

# JHARKHAND RAI UNIVERSITY



## **MINING ENGINEERING**

### **B.Tech**



## SYLLABUS

## SEMESTER VII

**Kamre | Ratu Road | Ranchi | Jharkhand**

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## B.TECH SEMESTER VII

B.TECH IN MINING ENGINEERING												
SEMESTER VII												
S. No	Subject code	Name of Subject	Period			Evaluation Scheme				Subject	Credit	Hours
			L	T	P	Assi gnm ent	T A	Tot al	ESC			
1	8.401	Mine Environmental Engineering	3	0	0	20	10	30	70	100	3	3
2	8.402	Environmental Aspect of Mining	3	0	0	20	10	30	70	100	3	3
3	8.403	Mining Machinery II	3	0	0	20	10	30	70	100	3	3
4	8.404	Mine Legislation & Safety I	3	0	0	20	10	30	70	100	3	3
5	<b>ELECTIVE I (Any one of the followings subjects)</b>											
	8.431	Dimensional Stone Mining	3	0	0	20	10	30	70	100	3	3
	8.432	Rock Excavation Engineering										
	8.433	Design of Open pit mines										
6	40B.401	<b>**Seminar in Executive Communication</b>	2	0	0	20	10	30	20	50	0	2
<b>PRATICAL / SESSIONAL</b>												
1	8P.401	Mine Environmental Engineering Lab	0	0	2		20	20	30	50	1	2
2	8P.406	Computer Aided Mine Planning Lab	0	0	2		20	20	30	50	1	2
3	8.445	Vocational Trainee Report II	0	0	0		0	0	0	50	2	
									<b>Total</b>	<b>650</b>	<b>20</b>	<b>19</b>

- **\*\* NOTE: Qualifying Non Credit Course & only Viva voce is conducted.**
- **MOOCS introduced through SWAYAM in all semester.**

**Program:** B.Tech  
**Semester:** Seven  
**Course:** Mine Environmental Engineering  
**Course Code:** 8.401

L	T	P	C
3	0	0	3

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### Course Objective:

- The students will have knowledge on spontaneous heating, mine fires, inundation and explosions.
- To study about mine rescue and first aid.
- The students will get practical knowledge about underground mine ventilation methods and planning.
- The students will have deep knowledge about the mine accidents, disaster, disease and mine Safety with risk assessment, mitigation and management.
- Helps to analyze the problems caused by the lack of environmental awareness in mining activity.
- Proposes sustainable solutions that use existing rules as a basis for environmental policies.

### Unit I

Mine fires: Causes and classification of mine fires; Spontaneous combustion mechanism, stages of spontaneous combustion, susceptibility indices, factors affecting spontaneous combustion; Detection and prevention of spontaneous heating and accidental fires; Dealing with mine fires direct and indirect methods, fire stopping; Re-opening of sealed-off areas; Fires in quarries, Coal stacks and waste dumps.

### Unit II

Mine explosions: Firedamp and coal dust explosions causes and prevention, explosive limits; Stone- dust and water barriers; Explosion in quarries over developed pillars; Investigation after an explosion.

### Unit III

Inundation: Causes and prevention; Precautions and techniques of approaching old workings; Dewatering of waterlogged working, safety boring apparatus, pattern of holes; Design and construction of water dams. Rescue and recovery: Rescue equipment and their uses, classification of rescue apparatus; Resuscitation; Rescue stations and rescue rooms; Organization of rescue work; Emergency preparedness and response system.

### Unit IV

Air borne respirable dust: Generation, dispersion, measurement and control; Physiological effects of dust, dust-related diseases. Illumination: Cap lamps; Layout and organization of lamp rooms; Standards of illumination; Photometry and illumination survey; Lighting from main and other sources.

### **Suggested Reading:**

1. *Elements of Mining Technology Vol II*, D.J.Deshmukh, Central Techno Publication, Nagpur
2. *Mine Environment & Ventilation*, G.B.Misra, Oxford University Press, Calcutta
3. *Mine Disaster & Mine Rescue*, M.A. Ramlu, Oxford University Press, Calcutta

**Program:** B.Tech

**Semester:** Seven

**Course:** Mine Environmental Engineering Lab

**Course Code:** 8P.401

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0	0	2	1

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### List of Experiment:

1. Detection of Methane using flame safety lamp.
2. Demonstration of whirling hygrometer and determination of relative humidity using whirling hygrometer.
3. Demonstration of Kata thermometer and determination of cooling power by Kata thermometer.
4. Demonstration of various ventilation devices.
5. Demonstration of vane Anemometer and determination of quantity by Anemometer.
6. Demonstration of velometer and measurement of air velocity by velometer.

