

JHARKHAND RAI UNIVERSITY



MINING ENGINEERING

B.TECH



SYLLABUS

(2020 - 2024)

SEMESTER V

Kamre | Ratu Road | Ranchi | Jharkhand

Web : www.jru.edu.in | Email : info@jru.edu.in

B.TECH SEMESTER V

BATCH 2020-2024												
BTECH IN MINING ENGINEERING												
SEMESTER V												
S.No.	CATEGORY	CODE	COURSE TITLE	Period			Evaluation Scheme				Subject Total	Credit
				L	T	P	Assignment	T A	Total	ESC		
1	Professional Core Courses	8PCCMiE301	Mining Machinery I	3	0	0	20	10	30	70	100	3
2	Professional Core Courses	8PCCMiE302	Surface Mining	3	0	0	20	10	30	70	100	3
3	Professional Core Courses	8PCCMiE303	Underground Coal Mining	3	0	0	20	10	30	70	100	3
4	Professional Core Courses	8PCCMiE304	Rock Mechanics	3	0	0	20	10	30	70	100	3
5	Professional Core Courses	8PCCMiE305	Numerical & Statistical Methods	3	0	0	20	10	30	70	100	3
6	Professional Core Courses	8PCCMiE306	Remote Sensing & GIS	3	0	0	20	10	30	70	100	3
7	Humanities and Social Sciences	HSMC301	**Professional Skills	2	0	0	20	10	30	70	100	0
8	Mandatory Courses	MC301	**Constitution of India	2	0	0	20	10	30	70	100	0
PRACTICAL / SESSIONAL												
1	Professional Core Courses	8PCCMiE304P	Rock Mechanics Lab	0	0	2			30	20	50	1
2	Project	8PROJMiE301	Vocational Training Report I	0	0	0			50	50	100	2
										TOTAL	950	21

Vocational Training in a Surface / Underground Mine of minimum 30 (Thirty) days to be taken at the end of Vth Semester Will be Credited in VII th Semester.

****NOTE: Qualifying Non Credit Course.**

Program: B.Tech

Semester: Five

Course: Mining Machinery I

Course Code: 8PCCMiE301

L	T	P	C
3	0	0	3

Course Objective:

- Enables the students to select appropriate machinery for various mining operations based on the production targets.
- The students will have knowledge on function of winding engines, winding accessories, pit-top and bottom mine circuits.
- They will also know about working of various coal face machinery, face haulage systems and conveyors.
- The students will have basic knowledge on motive power used in mines, rope haulage and other transport systems.

Course Outcome:

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

- CO1: Understand the classification & application of mine machinery.
- CO2: Understand the winding system and safety features.
- CO3: Able to apply the knowledge of power transmission system and installation in mines.
- CO4: Explain the types, selection and uses of mining ropes and able to apply the knowledge of rope capping and splicing.

Module 1

Classification, application, constructional features of drilling machines used in coal and metal mining, Coal cutters, shearer, plough, continuous miner, road header and dint header. Loading and transport equipment, man riding systems.

Module 2

Classification and constructional difference of different types of winders, mechanics of winding, power calculation, rope selection, inspection and maintenance. Safety features and contrivances. Classification, construction and selection steps for mine dewatering pumps.

Module 3

Transmission of Power Belt, rope, chain, gear, hydraulic and electro-hydraulic transmission. Compressed Air Comparison with other sources of power. Air compressors – types, construction, installation and maintenance. Compressed air transmission and distribution, compressed air drills, pneumatic picks, air motors and other compressed air equipment.

Module 4

Wire Ropes Types, construction and uses. Rope deterioration and maintenance. Capping and splicing of rope. Rope haulages. Track, mine tubs and cars. Safety appliances on haulage roads. Locomotive haulage. Mono rail. Statutory Provisions

Suggested Reading:

1. D.J. Deshmukh VOL III
2. Mine pump, haulage, winding. S. GHATAK

Program: B.Tech

Semester: Five

Course: Surface Mining

Course Code: 8PCCMiE302

L	T	P	C
3	0	0	3

Course Objective:

- Enables the students to apply the knowledge of mining machinery in their economic deployment for achieving the production targets in opencast mines.
- The students will have insight about the advanced techniques for mine planning, geotechnical investigation and equipment management and also will understand the modern trends in opencast mines, safety and environment.
- The students will have ability to classify and select the suitable surface mining methods and equipment based on site conditions. They will also have a concept of waste dump formations and slope failures in surface mines.

