

 **JHARKHAND**  
**Rai University**

# JHARKHAND RAI UNIVERSITY



## **MINING ENGINEERING**

### **DIPLOMA**



SYLLABUS

2021-2024

**SEMESTER- III**

Kamre | Ratu Road | Ranchi | Jharkhand

<b>DIPLOMA IN MINING ENGINEERING</b>												
<b>SEMESTER III</b>												
<b>S. No</b>	<b>Subject code</b>	<b>Name of Subject</b>	<b>Period</b>			<b>Evaluation Scheme</b>				<b>Subject</b>	<b>Credit</b>	<b>Hours</b>
			<b>L</b>	<b>T</b>	<b>P</b>	<b>Assignment</b>	<b>T A</b>	<b>Total</b>	<b>ESC</b>			
1	8D.201	Mechanical Engineering	3	0	0	20	10	30	70	100	3	3
2	8D.202	Mining Geology I	3	0	0	20	10	30	70	100	3	3
3	8D.203	Mine Surveying I	3	0	0	20	10	30	70	100	3	3
4	8D.204	Introduction to Mining	3	0	0	20	10	30	70	100	3	3
5	9D.204	Applied mathematics	3	0	0	20	10	30	70	100	3	3
6	40D.201	Communication & Soft Skills	2	0	0	20	10	30	70	100	2	2
7	14D.201	<b>** Disaster Management</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>20</b>	<b>10</b>	<b>30</b>	<b>70</b>	<b>100</b>	<b>0</b>	<b>3</b>
<b>PRACTICAL / SESSIONAL</b>												
1	8DP.201	Mechanical Engineering Lab	-	-	2	-	30	30	20	50	1	2
2	8DP.202	Mining Geology I Lab	-	-	2	-	30	30	20	50	1	2
3	8DP.203	Mine Surveying I Lab	-	-	2	-	30	30	20	50	1	2
								<b>Total</b>	<b>750</b>	<b>20</b>	<b>23</b>	

- **\*\* NOTE: Qualifying Non Credit Course**
- **Note: Vocational Training in a Surface / Underground Mine of minimum 30 (Thirty) days to be taken at the end of III<sup>rd</sup> Semester Will be Credited in V<sup>th</sup> Semester.**
- **MOOCS introduced through SWAYAM in all semester.**

**Program:** Diploma  
**Semester:** Three  
**Course:** Mechanical Engineering  
**Course Code:** 8D.201

L	T	P	C
3	0	0	3

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### Course Objective:

- To equip the mining engineering students with the basic principles of operation of Mining Machinery.
- Critically analyze problem and solve the problems related to mechanical elements and analyze the deformation behavior for different types of loads.
- Ability to understand fundamental material properties
- Ability to research and present on advance material topics
- To understand structure-properties relationship
- Manipulate atomic and micro-structural processes to create desired structure and properties
- To give basic knowledge of science behind materials and physical metallurgy
- To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.

### Unit I

Units and Dimensions, Units of pressure, Volume, Temperature, Work, Power, Energy in SI system only and their dimensions. Engineering Materials: Chemical composition, properties and uses of following ferrous Metals: Cast iron, steel, Wrought iron, manganese steel, nickel steel, chromium steel, nickel-chromium steel, stainless steel. Non ferrous: Aluminum, copper, nickel, bronze, brass, copper nickel alloys, Aluminum alloys etc.

### Unit II

Brakes and Clutches: Classification, Construction & working of block brakes, internal expanding brakes, hydraulic brakes, vacuum brakes (no numerical problems). Clutches: Construction & working of plate clutches, cone clutches, centrifugal clutch, and claw clutch (no numerical problems) IC Engine: Classification, Otto cycle, Diesel cycle. Two stroke & four stroke petrol engine .Two stroke & four stroke Diesel engine .Different systems like fuel injection, fuel ignition for petrol & diesel engines.

### Unit III

Air Compressor: Classification, Definitions of different terms such as inlet pressure, discharge pressure, capacity, theoretical power, break power, free air delivery.

### Unit IV

Hydraulics Machines: Properties of fluid, components of hydraulic circuits and their symbols, constructional details and working of hydraulic of shaper and hydraulic press. Types of pumps. Working principle of centrifugal pump, working principle of reciprocating pump. Uses of pumps in mining industry. Normalizing, annealing, hardening or quenching, tempering, case hardening of steel.