**Program:** B.Tech

**Semester:** Seven

**Course:** Environmental Aspects of Mining

**Course Code:** 8.402

L	T	P	C
3	0	0	3

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**Course Objective:**

- Enable the students to understand the ill effect of mining activities on environment and how to reduce it.
- Upon completion of this course, the students can able to identify the new methodologies / technologies for effective utilization of renewable energy sources.

**Unit I**

Introduction: Sustainable development, environmental carrying capacity - concepts & principles; Environmental impacts of mining and associated activities. Ecology: Introduction to ecology, ecosystem structures and functions.

**Unit II**

Air pollution: Atmospheric composition and meteorology; Sources of air pollution–point and non-point; Emission factors; Control measures– extraction, suppression and consolidation of dust. Noise and vibration: Basic concepts, sources, monitoring and control measures.

**Unit III**

Water pollution: Global hydrological cycle; Self purification mechanism ,sources of water pollution, important parameters–pH, turbidity, oil & grease, nitrates, DO, BOD, COD; Eutrophication, de oxygenation, acid mine drainage and heavy metal pollution– preventive and control measures. Land environment: Land degradation due to mining; Physical and biological reclamation.

**Unit IV**

Environmental administration: Laws related to mining environment; EIA of mining projects. Land Acquisition & Revenue: Concepts: Related laws and regulations. Corporate Social Responsibility: Concepts and principles. Mine closure: Concepts and principles.

***Suggested Reading:***

1. *Mine Environment & Ventilation*, G.B.Misra, Oxford University Press, Calcutta
2. *Environmental Impact of Mining and Mineral Processing*, Ravi Jain
3. *Hand Book of Methods in Environment Studies*, S.K.Maiti, ISM
4. *Environment Management In Mining Area*, Dr.N.C.Saxena

**Program:** B.Tech  
**Semester:** Seven  
**Course:** Mining Machinery II  
**Course Code:** 8.403

L	T	P	C
3	0	0	3

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### Course Objective:

- The students will get exposure towards the material handling methods and systems and its principle to convey the minerals or materials from mines, plants and workshops.
- The students will have practical knowledge about underground machineries, ropes, pit-top and pit-bottom layouts.
- Enables students about the conveyor system and its advancement.

### Unit I

Construction and operation of blast hole drills, rippers, shovels ,hydraulic excavators, scraper, dragline, dumpers, wheel loaders, dozers, graders, surface miners, BWE, spreader, stacker & reclaimers. High capacity belt conveyors—constructional detail and selection procedures. Aerial ropeways—classification, layout and constructional features. Classification, application and constructional features of crushers, breakers and feeders.

### Unit II

Surface and Underground Layout Pit top and pit bottom circuits. Surface structures. Surface handling systems – coal and ore handling plants. Storage bunkers. Railway siding. Pit bottom layouts. Winding Drum and friction winding, headgears, headgear pulleys, cages and skips, suspension gear, keps and guides.

### Unit III

Steam and electric winders, safety devices in winders, duty cycle. Automatic winding. Multilevel winding. Trackless Haulage Types of conveyors and their sequence control. High angle conveyor. Free steered vehicles - shuttle cars, LHD, SDL and low profile dump trucks (LPDT).

### Unit IV

Aerial Ropeways Types, construction and installation. Loading, unloading and angle stations, Man-riding Systems Statutory Provisions

### Suggested Reading:

1. *Voll-II, D.J. Deshmukh, Central Techno Publication, Nagpur*
2. *Mine pump, haulage, winding, Ghatak, Coal Field Publisher Asansol.*

**Program:** B.Tech

**Semester:** Seven

**Course:** Mine Legislation and Safety I

**Course Code:** 8.404

L	T	P	C
3	0	0	3

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### **Course Objective:**

- 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.
- To study various acts, rules and regulations relating to the mineral industry.
- Student will know about subsidence control, governing norms and regulations.
- Students will be acquainted with rules, laws and order for running a mine.

### **Unit I**

Mines Act 1952: Meaning of the terms, Mine Act, Regulations, Rules, Bye-laws, standing orders, and situations under which act does not apply. Provisions of Mines Act in respect of Drinking water health and hygienic conservancy, Medical Appliances, Hour and limitations of Employment - Leave with wages.

### **Unit II**

Mines Rules 1955: Mine Rules related to drinking water, lavatories, urinals with on surface and in underground first aid, - Ambulance, Hours, and limitations of Employment - leave with wages - with wages and over time.

### **Unit III**

Coal Mines and Metalliferous Mines Regulations: Important definitions, regulations related to notice of accidents duties of managers, Asst/under Managers, Overman, foreman and surveyor, Mine plans and sections. Means of Access and egress ladder and Ladder ways under M.M.R. Transport of men and material by Haulage mine working, precautions against dangers from gas and water Mine ventilation, mine lighting and safety equipment and types of fences (Miscellaneous)

### **Unit IV**

Safety Aspects in Mines: Accidents classification and analysis-safe condition- unsafe condition- mine safety- safety objectives- major factors to be considered for safety - safety week- pit safety committee- safety organization and safety policy.