Course Outcome:

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

- CO1: Understand the basic concept of surface mining for understanding the applicability & slope stability problem in any opencast mine.
- CO2: Understand the application and operation of shovel, dragline, dozer and other opencast machinery.
- CO3: Understand the application, operation and limitation of bucket wheel excavator and surface transport system.
- CO4: Explain the applicability of the different in-pit crushing and conveying methods & interpretation of slope stability.

Module 1

Introduction: Surface mining-basic concepts, applicability, advantages and disadvantages; Role of surface mining in total mineral production; Surface mining unit operations; Surface mining equipment systems– classification, applicability, advantages and disadvantages. Opening up of deposits: Boxcut –objective, types, parameters, methods; Factors affecting selection of box cut site; Production benches– formation, parameters and factors affecting their selection.

Module 2

Discontinuous/cyclic methods of excavation and transport: Shovel: Applicability and limitations of shovel, Cycle time and productivity calculation for shovel; Dragline operation: Applicability and limitations, different modes of operation; Cycle time and productivity calculation; Maximum usefulness factor and its significance in selection of dragline for a given situation; Scrapers: Applicability and limitations, various types; Method and cycle of operation; Dozers: Applicability and limitations; Types and classification; merits and demerits; Method and cycle of operation. Front-end- loaders: Applicability and limitations.

Module 3

Continuous methods of excavation and transport: Bucket wheel excavators: Applicability and limitations; Types and principle of operation; Calculation of productivity. Continuous surface miners: Types, classification, applicability and limitations; Principles of operation; Conveyors: types of conveyors; Mode of operation, applicability and limitations; Merits and demerits of conveyor as a system of transportation.

Module 4

Different in-pit crushing and conveying methods and their respective applicability & limitations, Types of mine slope—high wall and waste dumps; Common modes of slope failure; Factors influencing stability of slopes; Slope stability assessment techniques.

Suggested Reading:

1. *Explosive and Blasting Techniques, G.K. Pradhan*
2. *Explosives and Blasting Techniques, S.K. Das*
3. *Surface Mining, G.B. Mishra*

Program: B.Tech

Semester: Five

Course: Underground Coal Mining

Course Code: 8PCCMiE303

L	T	P	C
3	0	0	3

Course Objective:

- The students will have good exposure about the various advanced methods of coal mining with the knowledge about advanced coal face mechanization.
- To pioneer the history of longwall mining and its development stages.
- To understand the extraction, support and transport on a longwall face.
- Enables the students to appreciate various coal mining methods and to ably manage highly mechanized mines.
- To introduce the recent trends of level of mechanization for coal face.
- To understand the various advanced methods of coal mining.

Course Outcome:

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

- CO1: Explain the technical knowledge on development & extraction of coal by board & pillar mining.
- CO2: Understand the method & problems of extraction of coal from the underground mines along with stowing.
- CO3: Explain the basic knowledge of long wall mining with its applicability, components and machinery required for mining.
- CO4: Apply the knowledge of various support system in mines with its advantages & applicability.

Module 1

Introduction: History of coal mining; coal resource and their geographical distributions; Coalification and factors affecting coalification process, modes of accumulation of coal, evidences in support of in-situ and drift theories; Geological time scale vis -à-vis formation of coal, occurrence and distribution of coal in various stratigraphic horizons; Coal seam structure and abnormalities, geological and other features of Indian coalfields. Bord and Pillar Mining: Choice of methods of mining coal seams; factors affecting choice of mining methods. General principles of Bord and Pillar (B&P) development and associated merits/demerits; Design of B&P workings, statutory provisions related to B&P workings, Semi- mechanized and mechanized schemes of B&P development; Mechanized face loading. Conditions suitable for mechanical loaders and continuous miners.