### Suggested Reading:

1. *Strength of materials, Khurmi*
2. *Engineering Mechanics, Singer*
3. *Applied Mechanics, Ramanutham*

**Program:** Diploma

**Semester:** Three

**Course:** Mechanical Engineering Lab

**Course Code:** 8DP.201

L	T	P	C
0	0	2	1

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### List of Experiments:

1. Demonstration of different types of brakes.
2. Demonstration of different types of clutches and their working.
3. Demonstration of petrol engine (Two stroke & four stroke cycle engine.)
4. Demonstration of Diesel engine (four stroke cycle engine.)
5. Demonstration of reciprocating air compressor.
6. Demonstration & application of Rotary compressor.
7. Study of hydraulic circuit of shaper machine.
8. Study of hydraulic circuit of hydraulic press.
9. Demonstration of Centrifugal pump & its components.
10. Demonstration of Reciprocating pump & its components.

**Program:** Diploma  
**Semester:** Three  
**Course:** Mining Geology I  
**Course Code:** 8D.202

L	T	P	C
3	0	0	3

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### Course Objective:

- This will provide basic knowledge on identification of various rocks & minerals by verifying the physical properties.
- The course will equip the students with the ability to appreciate the structure of earth and ore formations.
- The students will have knowledge about ore reserve estimation, ore assaying, remote sensing, geological mapping and identification of geological structures in the field.
- To practice the determination of engineering properties of rocks, preparation of weathering profiles, RMR, RQD, preparation of geological and structural maps and congestion of geological structures in the field.

### Unit I

General geology: Branches, Sub branches, scope, origin of earth, continental Drift, Isostasy. Mineralogy: Definition, Classification of minerals and Physical and Chemical Properties of Minerals, properties of common minerals like Quartz, feldspar, Mica, Pyrite, Chalcopyrite, Galena, Hematite, Magnetite, Chromite, Psilomelane etc.

### Unit II

Petrology: Igneous rocks: Magma and Lava, extrusive and intrusive forms. Classification and description of common igneous rocks (Granite, Dolerite, Gabbro, Basalt, Pegmatite)

Sedimentary Rocks: Sedimentation process; classification and description of common sedimentary rocks (Conglomerate, sandstone, shale, Limestone). Metamorphic Rocks: Process of metamorphism, classification & description of common metamorphic rocks (Slate, Marble, Quartzite, Gneiss, Schist)

### Unit III

Paleontology and Stratigraphy: Concept of paleontology; fossils, their mode of presentation, concept of index fossils; principles of stratigraphic subdivisions and associated rock types of important are provenience & Coal belt.

### Unit IV

Physical Geology: Erosion & weathering, River& wind erosion, Earth quake, Volcano

Geological Map: Drawing of Geological section of maps, Description of Geological maps, characteristics of contour line.

### Suggested Reading:

1. *A text book of Geology, P.K. Mukherjee*
2. *Physical Geology, A.K. Dutta*
3. *Structural Geology, S.W. Chiplonkar*

**Program:** Diploma

**Semester:** Three

**Course:** Mining Geology I Lab

**Course Code:** 8DP.202

L	T	P	C
0	0	2	1

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### List of Experiments:

1. Study of physical properties of common rock forming Minerals and ore Minerals
2. Study of common igneous rocks.
3. Study of common sedimentary rocks.
4. Study of common metamorphic rocks with references to their structures, mineral composition and its uses.
5. Study and drawing of geological maps.

**Program:** Diploma  
**Semester:** Three  
**Course:** Mining Surveying I  
**Course Code:** 8D.203

L	T	P	C
3	0	0	3

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### Course Objective:

- The course provides for basic skills in survey and correct usage of survey instruments.
- The student will be able to enter for the Elementary Survey Course.
- Appreciate the need for accurate and thorough note taking in field work to serve as a legal record
- Gain the ability to use modern survey equipment to measure angles and distances.
- Gain the ability to measure differences in elevation, draw and utilize contour plots, and calculate volumes for earthwork.
- Improve ability to function as a member of a survey party in completing the assigned field work.

### Unit I

Introduction to surveying: Definition of surveying, objects of surveying, Plane and Geodetic surveying. Classification & Basic principles of surveying. Principle of chain surveying. Equipments in Chain surveying, cross staff, optical square its principle and use. Different operations in chain surveying, Ranging: direct & reciprocal ranging. Line ranger structure, principle of working and its use. Chaining: Chaining on flat & slopping ground, obstacle in chaining (No numerical). Errors in chaining. Offsetting.

