JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech. Minor in MINING ENGINEERING

COURSE STRUCTURE & SYLLABUS (R25 Regulations)

Applicable from AY 2025-26 Batch

Minor Degree *(4 Semesters)*

Semester	Theory (# Credits) (*Which is not studied in regular course*):	Laboratory (# Credits)	Total Credits
II Year II Sem.	Principles of Mining Engineering (**3 Credits**)	Mine Surveying Lab (**1 Credit**)	4
III Year I Sem.	Drilling & Blasting Technology (**3 Credits**)	--	3
III Year II Sem.	Rock Excavation Engineering (**3 Credits**)	Rock Mechanics Lab (**1 Credit**)	4
IV Year I Sem.	Mine Legislation and General Safety (**3 Credits**)	--	3
IV Year I Sem.	Project/ Experiential Learning	--	4
		Total Credits	**18**

PRINCIPLES TO MINING ENGINEERING

B.Tech. Minor in Mining Engg.

L	T	P	C
3	0	0	3

Course Objectives: Student is expected:

1. To learn about mining industry and its role in nation economy.
2. To know the basic mining operations and mining methods.
3. To understand environmental issues due to mining.

Course Outcomes: Student will:

1. Gain knowledge of mining importance and its role in nation growth.
2. Acquire the knowledge of reserves and production in India and other countries of important minerals.
3. Get exposure of mining operations such as drilling, blasting, loading and transportation.
4. Understand the mining methods of underground and open cast.
5. Know the concepts of mine ventilation and environment

UNIT - I

Introduction to Indian mining industry - importance of mining industry and comparison with other industries; The role of mining industry in economic growth of India.

UNIT - II

National and International Scenario of reserves and production regarding coal and lignite, Iron ore, Copper ore, limestone, gold, lead and zinc, uranium, beach sands and granite.

UNIT - III

Unit operations: Drilling, blasting, loading, transportation and size reduction and supports in underground mining and opencast mines.

UNIT - IV

Introduction to mining methods: underground mining methods and surface mining methods in brief.

UNIT - V

Introduction to mine ventilation, environment and safety.

TEXT/ REFERENCE BOOKS:

1. Elements of Mining Technology, D.J. Deshmukh, Volume I and II
2. Introductory Mining Engineering, H.L. Hartman
3. Surface Mining Technology, S.K. Das

MINE SURVEYING LABORATORY

B.Tech. Minor in Mining Engg.

L	T	P	C
0	0	2	1

Pre-Requisites: Mine Surveying

Course Objectives: To familiarize with the various surveying instruments and methods.

Course Outcomes: At the end of the course, students will be able to

1. Do the Range and to measure the distance between two points
2. Conduct the chain triangulation survey
3. Determine the area by using different methods
4. Determine the elevation of a given point
5. Use the instruments used in the surveying

LIST OF EXPERIMENTS:

1. Measurement of distance between three prints (A,B,C) using Chain (with and without obstacles)
2. Measurement of distance between three points (A,B,C) using Tapes.(with and without obstacles)
3. Setting out a right angle using offset surveying method.
4. Measurement of bearing angle between two or three points using prismatic compass.
5. Study of Dumpy level.
6. Fly Levelling.
7. Reciprocal levelling.
8. Computation of area. (ovend by three points. (A,B,C)
9. Computation of volume (ovend by three points. (A,B,C)
10. Two point method or three point method in plane table surveying.

DRILLING AND BLASTING TECHNOLOGY

B.Tech. Minor in Mining Engg.

L	T	P	C
3	0	0	3

Course Objectives: To familiarize the students
1. With exploratory and production drilling.
2. The factors affecting drilling;
3. Various types of the explosives and blasting techniques used in underground.
4. Transportation and handling of explosives in opencast mines; use of accessories for blasting in opencast mines.
5. Controlled blasting and use of computers and software for blasting in open cast mining.

Course Outcomes: At the end of the course, students will be able to
1. Gain knowledge about exploratory/diamond drilling, use of fishing tools.
2. Understands various methods of drilling, design and selection of drilling methods under or for different conditions.
3. Knowledge about explosives and blasting techniques in underground mines and open cast mines.
4. Makes student confident in design of blasting operations in the field.
5. Learn about controlled blasting, use of softwares in rock blasting.

UNIT - I

Exploratory Drilling: Drilling for exploration and other purposes; diamond drilling-equipment and principal of operation, its merits, demerits and limitations; core recovery — single, double and triple tube core barrels; wire line drilling; directional drilling; fishing tools; borehole surveying; borehole logging; novel and special drilling techniques, Horizontal and directional drilling.

