

JHARKHAND RAI UNIVERSITY



MINING ENGINEERING

B.TECH



SYLLABUS

(2020 - 2024)

SEMESTER VIII

Kamre | Ratu Road | Ranchi | Jharkhand

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B.TECH SEMESTER VIII

BATCH 2020-2024												
BTECH IN MINING ENGINEERING												
SEMESTER VIII												
S.No.	CATEGORY	CODE	COURSE TITLE	Period			Evaluation Scheme			Subject Total	Credit	
				L	T	P	Assign-ment	T A	Total			ESC
1	Professional Core Courses	8PCCMiE405	Operational Research in Mining	3	0	0	20	10	30	70	100	3
2	Professional Core Courses	8PCCMiE406	Mine Legislation & Safety II	3	0	0	20	10	30	70	100	3
3	Professional Core Courses	8PCCMiE407	Mine Management	3	0	0	20	10	30	70	100	3
4	Professional Core Courses	8PCCMiE408	Fuel Technology & Mineral Processing	3	0	0	20	10	30	70	100	3
5	Professional Core Courses	8PCCMiE409	Mine & Mineral Economics	3	0	0	20	10	30	70	100	3
6	OPEN ELECTIVE (Any one of the following subjects)											
	Open Elective Courses	8OEEL401	Engineering Economics	3	0	0	20	10	30	70	100	3
	Open Elective Courses	8OEEL402	Industrial Management									
	Open Elective Courses	8OEEL403	Coal Bed Methane Mining									
7	Humanities and Social Sciences	HSMC402	**Human Values & Ethics	2	0	0	20	10	30	70	100	0
PRACTICAL / SESSIONAL												
1	Professional Core Courses	8PCCMiE408P	Fuel Technology & Mineral Processing Lab	0	0	2			30	20	50	1
2	Project	8PROJMiE402	Mining Project Work	0	0	10			100	100	200	5
									TOTAL	950	24	
									Total of All Semester	6250	160	

**NOTE: Qualifying Non Credit Course.

A student will be eligible to get Under Graduate degree with Honours , if he/she acquires an additional 20 credits through MOOCs.

Program: B.Tech
Semester: Eight
Course: Operational Research in Mining
Course Code: 8PCCMiE405

L	T	P	C
3	0	0	3

Course Objective:

- The students will learn the concept of system engineering and applicability in mining field.
- To study the various techniques of operations research, simulation and network analysis.
- Enables the students to know basic of system engineering concept and analysis.

Course Outcome:

After the completion of the course, student will be able to:

- CO 1: Formulate real-world problems as a linear programming model and describe the theoretical workings of the graphical and simplex method.
- CO 2: Formulate specialized linear programming problems, namely transportation and assignment problems and describe theoretical workings of the solution methods for transportation and assignment problems.
- CO 3: To develop the abilities in project evaluation techniques like PERT, CPM etc.
- CO 4: Apply the knowledge of game theory concepts to articulate real-world decision situations for identifying, analyzing, and practicing strategic decisions to counter the consequences.

Module I

Linear Programming :Linear Programming models; Assumption of linear programming, Graphical and Simple method of solving Linear Programming Problems; Basic and Basic feasible solution, optimal solution, interpretation of SIMPLEX table. Primal and Dual Problem. Application of Linear Programming for solution of mining related problems of production planning, scheduling and blending.

Module 2

Transportation and Assignment Problem: Transportation models, Solution. Algorithm for Transportation problem. Assignment model, Variations on Classical Assignment model; solution algorithm for Assignment problems. Mathematical formulation of an assignment problems. Difference between transportation and assignment problems.

Module 3

Project Management with PERT & CPM: Assumption of PERT and CPM; Methods of drawing network; Rules of network construction, numbering the events, construction of network, Time analysis ; Forward pass computation; backward pass computation; determination of floats and slack times; Critical path calculation.

Module 4

Game Theory: Definition; pay off, types of games, the Maximin- Minimax principle, games without saddle point, graphical method, dominance property.

Suggested Reading:

1. *Numerical Methods in Engineering and Science* by Grewal B.S. and Grewal J.S
2. *Optimization: Linear Programming* by B K Mishra and B N Mishra
3. *Linear Programming: Foundations and Extensions* by Robert J Vanderbei

Program: B.Tech
Semester: Eight
Course: Mine Legislation and Safety II
Course Code: 8PCCMiE406

L	T	P	C
3	0	0	3

Course Objective:

- Enables the students to understand the organizational structure, working safety and management concepts for mining enterprises to effectively manage them within the frame work of rules and regulations.
- Students will be acquainted with rules, laws and order for running a mine.
- The students will have knowledge on various acts, rules and regulations relating to the mineral industry.
- They will also know about accidents, diseases and mine safety.