### Unit II

Compass Surveying: The Prismatic & Surveyors compass, their Comparison. Bearing of a line: Definitions: True & Magnetic Meridian; True and Magnetic bearings, Fore & Back bearings, Declination. Whole circle bearing system & Quadrantal. Bearing system. Conversion of bearings from one system to other. Calculation of angles from bearings. Calculation of bearings from angles. Local attraction: Sources, detection & its elimination. Magnetic Dip & Magnetic declination. Calculation of True bearings. Traversing with compass: Closed and open traverse; plotting a compass traverse; Checks for open & closed traverse; Closing error, Graphical adjustment of closing error. Introduction to Plane table and its accessories, Temporary adjustments of Plane table, centering, leveling, orienting the plane table by method of back sighting by method of magnetic needle. Methods of plane tabling Radiation, Intersection, Traversing, Resection method. Advantages & disadvantages of plane table survey, Errors in plane table survey.

### Unit III

Levelling: Definitions of the terms used in Levelling. Concept of datum, Back sight, Foresight stations, change point, height of instrument. Dumpy and tilling level Construction and temporary adjustments. Levelling staff, their types. Balancing of back sight and Fore sight distances. Holding and Reading the staff, simple and differential levelling, and booking of readings. Reduction of levels by Collimation system and by Rise & fall system. Arithmetic check, computation of missing readings. Classification of leveling: Differential, Reciprocal, and fly levelling, Profile levelling, cross sectioning. Plotting of a profile and cross section. Difficulties in leveling, common mistakes in levelling. Permanent adjustments of Dumpy & Tilling level. Automatic level (General idea only). Transferring levels underground: Measurement of depth of vertical shaft. Establishing u/g bench mark in relation to surface bench mark. Marking center & grade line of drift, Marking Highest flood level. Study and use of Abney level, Auto set level, Temporary adjustments.

### Unit IV

Contouring: Introduction and concept, definitions, purpose, Characteristic of Contour line, contour interval, factors affecting contour interval, Horizontal equivalent. Methods of Locating contours. Direct method,

indirect method. Interpolation of contours by estimation, arithmetical and by graphical method. Plotting of contour maps. Uses of contour map. Measurement of areas & volumes by Simpson's and Trapezoidal, prizmoidal rule, measurement of stock of coal, overburden mines. Subsidence monitoring, data required for subsidence studies, parameters required during monitoring, layout of survey lines, survey stations, measurement techniques and Instrumentation, Measurement of displacement, slope and subsurface movement, frequency of subsidence measurement. General requirements of mine plan, Types of plan, copies of plans & sections to be submitted.

***Suggested Reading:***

1. *Surveying and leveling Vol. I & II , T. P. Kanetkar*
2. *Surveying & Levelling , B.C. Punmia*
3. *Surveying & Levelling , Amarjit Aggarwal*



**Program:** Diploma

**Semester:** Three

**Course:** Mining Surveying I Lab

**Course Code:** 8DP.203

L	T	P	C
0	0	2	1

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### List of Experiments:

1. Locating various objects by chain & determination of area of polygon by Chain Surveying.
2. Measurement of bearings of sides of traverse with prismatic compass and computation of correct included angle.
3. Study of different Levels and Levelling staffs. Practice of Temporary adjustments and to find out the reduced levels of the given points using Dumpy Level by Height of Collimation method.
4. Locate different points on the ground and prepare contour map of the given area.
5. To study the orientation of plane table by back sighting method and by trough compass.
6. To determine the position of station occupied by plane table by two Point Problem.

**Program:** Diploma  
**Semester:** Three  
**Course:** Introduction to Mining  
**Course Code:** 8D.204

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3	0	0	3

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### Course Objective:

- Enable students to demonstrate the importance of mining in national economy.
- Students will understand the terminology associated with the discipline and be familiar with the available regulatory mechanism to enable safe & sustainable mining operations.
- Equips the students with detail knowledge on various engineering techniques used for drilling, blasting, roof support and allied activities in mine construction for exploitation of minerals.

### Unit I

Introduction to Mining & mineral: Definition, Different Types of Mining Methods, Mineral resources in India. Uses of important minerals mined e.g. Coal, lignite, iron ore, limestone copper, zinc, bauxite, gold, manganese, mica etc. Important Organizations involved like DGMS, CIL, MECL, CMRI, IBM etc. their role and functions.