UNIT - II

Production of Drilling: Various methods and mechanics of drilling -percussive, rotary and rotary percussive. Jack hammer drilling, Top hammer and Down the Hole (DTH) hammer and rotary drills.

Drillability: Drillability studie**s,** Factors affecting drilling- operational parameters (like air pressure, thrust, r.p.m., flushing, bit type and bit geometry) and physico-mechanical properties (like strength properties, hardness, abrasivity etc.) design and selection of drills and drill bits; bit wear and reconditioning of drill bits.

UNIT - III

Explosives: Classification and properties of explosives, Types of explosives – Permitted type and their importance, slurry explosives, SMS, SME and PMS, ANFO, Emulsion, boosters. Mechanics of blasting.

Accessories and Tools: Accessories- different types of detonators, safety fuses, detonating cords, relays, NONEL, exploders and other shot firing tools, testing of explosives, storage, transportation and handling and destruction of explosives and accessories.

UNIT - IV

Open Pit Blasting: Blasting in opencast mines, rock breakage mechanism, blast design, factors influencing blast design and blast optimization, primary and secondary blasting; environmental impacts due to blasting- ground vibrations, air over pressures, fly rocks, dust, fumes, water pollution;
controlled blasting, computer design of opencast blast; statutory requirements. Introduction to different blasting and fragmentation analysis softwares.

UNIT - V

Underground Blasting: Drill patterns for underground excavations, solid blasting; VCR blasting, induced blasting, charge ratios, rock fragmentation, dangers associated with underground blasting, blasting economics, gallery blasting, statutory requirements, computer design of underground blast, precautionary measures, misfires, blown out shot and blasting economics.

TEXT BOOKS:

1. Blasting in ground excavations and mines, Roy Piyush Pal, Oxford and IBH, 1st ed 1993.
2. Drilling technology handbook, C.P. Chugh, Oxford and IBH, 1sted, 1977.
3. Explosives and Blasting Techniques by G.K. Pradhan

REFERENCE BOOKS:

1. Rock blasting effect and operation, Roy Piush Pal, A.A. Balkema, 1st ed, 2005.
2. Elements of mining technology, Vol-1, D.J. Deshmukh, Central techno, 7th ed, 2001.
3. Blasting operations, B. Hemphill Gary, Mc-Graw Hill, 1st ed 1981.
4. Principles and practices of modern coal mining, R.D. Singh, New age International, 1st ed, 1977.
5. Explosive and blasting practices in mines, S.K. Das, Lovely prakashan, 1st ed, 1993.

NPTEL : Drilling and Blasting Technology by Prof. Kaushik Dey, IIT Karghpur

ROCK EXCAVATION ENGINEERING

B.Tech. Minor in Mining Engg.

L	T	P	C
3	0	0	3

Course Objectives: To understand the rock mechanics, rock cutting technology, rock cutting tools and rock excavating machine

Course Outcomes: The students will

1. Have knowledge about mechanism of rock excavation process and different rock fragmentation methods.
2. Know about the influence of different rock properties in rock excavation such as abrasivity, lamination and joints etc.
3. Acquire knowledge on rock cutting technology
4. Understand about different types of cutting tools, their mechanism and application
5. Have insight in to rock excavating machines, their application and technical indices of machines.

UNIT - I

Introduction: Concepts, historical developments in rock excavation systems, factors affecting the rock fragmentation, mechanism of rock breakage and fracture; their application to rock fragmentation methods– explosive action, cutting, ripping and impacts.

UNIT - II

Rock Properties: Rock properties related to excavation process; application of compressive, tensile and tri- axial strengths, index tests and abrasivity, anisotropy, elasticity, porosity, laminations, bedding and jointing in rock fragmentation process.

UNIT - III

Rock Cutting Technology: Mechanism of drilling – rotary, percussive, rotary percussive, mechanics of rock cutting, theory of single tool rock cutting, crack initiation and propagation, breakage pattern, rock excavation by cutting action – picks, discs, roller cutters, water jet cutting, methods of evaluation of drill ability and cut ability index of rocks.

UNIT - IV

Rock Cutting Tools: Rock cutting tool materials, different types, relative applications and their choice, tool shape and size, specific energy consumption, tool wear, effect of operational parameters on tool performance, maintenance and replacement of cutting tools of excavating machines.