Course Outcome:

After the completion of the course, student will be able to:

- CO 1: Apply knowledge of legislation in mines for the implementation of rules and regulations during their job.
- CO 2: Define work effectively with other engineering and science teams for suggesting any measures against any mine accidents.
- CO 3: State application of various acts , rules and regulation
- CO4: Interpret the cause and remedies of various accident disease and mine safety.

Module 1

Coal Mines Regulations 2017: Important definitions: Duties and responsibilities of workmen, competent person & officials. Planes and sections. Means of access & egress, Provisions regarding winding in shaft, Transport of men & material, mine working, Precautions against dangers from the dust, gas & water and Ventilation. Provisions regarding lighting and safety lamp, Explosives & Blasting, Provisions regarding machinery, plant & equipments and important provisions under chapter on miscellaneous.

Metalliferous Mines Regulations 1961: Plans and sections, Means of egress, Ladder & Ladder way and transport of men & material.

Module 2

Important provisions of **Mines Rescue Rules 1985**, Provisions of **Electricity Rules 1961** relevant to Mining and salient provisions of the **Mines and Minerals (Development & Regulation) Act 1957**, **Mineral Concession Rules 1960** and **Industrial Disputes Act 1947**.

Module 3

Mine Safety: Occupational hazards of mining; Accidents and their classification; Statistics of fatal and serious accidents; Frequency and severity rates of accidents; Place-wise and Cause-wise analysis.

Module 4

Mine Safety: Basic causes of accident occurrence; Investigations into accidents and accident reports; Measures for improving safety in mines; Cost of accidents. Introduction to safety management system and risk assessment.

Suggested Reading:

- 1. Central Government, Mines Act 1952, Lovely Prakashan, Dhanbad*
- 2. Central Government, Mines Rules 1955, Lovely Prakashan, Dhanbad*
- 3. Central Government, Coal Mines Regulation 1957, Lovely Prakashan, Dhanbad*
- 4. Central Government, DGMS Circulars, Lovely Prakashan, Dhanbad*
- 5. Ghatak, A Study of Mine Management Legislation and General Safety, Shining Printers, Asansol*

Program: B.Tech

Semester: Eight

Course: Mine Management

Course Code: 8PCCMiE407

L	T	P	C
3	0	0	3

Course Objective:

- Students gain knowledge on the basic management principles to become management(s) professional.
- Students will be acquainted with rules, laws and order for running a mine.
- At the end of the course, the student should be able to the students would be able to understand the basic application of operational tools and manufacturing.
- **Develop leadership and a good communication skill**

Course Outcome:

After the completion of the course, student will be able to:

- CO 1: Summarize the evolution theory of management and sketch the structure & design of organization.
- CO 2: Acquire knowledge and hands-on competence in applying the concepts of management in the development of mine economics.
- CO 3: Analyze and solve financial management problems.
- CO 4: Illustrate leadership skills and be able to be knowledgeable in behavioral science

Module 1

Introduction: Evolution of management theory and practice; Principles of scientific management; Structure and design of organization for mining enterprises.

Module 2

Personnel management: Selection, Training and Development of human resources for mining enterprises. Industrial Relations: Concepts and relevant regulations.

Module 3

Finance management: Capital budgeting techniques for mine projects; Methods of cost analysis and cost control, Break-even analysis.

Module 4

Behavioral sciences for management: Conflicts in organization; Motivation; Leadership; Communication.

Suggested Reading:

1. *Mine Management Legislation (up to 2004)[Vol.I to VII] (Coal) by H P Soni*
2. *Hand Book of Mine Management Legislation & General Safety by R K Raman*

Program: B.Tech
Semester: Eight
Course: Fuel Technology and Mineral Processing
Course Code: 8PCCMiE408

L	T	P	C
3	0	0	3

Course Objective:

- The course enables the students to select the suitable parameters and appropriate machinery for processing various types of minerals.
- Give the students an understanding of how the basic mineral processing unit operation can be combined into specific processes.
- Students will be acquainted with mineral separation methods – an overview, including: physical separation (gravity, magnetic and electrical); solid/liquid separation; flotation.
- To understand the leaching process & sampling processes.

