIVE SUBJECT – ROCK MECHANICS

SUBJECT CODE – BMI0731

Course Objective

The objective of this course is to provide students with an in-depth understanding of rock mechanics principles and their applications in mining. Students will learn to assess rock mass conditions, analyze rock behavior under various stress conditions, and apply these concepts to ensure the stability and safety of mining operations.

Unit 1:

Application of rock mechanics in mining, Definition of important terms used in Rock mechanics, Classification of rock mass, Parameters of rock mass classification, Importance of rock mass classification, RQD, Q –system and Bieniskiwi's Geomechanics classification of rock mass.

Unit 2:

Rock properties, Physico-mechanical properties of rock, Preparation and testing of specimen in the laboratory, ISRM standards, Determination of Physico-mechanical properties of rock as per ISRM standard testing procedures, Strength indices and their importance. Point load, Protodyaknov, Impact and Cone Indenter strength Index.

Unit 3:

Rock as an elastic medium, Principle of elastic analysis, Rheological properties of rock, Importance of rheological models, Different types of rheological models, Dynamic properties of rocks, Anisotropy and Creep.

Unit 4:

Principal stress and Principal plane, Analytical method of determining the magnitudes and directions of normal and shear stress on failure plane, Mohr's circle theories of failure of rock, Coulomb-Navier theory, Mohr's theory, Griffith's theory, Empirical theories of failure of rock, Different modes of failure of rock.

Unit 5:

Earth stresses, Importance of measurements of in situ stress, measurements of in situ stress by Flat jack, Overcoring and Hydraulic fracturing technique. Design of circular and elliptical openings. Determination of safe span of roof.



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Course Outcomes

- CO1** Apply rock mechanics principles to mining, including classification systems like RQD, Q-system, and Bieniskiwi's Geomechanics, to assess rock mass conditions for safe and efficient mining operations.
- CO2** Determine and analyze the physico-mechanical properties of rocks using ISRM standards to inform rock stability assessments and design considerations in mining.
- CO3** Understand and apply elastic and rheological models to analyze rock behavior under stress, including dynamic properties, anisotropy, and creep for effective mine design and stability management.
- CO4** Use analytical methods and Mohr's circle to determine stress magnitudes and directions on failure planes, applying theories like Coulomb-Navier, Mohr, and Griffith to predict and manage rock failure.
- CO5** Measure in situ earth stresses using techniques like flat jack, overcoring, and hydraulic fracturing, and design safe mine openings and roof spans based on stress data.

Textbooks:

1. Rock Mechanics by Obert and Duvall
2. Rock Mechanics by Goodman
3. Rock Mechanics by Jager & Cook
4. Rock Mechanics by B.S. Verma



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ELECTIVE SUBJECT – FUEL TECHNOLOGY AND MINERAL PROCESSING

SUBJECT CODE – BMI0732

Course Objective

The course equips students to select suitable machinery and parameters for processing minerals, understand how unit operations combine into specific processes, and familiarize them with separation methods like gravity, magnetic, flotation, and solid/liquid separation. It also covers leaching and sampling processes in mineral extraction.

Unit 1: Fuel Technology

Fuel Technology & Solid fuels: Wood, peat, lignite, coal, anthracite; proximate and ultimate analysis; coal characteristics for different industrial uses; characteristics of Indian coals; caking and coking properties; low and high temperature carbonization. Liquid fuels: Petroleum its products and testing methods. Gaseous fuels: Natural gas, producer gas and water gas. Combustion: Combustion stoichiometry; Coal burning equipment.

Unit 2: Mineral Processing - Introduction

Mineral Processing & Introduction: Scope, objectives and limitations of mineral processing; Liberation and beneficiation characteristics of minerals and coal. Comminution: Theory and practice of crushing and grinding; Different types of crushing and grinding equipment, their application and limitations. Size separation: Laboratory size analysis and interpretation; Settling of solids in fluids; Industrial screens; Mechanical classifiers and hydrocyclones.