Module 2

Pillar Extraction: Preparatory arrangement for depillaring operation, statutory provisions on depillaring; principles of designing pillar extraction, factors affecting choice of pillar extraction; partial and full extraction; depillaring with caving and stowing; mechanization in depillaring operation. Local and main fall, indications of roof weighting, measures to bring down roof at regular interval; air blast and measures to minimize its effects; precautions during depillaring operation against fire and inundation; multi-section and contiguous workings. Extraction of pillars in seams prone to bumps.

Module 3

Long wall Mining: Factors affecting long wall mining, long wall face layouts, advancing and retreating faces, single versus double unit long wall faces, orientation of longwall faces; single versus multiple heading gate roads, factors affecting length and width of long wall panel. Extraction of Long wall panel, working with shearer and plough, support system of long wall face and gate roads, case studies of long wall faces in India.

Module 4

Roof Supports: Timber props and cogs; friction/hydraulic props and chocks; other steel supports; types of roof bolts; function, applicability and advantage of roof bolting and cable bolting; powered supports; systematic support rules; supporting scheme of development gallery, B &P and L/W faces, depillaring district; withdrawal of support.

Suggested Reading:

1. *Underground Winning of Coal*, T.N.Singh
2. *Modern Coal Mining Technology*, S.K. Das
3. *Elements of Mining Technology Vol I*, D.J. Deshmukh

Program: B.Tech

Semester: Five

Course: Rock Mechanics

Course Code: 8PCCMiE304

L	T	P	C
3	0	0	3

Course Objective:

- The course provides detailed knowledge on rock properties
- This will equip the students with the ability to carry out various tests and monitoring the rock behavior.
- Students will be able in analysis of analysis of data and solving rock mechanics problem in mining and excavation projects.
- Provides detailed knowledge on rock properties and equips the students with the ability to carry out various tests.
- Students will be able in analyzing the data and solving rock mechanics problem in mining and excavation projects.
- Data and solving rock mechanics problem in mining and excavation projects.

Course Outcome:

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

- CO1: Understand the basic knowledge of rock mechanics for understanding, formulating and solving strata control problem in any underground mine.
- CO2: Explain the various physico mechanical properties of rock in respect to mining.
- CO3: Acquire knowledge and hands-on competence in applying the concepts of rock failure theories.
- CO4 :Evaluate the dynamic properties of rock, creep theory and rock mass by various Laboratory test & in situ test

Module 1

Rock mechanics: Definition, history, inherent complexities, source of information and field of application of rock mechanics. Concept of stress and strain in rock: Analysis of stress, strain and constitutive relations in isotropic and anisotropic rocks.

Module 2

Physico-mechanical properties of rock: Determination of physical properties, strengths, strength indices and static elastic constants; Parameters influencing strength; Abrasivity of rock and its determination.

Module 3

Failure criteria for rock and rock mass: Theories of rock failure; Coulomb, Mohr and Griffith criteria; Empirical criteria. Pre-mining state of stress: Sources, methods of determination including over coring, hydro-fracturing methods and other methods.

Module 4

Dynamic properties of rock and rock mass: Propagation of elastic wave in rock media; Determination of dynamic strength and elastic constants of rock. Time dependent properties of rock: Creep deformation and strength behavior; Creep test and rheological models. Strength and Deformability of Rock Mass: In situ shear tests; Evaluation of shear strength; In situ bearing

strength test; In situ deformability tests-Plate Loading Test, Plate Jacking Test and Bore hole Jack Tests.

Suggested Reading:

1. *Elements of Mining Technology Vol I, D.J. Deshmukh*
2. *The elements of mechanics of mining ground, B.S. Verma*
3. *Rock Mechanics for Engineers, Dr. B.P. Verma*

Program: B.Tech

Semester: Five

Course: Rock Mechanics Lab

Course Code: 8PCCMiE304P

L	T	P	C
0	0	2	1

List of Experiments:

1. Preparation of rock sample for testing in laboratory.
2. Methods for determination of compressive strength, tensile strength, shear strength and triaxial strength of rock.
3. Porosity of rock.
4. Abrasivity of rock.
5. Strength indices of rock.
6. Modulus of elasticity and Poisson's ratio.
7. Slake durability of rock.
8. Determination of in situ stresses in rock.