Course Outcome:

After the completion of the course, student will be able to:

- CO 1: Apply knowledge of mineral dressing for understanding, formulating and solving problems related with mineral dressing.
- CO 2: Acquire knowledge and hands-on competence in applying the concepts in the design and development of machines for separating the low grade ore economically.
- CO 3: Design & understand the various methods for mineral beneficiation.
- CO 4: Demonstrate the knowledge on leaching and laboratory sampling process.

Module 1

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.

Module 2

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.

Module 3

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

Module 4

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.

Suggested Reading:

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*

Program: B.Tech

Semester: Eight

Course: Fuel Technology and Mineral Processing Lab

Course Code: 8PCCMiE405

L	T	P	C
0	0	2	1

List of Experiments:

1. Proximity analysis of coal.
2. Caking index of coal.
3. Crushing by Jaw roll crusher.
4. Grading of iron ore fines.
5. Floating of coal fines.

Program: B.Tech
Semester: Eight
Course: Mine and Mineral Economics
Course Code: 8PCCMiE409

L	T	P	C
3	0	0	3

Course Objective:

- The course enables the students to understand the economics of business enterprise to become a successful manager.
- Upon completion of the course, students will be able to gain knowledge and skills needed to run a business successfully.
- Expertise the students to brings employment, government revenues, and opportunities for economic growth and diversification through mining.
- Study of estimation and valuation of mineral deposit and study of project appraisal.

Course Outcome:

After the completion of the course, student will be able to:

- CO 1: Apply knowledge of mine economics for understanding mineral related policies and solve problems related with the mine economics.
- CO 2: Analyze and solve the concepts of mine economics, its risk and mineral inventory.
- CO 3: Describe the concept of mine sampling & illustrate the valuation of mineral deposit and be able to estimate the mine life and profitability.
- CO 4: Discuss the forms of business, royalty, taxes & duties in mining sector.

Module 1

Mineral Industry in India: Public and Private Entrepreneurship; Organization of mining enterprises, Mineral Resources' and reserves, Mineral resource estimation; UNFC and JORC Classification, Techno-economic feasibility studies.

Module 2

Cut-off grade, dilution and recovery, mineral conservation and development; Time value of money. Discounted cash flow concept, Net Present Value and Internal Rate of Return (IRR), Determining appropriate discount rate.

Module 3

Mine Valuation, Project financial indicators; Consumer Price Index, Effects and Inflation, Real and nominal interest rates; Cost accounting in Mining Operation, Cost -volume-Profit analysis, Depreciation and Amortization; Introduction to Mining finance, non-banking mine finance and stock operation; Quantification and management of mining investment risk.

Module 4

Coal grade and Pricing, Average Sale price fixing for metalliferous ores, Mineral Lease Mineral auction, cost of mine closure; National Mineral Policy, Mineral trade and business; national and International Perspective. Critical Minerals.

Suggested Reading:

1. Gentry D.W., O'Neil T.J. (1984). Mine Investment Analysis. Society for Mining Metallurgy & Exploration, Englewood, CO (USA).
2. Ray S. C., Sinha I. N. (2016). Mine and Mineral Economics, PHI Learning.

3. Runge I. C. (1998). Mining Economics and strategy. Society for Mining Metallurgy & Exploration, Englewood, CO (USA).
4. Michael S. (2019). Mining Capital, Springer Nature, Switzerland AG.
5. Marian R., Wårell L. (2021). A Handbook of Primary Commodities In The Global Economy, Cambridge University Press.
6. Prasanna C. (2019). Financial Management: Theory and Practice (10 Edition), McGraw Hill Education (India).

OPEN ELECTIVE (ANY ONE OF THE FOLLOWING SUBJECTS)

Program: B.Tech

Semester: Eight

Course: Engineering Economics

Course Code: 8OEEL401

L	T	P	C
3	0	0	3

Course Objective:

- Enable students to perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives.
- Students will have knowledge of liability, insurance and safety/environmental requirements on projects.
- Prepare engineering students to analyze cost/revenue data and carry out make economic analyses in the decision making process to justify or reject.
- The objectives of this course are to review with students basic economic principles with students.
- Educate the students on how to systematically evaluate the various cost elements of a typical manufactured product, an engineering project or service, with a view to determining the price offer.