### **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*

**ELECTIVE II (ANY ONE OF THE FOLLOWING SUBJECTS)**
**Program:** B.Tech

**Semester:** Seven

**Course:** Dimensional Stone Mining

**Course Code:** 8.431

L	T	P	C
3	0	0	3

**Course Objective:**

- The course is designed to help the student in understanding the different methods to mining and processing also extraction methods of dimensional stone.
- They can know about various properties of dimensional stone and various machines to use for extraction of dimensional stone.
- After learning this course the students should be able to understand the different method to mining and processing also extraction methods of dimensional stone.

**Unit I**

Introduction: Definition, historical use of natural stones. Geology and occurrences: Classification of dimensional stones, composition, chemical and geo-chemical properties, various standards for normalization of dimensional stones. Mining of dimensional stones: Various techniques of dimensional stones mining—block mining and slab mining; Manual mining; Mechanized mining—line drilling, in-situ sawing by wire saw, chain saw, portable circular saw, flame cutting.

**Unit II**

Cutting/Sawing tools: Tool carrier—circular steel blade, steel wire rope, chain jib saw, physical and mechanical properties, elastic properties, tension etc.; Cutting tools—diamond segments, diamond pearls/bits, tungsten bits etc.; Process of manufacture, ingredients, brazing /fitting, wearing pattern and control; Cost of cutting. Handling of blocks and slabs: Equipment used derrick crane, front loaders, fork-lifts, mobile cranes, trucks and trailers.

**Unit III**

Quarrying machines for dimensional stones: Portable circular saw, wire saw, chain saw, line drills—special design features of the machines, techniques of use and maintenance. Production monitoring: Recovery, waste generation, productivity, inherent defects, measurement and corrective actions, cost evaluation. Environmental issues: Management of solid waste, slurry waste, soil and water; Protection and rehabilitation.

**Unit IV**

Health, safety and welfare: Protective care from abrasive dust, personal safety and welfare. Application, processing and architecture in dimensional stone: Application—flooring, roofing, cladding, stairs, paving, facets; Processing and polishing —various techniques for sawing of blocks, shaping of edges, polishing and calibration; Fixing and installation—techniques of fixing of dimensional stones in various applications like flooring, cladding, faceds, stairs, roofing and paving; Care and maintenance of dimensional stones—techniques for post fixing care and maintenance of dimensional stones in various applications.

**Suggested Reading:**

1. *HAND BOOK ON SAFETY IN MINES & DIMENSION STONE QUARRIES, Mines Group Vocational Training Society, Hospet*
2. *A Text-Book of Ore and Stone Mining (1894) by Sir Clement Le Neve Foster*



**Program:** B.Tech  
**Semester:** Seven  
**Course:** Rock Excavation Engineering  
**Course Code:** 8.432

L	T	P	C
3	0	0	3

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### Course Objective:

- The students will get familiarity about rock mechanics properties, rock cutting technology and excavating machines.
- To understand the rock mechanics, rock cutting technology, rock cutting tools and rock excavating machine.
- Student get introduced with the rock mass classification and mechanism of rock reinforcement And the typical and special methods of rock reinforcement.

### Unit I

Scope and importance: Rock excavation engineering in mining and construction industries; physico-mechanical and geotechnical properties of rocks Vis-à-vis excavation method; selection of excavation method.

### Unit II

Drilling: Mechanics of rock drilling; design and operating parameters of surface and underground drilling; evaluation of drill performance; drill ability of rocks; mechanism of bit wear; bit selection; problems of drilling; economics of drilling.

### Unit II

Blasting: mechanics of rock fragmentation by explosives; advances in explosives and their selection criteria for rock excavation; blast design for surface excavations and optimization; advanced blast initiation systems; blast performance evaluation; cast blasting; techno economic and safety aspects of surface and underground blasting; advances in blast design for underground excavations; contour blasting; computer aided blast designs; review of tunnel blasting techniques in recent advances.

### Unit IV

Rock Cutting: theories of rock tool interaction for surface excavation machinery- rippers, bucket wheel excavators, continuous surface miners; theories of rock tool interaction for underground excavation machinery- ploughs, shearers, road headers, continuous miners and tunnel boring machines; selection criteria for cutting tools; Advanced rock cutting techniques- high pressure water jet assisted cutting.