Program: B.Tech

Semester: Five

Course: Numerical and Statistical Method

Course Code: 8PCCMiE305

L	T	P	C
3	0	0	3

Course Objective:

- The students will get the concept about finite element models, methods and boundary elements method and its practical applications in mining and rock mechanics.
- To understand the practical applications of numerical methods in mining field.
- The understanding of the mathematical principles on numerical differentiation and integration and numerical solutions to ODE would provide them the ability to formulate and solve some of the physical problems of engineering.
- To acquaint the student with analysis of correlation and Eigen value problems used in wide variety of situations.

Course Outcome:

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

- CO 1: - Apply numerical methods to find solutions of algebraic and transcendental equations using different methods under different conditions
- CO 2: - Apply various interpolation methods and finite difference concepts to solve practical problems of Numerical Integration.
- CO 3: - To give a brief idea about advance probability concepts for solving practical problems of real world.
- CO 4: - Apply statistical tools like correlation, regression to solve various engineering problems.

Module 1

Numerical Methods: Solution of algebraic and transcendental equations by bisection, iteration, false position and Newton Raphson methods. Solution of a system of linear simultaneous equations by Gauss elimination, Gauss-Jordan, Jacobi and Gauss Seidel methods.

Module 2

Finite difference, Symbolic relations, Interpolation and extra polation, Newton-Gregory forward and backward, Gauss forward and backward, Numerical differentiation and integration, Trapezoidal, Simpson's $1/3^{\text{rd}}$, Simpson's $3/8^{\text{th}}$, Euler's, Modified Euler's, Runge-Kutta and Milne's methods.

Module 3

Probability: Various approaches of probability, two theorems (without proof), conditional probability, Bayes Theorem. Random variable: Definition, probability mass & density functions, distribution function, mathematical expectation and moment generating function.

Module 4

Measure of central tendency, Measure of Dispersion. Statistical Methods: Moments, skewness and kurtosis; curve fitting. Correlation and Regression: correlation coefficients, regression lines, regression coefficients and their properties.

Suggested Reading:

1. *Numerical & Statistical method, D.R. Vittal*
2. *Numerical Methods in Engineering and Science” by Grewal B.S. and Grewal J.S*

Program: B.Tech

Semester: Five

Course: Remote Sensing & GIS

Course Code: 8PCCMiE306

L	T	P	C
3	0	0	3

Course Objective:

- This course enables students to create a map that accurately shows distances, areas, or directions.
- Applications of remote sensing and GIS in geological mapping and mineral exploration.
- They will have deep knowledge about geophysics, remote sensing and GIS.

Course Outcome:

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

- CO1: Understand the basic knowledge of remote sensing & concept of EMR.
- CO2: Apply the knowledge of Aerial photography and photogrammetry.-electromagnetic Radiation, Remote Sensing Data Product, Spatial Filtering, Band Rationings Image Classification GIS-Project Planning, Management and Implementation.
- CO3: Learners know about Basics of GIS -components of GIS, History, Geospatial data architecture, Operations, Geographic co ordinate systems, Map projections etc.
- CO4: Analyze the vector data & processing and Applying the use of GIS.

Module I – REMOTE SENSING -INTRODUCTION AND CONCEPTS (9 hours)

Introduction of Remote Sensing – Energy sources and Radiation principles, Energy equation, EMR and Spectrum, EMR interaction with Atmosphere- scattering, Absorption, EMR interaction with earth surface features- reflection, absorption, emission and transmission, Spectral response pattern, vegetation, soil, water bodies- Spectral reflectance.

Module II - AERIAL PHOTOGRAPHY AND PHOTOGRAMMETRY (9 hours)

Introduction-,Terrestrial and Aerial photographs - vertical and oblique photographs - height determination contouring - photographic interpretations - stereoscopy – parallax bar- Flight Planning- Photo Interpretation, Applications of aerial Photos-Photo theodolite.