Unit 3: Gravity, Froth, Electrical, and Magnetic Separation

Gravity concentration methods: Jigging, heavy media separation, flowing film concentrator's, theory, application and limitations. Froth flotation: Physicochemical principles; Reagents; Machines; Flotation of sulphides, oxides and coal. Electrical and magnetic methods of concentration: Principles, fields of application and limitations.

Unit 4: Dewatering and Hydro-metallurgy

Dewatering: Thickener and filter. Hydro-metallurgical methods of recovery: Leaching- principle, various methods and applications. Laboratory sampling, Simplified flow sheets for coal, copper, lead, zinc, gold, iron, manganese ores and lime stone.

Unit 5: Tailings Management and Environmental Impact

characteristics, disposal methods, environmental impact, and reprocessing. Waste management, environmental regulations, and site rehabilitation for sustainable operations.



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Course Outcomes

- CO1** Apply knowledge of mineral dressing for understanding, formulating and solving problems related with mineral dressing.
- CO2** Acquire knowledge and hands-on competence in applying the concepts in the design and development of machines for separating the low-grade ore economically.
- CO3** Design & understand the various methods for mineral beneficiation.
- CO4** Demonstrate the knowledge on leaching and laboratory sampling process.
- CO5** Demonstrate understanding of tailings management, disposal methods, environmental impact, and site rehabilitation practices.

Textbooks:

1. Mineral Processing Technology by B A Wills
2. Introduction to Mineral Processing by E G Kelly and D J Spottiswood
3. Mineral Processing by S K Jain



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SUBJECT – MINING ENVIRONMENT – III

SUBJECT CODE – BMI074

Course Objective

The objective of this course is to equip students with the knowledge and skills necessary to manage and control environmental hazards in mining operations. Students will learn to implement fire control strategies, manage spontaneous heating, prevent explosions, and apply rescue and recovery techniques in emergencies.

Unit 1: Mine Fires

Mine fires, fires in quarries and surface storage systems, control of fires and fires extinguishers, study of atmosphere behind sealed off areas, conditions and procedure of reopening a sealed off area, firefighting organisations.

Unit 2: Spontaneous Heating

Causes, detection and preventive measures in underground and surface coal mines, stacks and dumps, control of spontaneous heating, fire stopping and sealing off an area.

Unit 3: Explosion

Fire damp and coal dust explosions, their causes and prevention, stone dust and water barriers, investigations after explosion.

Unit 4: Rescue and Recovery

Types of rescue equipment and their use, rescue stations, first aid appliances, training of personnel, and organisation of rescue and recovery work during mine fires, explosion, inundation.

Unit 5: Mine Inundation

Causes and precautionary measures, bulk head doors, barriers, dams, precautions to be taken while approaching old workings, recovery of flooded mines and de watering of old workings.



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Course Outcomes

- CO1** Implement fire control strategies and use extinguishers effectively in mines and quarries, study atmospheres behind sealed areas, and follow procedures for reopening sealed-off zones to manage mine fires.
- CO2** Detect and prevent spontaneous heating in underground and surface coal mines, manage heating in stacks and dumps, and apply fire stopping and sealing techniques to control risks.
- CO3** Prevent and manage fire damp and coal dust explosions by implementing stone dust and water barriers, and conduct thorough investigations post-explosion to improve safety measures.
- CO4** Utilize rescue equipment and first aid appliances, set up rescue stations, and train personnel for effective response and recovery during mine fires, explosions, and inundations.
- CO5** Identify causes of mine inundation, apply precautionary measures, and use bulkhead doors, barriers, and dams for safe recovery and dewatering of flooded mines and old workings.

Textbooks:

4. Mine Env. By G.B. Mishra
5. Elements of Mining Tech. Vol.2 by D. J. Deshmukh
6. U/G Mine Env. by Mcpherson
7. Mine fires by Dr. Ramlu



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SUBJECT – MINING PLANNING

SUBJECT CODE – BMI075

Course Objective

The objective of this course is to provide students with the knowledge and skills necessary to design, plan, and optimize mining operations. Students will learn to estimate reserves, apply scheduling techniques, and design mine layouts and infrastructure to ensure the efficient extraction of resources.