### Unit II

Mining Terminologies & definition: Common terminologies used in coal mining, metal mining, mine ventilation and environment and mine supports. Simple definition, explanation, purposes and sketches. Mode of access: Modes of entry to mine, Adit, Shaft, Trench, Open Pit and their description and sketches.

### Unit III

Explosives & Accessories: Common explosive bases, Properties of Explosives, High Explosive & Low explosive, their comparison. Permitted explosives their types, composition, properties, uses, advantages & disadvantages. Brand names of some commonly used explosive of each type. Detonator, common types of detonators, plain detonators, instantaneous and delay action detonators their construction, uses, comparison etc. low tension & high-tension detonators. Safety fuses, detonating cords, detonating relays. Shot firing tools, exploders.

### Unit IV

Introductory lessons on working Coal: Classifications of method of working coal (a) Board & Pillar (b) Open cast method (c) Long wall. Applicability condition for selection of each methods of working. Advantages, disadvantages & simple layout of each method.

### Suggested Reading:

1. *Explosive and Blasting Techniques*, G.K. Pradhan
2. *Explosives and Blasting Techniques*, S.K. Das
3. *Element of Mining Technology Vol.- I*, D.J. Deshmukh

**Program:** Diploma

**Semester:** Three  
**Course:** Applied Mathematics  
**Course Code:** 9D.204

L	T	P	C
3	0	0	3

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### Course Objective:

- The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions. Students will be able to solve problems related to engineering applications by using these techniques.
- Students will use mathematics concepts in real world situations.
- Students will simplify and perform operations with nonlinear expressions.
- Apply the principles of Vector algebra to solve a variety of basic problems in engineering and Applied Science.

### Unit I

Complex Variable: Continuity, Differentiability, and analyticity of a function of a complex variable, Cauchy – Riemann equations in Cartesian and Polar form, Harmonic Function.

### Unit II

Ordinary Differential Equation: Formation of Ordinary differential equation ,Variable Separable Homogeneous Equation ,Solution of Bernoulli's Equation ,Exact-Differential Equation.

### Unit III

Graph Theory: Graph, Sub graph, Walk travel and Path, Connected and Disconnected graph. Handshaking theorem or Edge and Vertex of a graph. Matrix representation of graph (Incidence and Adjacency Matrices).Spanning Tree. Kruskal's Algorithms for minimal Spanning tree.

### Unit IV

Numerical Solution of Algebraic Equation and Simultaneous Equation: Bisection Method, Regula –Falsi Method, Newton-Raphson Method, and Gauss elimination Method, Iterative Method –Gauss Siedal and Jacobi's Method. Laplace Transform: Definition of Laplace Transform, Inverse Laplace Transform.

### Suggested Readings:

1. *Higher Engineering Mathematics –Dr.B.S.Grewal Khanna Publication*
2. *Higher Engineering Mathematics –H.K.Das*
3. *Engineering Mathematic -N.P.Bali Laxmi Publication*
4. *Graph Theory: Prabhakar Gupta and Vineet Agarwal Pragati Prakashan.*

**Program:** Diploma

**Semester:** Three

**Course:** Communication and Soft Skills

**Course Code:** 40D.201

L	T	P	C
2	0	0	2

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**Course Objective:** The aim is to develop students' soft skills, communication, leadership and teamwork skills; and personal development skills using practical approach and exposure of students to the realities of the world.

- To enhance Leadership – assessing the requirements of a task, identifying the strengths/weaknesses within the team, utilizing the diverse skills of the group to achieve the set *objectives*.
- To improve *Communication* – demonstrating clear briefing and listening /speaking skills.
- To make them realize that effective *communication* and interpersonal skills are crucial to increase employment opportunities and to compete successfully in the business environment.
- The *course* aims to cause a basic awareness about the significance of *soft skills* in professional and inter-personal *communications* and facilitate an all-round development of personality. Hard or technical skills help securing a basic position in one's life and career. But only *soft skills* can ensure a person retain it, climb.