Module III - BASICS OF GIS (9 hours)

Introduction, concepts, Information system, components of GIS, History, Geospatial data architecture, Operations, Geographic co ordinate systems, Map projections, concepts, Input data for GIS, display, types of output products. GIS categories, Level and scale of Measurement, importance of data quality.

Module IV - VECTOR DATA & PROCESSING (9 hours)

GIS data types, data Representation, Data sources, typical GIS data sets, Data Acquisition, vector data model, relationship between classes, data structure, Database Management, Data Management and Analysis; Advantages and disadvantages of Raser or Vector Data; Uses of GIS.

Suggested Reading:

1. *Surveying and Levelling – R. Agor*

2. *Higher Surveying – B C Punamia*
3. *Surveying and Levelling – Basak*

Program: B.Tech

Semester: Five

Course: Vocational Trainee Report II

Course Code: 8PROJMiE301

L	T	P	C
0	0	0	2

Course Objective:

- To provide training in mines for gaining thorough understanding of all the theoretical knowledge.
- Gaining practical experience is an important aspect of the mining engineering program having many characteristic features of its own.
- The students will have insight about mining methods and techniques.
- The outcome at the place of work is always much more than what can be learned in the class room.
- To provide the students an opportunity to express their skills, academic knowledge, practical experience and ability to analyze problems.
- To provide the students an opportunity to express their skills, academic knowledge, practical experience and ability to analyze problems.

Course Outcome:

After the completion of these topics the student should be able to

- Mining graduates would be equipped with managerial skill which would be useful to them for achieving their program educational outputs.

1. Study of History of Mine – Note name of the Owner, Agent, Manager, SafetyOffice
2. Study of Mine geological information
3. Study of Mine Plans and Sections
4. Study of Surface features related to Mine
5. Study of method of working
6. Study of method of blasting
7. Study of Transportation system and layouts
8. Study of Ventilation systems and layouts
9. Study of Drainage system
10. Study of Pit top and Pit bottom layouts.
11. Study of man Power plan
12. Develop the Lamp room layout and Magazine Layout
13. Draw the charts depicting instructional items related to Mining subjects

Vocational Training in a Surface / Underground Mine of minimum 30 (Thirty) days to be taken at the end of Semesters.

Program: B.Tech
Semester: Five
Course: Constitution of India
Course Code: MC301

L	T	P	C
2	0	0	0

Course Objective:

The basic object of the course is to provide the acquaintance with the basic features of Indian Constitution e.g. Fundamental Rights, Fundamental Duties and Directive Principles of State policy Further it is aimed to impart the knowledge about Judicial system in India.

Course Outcome:

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

- CO1: Understand the basic features of our constitution.
- CO2: Learn the concept of Right to Equality & Prohibition on grounds of Religion, Race, Caste, sex & Place of Birth.
- CO3: Understand the concept of Basic freedoms, Protection in respect of conviction for offences & Right to Life and Personal Liberty.
- CO4: Explain the Right against exploitation & Freedom of Religion.
- CO5: Understand the concept of Directive Principles of State Policy and their relation with Fundamental Rights, Fundamental Duties & Right to Property.

Module-I (4 Hours)

1. Nature of Indian Constitution
2. Preamble
3. Union and its Territory (Arts 1-4)
4. Citizenship (Arts 5-11)
5. Definition of State (Art 12)

Module-II (6 Hours)

1. Judicial Review (Article 13)
2. Right to Equality (Article 14)
3. Prohibition on grounds of Religion, Race, Caste, Sex, Place of Birth (Article 15)
4. Equality of Opportunity in Public Employment (Article 16)
5. Abolition of Untouchability and Titles (Articles 17-18)

Module-III (6 Hours)

1. Basic freedoms (Article 19)
2. Protection in respect of conviction for offences (Article 20)
3. Right to Life and Personal Liberty (Article 21)
4. Safeguards against arbitrary arrest and detention (Article 22)

Module-IV (6 Hours)

1. Right against exploitation (Articles 23-24)
2. Freedom of Religion (Articles 25-28)
3. Cultural and Educational Rights of Minorities (Articles 29-30)
4. Constitutional Remedies (Articles 32-35)