Course Outcome:

After the completion of the course, student will be able to:

- CO 1: Describe the concept of demand & supply and its managerial application.
- CO 2: Estimate the Present, annual and future worth comparisons for cash flows.
- CO 3: Calculate the capital investment, net present value & internal rate of return.
- CO 4: Account & analyses the sustainability, income determination and fluctuations in economy.

Model 1

Introduction, demand and supply, statistical demand and supply analysis, managerial application of the elasticity of demand and supply.

Model 2

Estimation of production and cost function; forecasting techniques and their use for decision making at different levels; linear programming and production analysis. Price output determination: a review with special reference to condition of uncertainty, kinds of pricing problems.

Model 3

Capital market and investment decisions: pay back method, average return on investment or accounting rate of return, net present value, and internal rate of return.

Model 4

Outline of welfare economics, resource accounting and sustainability, income determination and fluctuations.

Suggested Reading:

1. *Engineering Economics* by Dr. R.K. Singal & Er. Rishi Singal
2. *Engineering Economics* by Panneerselvam

Program: B.Tech
Semester: Eight
Course: Industrial Management
Course Code: 8OEEL402

L	T	P	C
3	0	0	3

Course Objective:

- To make the students aware of the outline of managerial functions relating to manufacturing.
- At the end of the course, the student should be able to understand the basic application of operational tools and manufacturing.
- Upon completion of the course, students will be able to gain knowledge and skills needed to run a business successfully.
- Learn various aspect of reliability

Course Outcome:

After the completion of the course, student will be able to:

- CO 1: Apply management practices & & practice the various management theory.
- CO 2: Describe the effectively the formation of companies, financial analysis and costing, & operation Research.
- CO 3: Identify strategies for deployment and management of human resources on organization.
- CO 4: Understand Project management & assurance Sciences.

Model 1

Management functions, Evolution of management theory and practice, organization.

Model 2

Formation of companies, financial analysis and costing, engineering economy, work study. Elements of Operation Research- PERT, CPM, LPP, Scheduling and Sequencing.

Model 3

Deployment and management of human resources, Product engineering, Plant location and layout, production planning and inventory control.

Model 4

Project management, Assurance Sciences – reliability, quality and maintainability.

Suggested Reading:

1. [Industrial Management](#) by O.N.Pandey
2. [Industrial Management](#) by K. Patrai
3. [A Text Book of Industrial Management](#) by A.P.Verma and N.Mohan

Program: B.Tech

Semester: Eight

Course: Coal Bed Methane Mining

Course Code: 8OEEL403

L	T	P	C
3	0	0	3

Course Objective:

- After completion of this course student will be aware of alternate fossil fuels, their production methods.
- Upon completion of this course, the students can able to identify the new methodologies / technologies for effective utilization of renewable energy sources

Course Outcome:

After the completion of the course, student will be able to:

- CO 1: Explain technology & process for coal bed methane exploration.
- CO 2: Analyze the CBM reservoir & methane estimation.
- CO 2: Understand the concept of hydraulic fracturing in coal bed.
- CO 3: Interpret the method of compression & transportation in CBM.

Model 1

Coalification process and coal grades. Methane generation and storage in coal; Geological control in Coal Bed Methane (CBM) exploration; Methane adsorption, desorption in coal.

Model 2

Coal as CBM reservoir: In-place methane estimation; Transport of methane in coal-bed. Drilling & Completion of a CBM hole/well. Identification and characterization of coal beds by hole/ well logs.

Model 3

Hydraulic fracturing in coal beds. Production performance of a CBM hole/well; Water drainage & gas-water separation. Gas volume measurement.

Model 4

Compression & transport; Liquefaction and utilization. Enhanced recovery by CO₂ and N₂ adsorption methods.

Suggested Reading:

- 1. Progressive Technologies of Coal, Coal bed Methane, and Ores Mining by Volodymyr Bondarenko, Iryna Kovalevs'ka*
- 2. Advanced Reservoir and Production Engineering for Coal Bed Methane by Pramod Thakur*
- 3. Fundamentals of Coal bed Methane Reservoir Engineering by John Seidle*

Program: B.Tech

Semester: Eight

Course: Mining project Work

Course Code: 8PROJMiE402

L	T	P	C
0	0	10	5

Course Objective:

- To provide the students an opportunity to express their skills, academic knowledge, practical experience and ability to analyze problems.
- The aim of the project is to stimulate creative and innovative aspects of their technological learning.
- The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.