## Unit I

### COMMUNICATION SKILLS

Introduction

Role of Communication in Today's World

Objective of Communication

Process of Communication

Elements of Communication

Essentials of Communication

Barriers/ Factors Inhibiting Communication

Flow of Communication

Verbal Mode of Communication

## Unit II

### COMMUNICATION NETWORK

Non Verbal Mode of Communication

Kinesics/Body Language, proxemics , chronemics, para lingual

Style in Technical Communication

Communication Skills; Reading, Writing, Speaking, Listening & Talking

## Unit III

### GRAPHICS

Introduction

Planning of Graphics

Placing of Graphics

Construction of Graphics

Types of Graphics (textual, visual, tables, bar Charts, pie charts, line charts, organizational charts, flow charts, maps & Pictographs)

## Unit IV

### TELEPHONIC CONVERSATION SKILLS

Introduction

Stages in Telephonic Conversation

Listening & Speaking Skills

Telephonic Skills

Problems in Telephonic Conversation

Intensive Listening

### **Suggested Readings:**

- *Monippally, Matthukutty. M. 2001. Business Communication Strategies. 11<sup>th</sup> Reprint. Tata McGraw-Hill. New Delhi*
- *Swets, Paul. W. 1983. The Art of Talking So That People Will Listen: Getting Through to Family, Friends and Business Associates. Prentice Hall Press. New York*
- *Lewis, Norman. 1991. Word Power Made Easy. Pocket Books*
- *Sen, Leena. Communication Skills ; Eastern Economy Edition*
- *Ghanekar, Dr. Anjali. Essentials of Business Communication Skills ; Everest Publishing House*
- *David Green. Contemporary English Grammar, Structure & Composition ; MacMillan*
- *Dictionary; Oxford*
- *Dictionary ; Longman*

### **Websites**

- [www.tatamcgrawhill.com/digital\\_solutions/monippally](http://www.tatamcgrawhill.com/digital_solutions/monippally)
- [www.dictionary.cambridge.org](http://www.dictionary.cambridge.org)
- [www.wordsmith.org](http://www.wordsmith.org)
- [www.edufind.com](http://www.edufind.com)
- [www.english\\_the\\_easy\\_eay.com](http://www.english_the_easy_eay.com)

**Program:** Diploma  
**Semester:** Three  
**Course:** Disaster Management  
**Course Code:** 14D.201

L	T	P	C
3	0	0	0

### Course Objective:

- Develop an understanding of the key concepts, definitions a key perspectives of All Hazards Emergency Management
- Understand the Emergency/Disaster Management Cycle
- Have a basic understanding for the history of Emergency Management
- Develop a basic under understanding of Prevention, Mitigation, Preparedness, Response and Recovery
- Develop a basic understanding for the role of public private partnerships.

### Unit I

Understanding Disasters: Understanding the concepts and definitions of disaster, hazard, vulnerability, risk, importance, dimensions & scope of Disaster Management, Disaster Management cycle and disaster profile of India.

### Unit II

Types, Trends, Causes, Consequences and Control of Disaster: Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves); Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear, bomb threat, explosion) and Man-made Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters; terrorist attack, , sudden shooting); Global Disaster Trends–Emerging Risks of Disasters–Climate Change and Urban Disasters; Financial emergency( risk of eviction, risk in arrears, sudden health emergency, family emergency, unexpected loss of income).

### Unit III

Prevention and Mitigation of Disaster :Disaster Mitigation: meaning and concept, Disaster Mitigation Strategies Emerging Trends in Disaster Mitigation, Mitigation management, Role of Team and Coordination. Disaster Preparedness: Concept & Nature, Disaster Preparedness Plan, Preventions. Roles & Responsibilities of Different Agencies and Government, Technologies for Disaster Management. Early Warning System; Preparedness, Capacity Development; Awareness during Disaster.

### Unit IV

Applications of Science and Technology for Disaster Management & Mitigation: Geo-informatics in Disaster Management (RS, GIS, GPS and RS) Disaster Communication System (Early Warning and Its Dissemination) Land Use Planning and Development, Regulations, Disaster Safe Designs and Constructions, Structural and Non Structural Mitigation of Disasters.

### Suggested Reading:

1. *Disaster Management- J. P. Singhal, Laxmi Publications.*
2. *Disaster Management - Dr. Mrinalini Pandey, Wiley India Pvt. Ltd.*
3. *Disaster Science and Management- Tushar Bhattacharya, McGraw Hill Education (India) Pvt. Ltd.*

4. *Disaster Management: Future Challenges and Opportunities* - Jagbir Singh, K W Publishers Pvt. Ltd.