Unit 1:

Coal reserves and their estimation, Geological and technological data needed for mine planning, Preparation of project and feasibility reports, Planning and scheduling of various mining operations.

Unit 2:

Planning and scheduling of various mining operations, linear programming, Simplex methods and transportation problem. Operation Research - Scope of application in mining, Linear programming, formulation and solution, Network planning with special reference to CPM/PERT, System approach for project scheduling.

Unit 3:

Division of mine area into units and sub units, Area, Reserve, Life and Capacity of mine, Panel size, Design of long wall face.

Unit 4:

Cost of various mining operations, Optimum size of mines, Mode of opening up of deposits, Choice of opening, Location and size of Development openings.

Unit 5:

Design of haulage, hoisting and drainage systems, Design of pit top and pit bottom, Coal handling plants, Railway siding etc.



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Course Outcomes

- CO1** Estimate coal reserves using geological and technological data, prepare comprehensive project and feasibility reports, and plan and schedule mining operations to optimize resource extraction.
- CO2** Apply linear programming, simplex methods, and transportation problems to mining operations, utilize CPM/PERT for network planning, and adopt a system approach for efficient project scheduling.
- CO3** Divide mine areas into units and sub-units, calculate area, reserve, life, and capacity, and design longwall faces to ensure effective and efficient mining operations.
- CO4** Analyze the cost of mining operations, determine the optimum size of mines, select appropriate methods for opening deposits, and design development openings to enhance mine efficiency.
- CO5** Design and implement haulage, hoisting, and drainage systems, and plan pit top and pit bottom layouts, coal handling plants, and railway sidings for effective mine infrastructure and operations.

Textbooks:

1. Advance Coal Mining by R.T. desh mukh and V.S. Vorobjev
2. Mine Planning by S.P. Mathur
3. Mine Planning by B.J. Bhattacharya



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SUBJECT – MINE SURVEYING – III LAB

SUBJECT CODE – BMI072P

S. No.	List of Experiments
1	Baseline measurement
2	Baseline extension
3	To connect the baseline to main triangulation network
4	Reduction to centre
5	Angle adjustments in triangulation network
6	Plotting the survey by co-ordinate methods
7	Correlation survey by Weisbach triangle method
8	Study of EDM
9	Study of Total station
10	Handling of surveying softwares



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ELECTIVE SUBJECT – ROCK MECHANICS LAB

SUBJECT CODE – BMI0731P

S. No.	List of Experiments
1	Determination of moisture content of rock sample by ISRM standard method
2	Determination of porosity of rock sample by ISRM standard method
3	Determination of Density of rock sample by ISRM standard method
4	Determination of slake durability strength index of rock sample by ISRM standard method
5	Determination of point load strength index of rock sample
6	Determination of Proto-dyakonov strength index of rock sample
7	Determination of Uni-axial Compressive strength of rock sample by ISRM standard method
8	Determination of Tensile strength of rock sample by Brazilian method
9	Determination of Single Shear and Double Shear strength of rock sample
10	Determination of Tri-axial Compressive strength of rock sample by ISRM standard method
11	Determination of Young' Modulus of rock sample by ISRM standard method

References:

1. Culshaw, M.G., 2015. Ulusay, R (ed.), 2015. The ISRM suggested methods for rock characterization, testing and monitoring: 2007–2014: Springer.



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**ELECTIVE SUBJECT – FUEL TECHNOLOGY AND MINERAL
PROCESSING LAB**

SUBJECT CODE – BMI0732P

S. No.	List of Experiments
1	Proximity analysis of coal.
2	Concentration of sulphide ore by Froth Floatation Method.
3	Crushing by Jaw roll crusher.
4	Concentration of Magnetic ore by Magnetic separation method.
5	Coal Washery.