### Suggested Reading:

1. *Theory and Technology of Rock Excavation*, Zou, Dingxiang
2. *Rock Fragmentation by Blasting* by B Mohanty
3. *Principles of Rock Drilling* by U M Rao Karanam and B Mishra
4. *Rock Blasting: Effects and Operations* by Pijush Pal Roy

**Program:** B.Tech  
**Semester:** Seven  
**Course:** Design of Open Pit Mines  
**Course Code:** 8.433

L	T	P	C
3	0	0	3

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### **Course Objective:**

- This course discusses the geological model and its purpose of linking the regional physical geology and the events that lead to the formation of the ore body to a mine-scale description of the setting.
- Discusses the distribution and nature of the overburden soils and rock types at the site, including the effects of alteration and weathering.
- Aware about the new techniques to design open cast mines and analyze the surface mining parameters.

### **Unit I**

Preliminary evaluation of deposits, different stages of exploration, drilling for grade and geo-technical information. Calculation of reserves, Collection of planning information.

### **Unit II**

Optimal size and output different stages of development, design of pit layout and method of advance. Selection of open cast equipments and equipment scheduling, Design for unit operations, rock breaking, excavation, transportation, storage and dumping.

### **Unit III**

Development of infrastructural facilities-communication power supplies, illumination, dewatering and other maintenance services, Site selection for mineral handling/ beneficiation plant.

### **Unit IV**

Control of opencast mining induced hazards- rock fall, fly rock, blast vibration, noise and mine dusts. Planning for reclamation of mined out area.

### **Suggested Reading:**

1. *Open Pit Mine Planning and Design*, William A. Hustrulid , Mark Kuchta
2. *Open Pit Mine Planning and Design* , William A

**Program:** B.Tech

**Semester:** Seven

**Course:** Seminar in Executive Communication

**Course Code:** 40B.401

L	T	P	C
2	0	0	0

**Course Objective:** To impart more advanced basic skills through intensive practice, in this unit again the students get opportunities to apply their general awareness and classroom learning to practical situation to achieve the targeted career goal in this increasingly competitive world Some of the career oriented units are Discussion Skills, Interview Skills, Job Search Strategies, Job Correspondence etc., they need to undergo,

- An average student acquires basic skills required for a cherished job.
- Their appreciative personality development becomes a value added attribute in their professional sphere.
- The course enhances *communication*, leadership and teamwork *skills*; and personal development *skills* using practical approach and exposure of students to the realities of the world
- To put greater emphasis on development of non-technical skills, such as flexibility, leadership and good *communication*.

### Activity Based

#### WORKSHOPS

- Debate
- Extempore
- Group Discussion
- Panel Discussion
- Presentation-Paper & Oral
- Reports: Survey Report, Project Report, Case Study

### **Suggested Readings:**

1. Monippally, Matthukutty. M. 2001. *Business Communication Strategies*. 11<sup>th</sup> Reprint. Tata McGraw-Hill. New Delhi
2. 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
3. Lewis, Norman. 1991. *Word Power Made Easy*. Pocket Books
4. Sen , Leena .*Communication Skills ; Eastern Economy Edition*
5. Ghanekar, Dr. Anjali. *Essentials of Business Communication Skills ; Everest Publishing House*
6. David Green. *Contemporary English Grammar, Structure & Composition ; MacMillan*
7. *Dictionary; Oxford*
8. *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)
- [www.englishclub.com](http://www.englishclub.com)
- [www.english\\_grammar\\_lessons.com](http://www.english_grammar_lessons.com)
- [www.wikipedia.org/wiki/english\\_grammar](http://www.wikipedia.org/wiki/english_grammar)

**Program:** B.Tech

**Semester:** Seven

**Course:** Computer Aided Mine Planning Lab

**Course Code:** 40B.401

L	T	P	C
0	0	2	1

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### **Course Objective:**

1. The students will have knowledge on design and planning of surface and underground mining methods using mining software.
2. They will also have a perspective on high-end simulation methodologies and modern techniques to solve mining problems.
3. Understanding of computer programming for mining problems like design of pillars / blast design /subsidence prediction.
4. To impart skills on designing and development of mining software and appreciate the scope of Computer application in Mining

### **List of Experiments:**

Introduction to strategic open pit planning and design; concepts of optimization in open pit design; Introduction to Mine Planning & Surveying software (SURPAC and others) –data acquisition, data representation and processing, database creation and management ,computations of various parameters, digital terrain model (DTM), interpolation of data on triangular correct angular grid points ,reduction of data into presentable form, sectioning, compositing, solid modelling, autoplotting, 3D modelling, block modeling and determination of ultimate pit configuration (UPC).

**Program:** B.Tech

**Semester:** Seven

**Course:** Vocational Trainee Report II

**Course Code:** 8.445

L	T	P	C
0	0	0	2

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**Course Objective:**

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

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