Module-V (8 Hours)

1. Directive Principles of State Policy and their relation with Fundamental Rights (Articles 36-51)
2. Fundamental Duties (Article 51-A)
3. Right to Property (Article 300-A)
4. Facts and Law laid down in *Maneka Gandhi V Union of India* AIR 1978 SC597
5. Facts and Law laid down in *Indira Sawhney V Union of India* AIR 1993SC 477

Suggested Reading:

1. *Austin Granville- The Indian constitution: Cornerstone of a Nation.*
2. *Seervai H.M. - Constitution of India*
3. *Jain M.P. – Indian Constitutional Law*
4. *Shukla V N- Constitution of India (ed. By M.P. Singh)*
5. *Basu D.D. – Shorter Constitution of India*

Program: B.Tech
Semester: Five
Course: Professional Skills
Course Code: HSMC301

L	T	P	C
2	0	0	0

Course Objective:

The objectives of the course are:

- To make the student understand the role of communication of personal & professional success.
- To develop awareness of appropriate communication strategies.
- To prepare and present messages with a specific intent.
- To analyze a variety of communication acts.
- To ethically use, document and integrate sources.
- To create a basic awareness about the significance of soft skills in professional and interpersonal communication.
- To facilitate an overall development of the personality.

Course Outcome:

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

- CO 1: Identify and coordinate life and professional goals.
- CO 2: Learn self-improvement through interpersonal skills.
- CO 3: Apply solutions to challenges.
- CO 4: Adapt to changes.
- CO 5: Manage life and work balance.

Unit I: Personal Development

Managing Self - Self Discovery, Self Awareness, Self Esteem, Self Responsibility, Self Management

Personal Development Skills, Categories of Personal Development, Personal Development Process
 Relationship Management - Managing Others, Interpersonal Skills, Improving Relationship, Transactional Analysis, JOHARI Window, four Life Positions

Unit II: Thinking Process

Strategic Thinking – Introduction, Concept, Stages in Strategic Thinking, Process of Strategic Thinking, Importance of Strategic Thinking, Characteristics of Strategic Thinkers, Developing Strategic Thinking

Lateral Thinking – Introduction, Meaning, Need for Lateral Thinking, Techniques of Lateral Thinking, Benefits of Lateral Thinking

Creative Thinking – Out of Box Thinking, Application of Thinking

Facing Changes – Adapting Change, Understanding Change- Examples of Organizational Change

Facing Challenges – Introduction, Taking Initiative, Benefits of facing challenges, Facing challenges in life

Balancing Work and Life – Importance, Gender differences regarding work life balance, Tips for balancing work and life

Unit III: Individual Behavior

Attitude – Components of Attitude, Factors influencing Attitude, Types of Attitude, Challenges and lessons from Attitude, Impact of Attitude on Behaviour

Motivation – Concept, Objective, Factors of Motivation, Self Steem, Intrinsic & Extrinsic Motivation

Time Management – Value of Time, Diagnosing Time management, Weekly Planner, To Do List, Prioritizing Work

Stress Management – Introduction, Difference between Stress, Anxiety and Tension, Managing Stress

Applied Ethics – Introducing Professional Ethics, Ethical Dilemma

Unit IV: Employment Communication

Job Communication – Developing Job Communication Skills, Job Communication Process, Developing Confidence; Job Search Strategy – Understanding the Job Market, The Job Search Process, Job Search Techniques; Job Application, Employment Letters

Resume Building – Difference between Bio data, Curriculum Vitae and Resume

The Job Interview - Types of Job Interview, Preparing for a Job Interview, Understanding Interview Questions, Handling Interview Questions, Interview Strategies

Psychometric Test

Suggested Readings:

- 1. Covey S (2004) The 7 Habits of Highly Effective People.*
- 2. Goud, N. & Arkoff, A. (2003) Psychology and Personal Growth, Allyn & Bacon.*
- 3. Sen, Leena, Communication Skills, Eastern Economy Edition*
- 4. Dr. K.Alex Managerial Skills, S.Chand*