UNIT- V

Rock Excavating Machines: Excavating machines, principles, operation, applicability and technical indices of road headers, TBM'S coalface machines and bucket wheel excavators.

TEXT BOOKS:

1. Introductory Mining Engineering, Hartman, H.L., John Wiley and Sons, New York, 1987.
2. Principles of Rock Fragmentation, Clark, G.B., John Wiley and Sons, New York, 1987.

REFERENCE BOOKS:

1. Mining Engineering Handbook, 3rd edition, Vol I & II, Hartman, H. L. (Editor), SME Society of Mining Engineers, New York, 2011.
2. Diamond Drilling, Chugh, C.P., Oxford-IBH, 1984.

ROCK MECHANICS LAB

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L	T	P	C
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Pre-Requisites: NIL

Course objectives:

1. To study the various of methods to determine the properties of rocks.
2. To study the operation of various instruments and equipment.

Course outcomes:

1. The students will have knowledge on strength and deformation characteristics of rock using different methods.
2. The students will able to perform test to determine the porosity of rocks
3. The students will able to understand weatherability of rocks through slake durability test
4. The students will acquire knowledge on drilability of rocks
5. The students will able to use different types of roof monitoring devices.

LIST OF EXPERIMENTS

1. Determination of RQD of rocks.
2. Determination of Protodyaknov index of a given rock sample
3. Determination of point load index strength of a given rock sample
4. Determination of porosity of rocks.
5. Determination of uniaxial compressive strength of a given rock sample
6. Determination of tensile strength of a given rock sample using Brazilian method
7. Determination of shear strength of rocks
8. Determination of modulus of elasticity of given rock sample using strain gauge.
9. Determination of triaxial strength of rock and drawing of Mohr's envelope
10. Determination of slake durability of rocks
11. Study of drillability index of rocks.
12. Study of different types of roof convergence and other ground control instruments.
13. Determination of time dependent deformation of rocks.

MINE LEGISLATION AND GENERAL SAFETY

B.Tech. Minor in Mining Engg.

L	T	P	C
3	0	0	3

Course Objectives: Introduces mining laws and legislation to the students with basic knowledge on mining engineering aspects. The students will be explained about the provisions of Indian electricity rules, vocational training rules, The Mines rescue rules, The Mines and Minerals (Development and Regulation) Act etc.

Course Outcomes: As the outgoing student's career is mainly dependent on mining industry, exposure to state and central laws related to mining are highly solicited.

1. This course gives an opportunity for the students to understand the statutions requirement for coal/metal mining by opencast/underground methods.
2. Students get idea of how mining laws and legislation evolved in India
3. Students will understand statutory rules, regulations and byelaws etc.
4. Students acquire knowledge of accidents, causes of accidents and report preparation
5. Students will know about safety management, safety audit and their importance.

UNIT - I

Introduction to mining laws and legislation, General principles of mining laws and development of mining legislation in India. The Mines Act, 1952, The Mines Rules, 1955.

UNIT - II

The Mines Vocational Training Rules, 1966; The Mines Rescue Rules, 1985.
The Mines Maternity Benefit Act, 1961 in brief; Payment of Wages Act, 2005; NCWB agreement (in brief).

UNIT - III

Coal Mines Regulations, 2017; Metalliferous Mines Regulations, 1961.

UNIT - IV

Indian Electricity Rules, General provisions of Mines and Minerals (Regulation and Development) Act; The Mineral Concession Rules, 1960; The Mineral Conservation and Development Rules.

UNIT - V

General causes of accidents in mines and their prevention. Accident enquiry reports, cost of accidents, occupational diseases.
Safety management plan. Safety audit, risk management.

TEXT BOOKS:

1. The Mines Act, 1952.
2. The Mines Rules, 1955.
3. The Mines Vocational Training Rules, 1966.
4. The Mines Rescue Rules, 1985.
5. The Mines Crèche rules, 1996
6. The Employee's (Workmen's) Compensation Act, 2010.
7. Indian Electricity Rules, 1956.
8. Coal Mines Regulations, 1957.
9. Metalliferous Mines Regulations, 1961.
10. Mines and Minerals (Regulation and Development) Act 1957.
11. The Mineral Concession Rules, 1960.
12. The Mineral Conservation and Development Rules, 1988.

REFERENCE BOOKS:

Legislation in Indian Mines: A Critical Appraisal vol.1&2 – Rakesh and Prasad.

PROJECT

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