Course Outcome:

- CO 1: Mining graduates would be equipped with managerial skill which would be useful to them for achieving their program educational outputs.
- CO 2: Explain the mining practices needed for current Indian coal mining scenario for sustainable development to meet organizational objective.
- CO 3: Contribute towards improvement in production and productivity including optimization of manpower in mines.
- CO 4: Detailed understanding of the scientific principles associated with various coal beneficiation techniques.
- CO 5: Develop skill for time bound projects implementation and production commissioning with appropriate technology adoption for economic mining & effective coal beneficiation.

Any project /research work related to mining area.

Program: B.Tech

Semester: Eight

Course: Human Values and Ethics

Course Code: 40B.451

L	T	P	C
2	0	0	0

Course Objective:

The objectives of the course are:

- To provide a critical perspective on the socialization of human beings.
- To introduce students about some key aspects of Indian culture and ethics.
- To help students reflect critically on gender violence.
- To expose the students to more egalitarian interactions between men and women.
- To develop students sensibility with regard to issues of gender in contemporary India.
- To understand the moral values that ought to guide the Management profession.
- To justify the moral judgment concerning the profession.
- Intended to develop a set of beliefs, attitudes, and habits that engineers should display concerning morality.
- To create an awareness on Management Ethics and Human Values.
- To inspire Moral and Social Values and Loyalty.

Course Outcome:

At the end of the course learners will be able to:

- CO 1: To attain a finer grasp of how gender discrimination works in our society and how to counter it.
- CO 2: Understand the ideas of values, ethics, and morality in a multicultural context.
- CO 3: Understand how universal values can be uncovered by different means, including scientific investigation, historical research, or public debate and deliberation (what some philosophers call a dialectic method)
- CO 4: Understand and discuss the idea of moral relativism and the challenges it poses to universal values
- CO 5: Critically assess the relationship between theory and practice in the formulation of values.
- CO 6: Understand that values arise from lived experiences, but need to be justified to others.
- CO 7: Understand the role of deliberation and debate in framing such values.
- CO 8: Understand how to create an actionable document through such a process.
- CO 9: Understand the importance of human solidarity and dignity.

1. VALUE CRISIS IN CONTEMPORARY INDIAN SOCIETY

- 1.1 Value Crisis at the Individual Level
- 1.2 Societal Level
- 1.3 Intellectual Level
- 1.4 Cultural Level
- 1.5 Value – What are they?
- 1.6 The Indian Concept of Values.

1.7 Modern Approach to the Study of Values.

1.8 Aesthetic Sensibilities

2. MORAL AND ETHICAL HUMAN VALUES

2.1 Bases for Moral Judgment

2.2 Some Canons of Ethics.

2.3 Virtue Ethics.

2.4 Ethics of Duty.

2.5 Ethics of Responsibility

2.6 Factors to be considered in Making Ethical Judgments.

2.7 Different Meanings of Human Values

2.8 A New Approach to Human Value ,Freedom, Creativity Love &Wisdom

3. MORAL VALUES IN PROFESSION

3.1 What is a Profession?

3.2 Professional Ethos

3.3 Code of Professional Ethics

3.4 Practicing the Code

3.5 Corporate Social Responsibility

3.6 The Larger Domain of Human Values

3.7 Institutionalizing Ethics and Human Values

4. GENDER SENSITIZATION

4.1 Socialization of women

4.2 Just Relationships, being together as equals

4.3 Declining sex ratio, demographic consequences

4.4 Women's work, its politics and economics, fact and fiction, unrecognized and Unaccounted work

4.5 Domestic violence, eve teasing and harassment. Is home a safe place?

Suggested Reading:

➤ *Dr. Rajan Mishra, Human Values: Laxmi Publications Pvt. Ltd.*

➤ *S. Dinesh Babu, Professional Ethics and Human Values; Laxmi Publications Pvt. Ltd.*

➤ *P.S. Rathore. Business Ethics And Communication; S.Chand Publishing*

➤ *Dr. K.Alex. Managerial Skills; S. Chand Publishing.*

➤ *Dr. M. Adithan, Study Skills For Professional Students For Higher Education , S.Chand Publishing*

➤ *Govindarajan M "Professional Ethics and Human Values."*

➤ *R.R. Gaur and R. Sangal " A Foundation Course in Human Values and Professional Ethics "*

Websites:

- www.tatamcgrawhill.com/digital Solutions/ monopoly
- www.schandedutech.com
- www.laxmipublications.com