UNDERGRADUATE PROGRAMME

Course Structure and Syllabus

(Effective from 2025-26 admitting batch onwards)

DEPARTMENT OF MINING ENGINEERING

Indian Institute of Engineering Science and Technology (IIEST), Shibpur

P.O.: Botanic Garden, District: Howrah

West Bengal – 711 103

TABLE OF CONTENTS

DEPARTMENT OF MINING ENGINEERING AT IIEST SHIBPUR

VISION

- To be recognized nationally and internationally as one of the leading institutes in research and providers of quality engineers in the field of Mining Engineering.

MISSION

- To impart quality education and training to undergraduate and postgraduate degree students in Mining Engineering to prepare them for industry, research and higher studies. The department actively encourages excellence in teaching, multidisciplinary research, collaborative activities, and positive contributions to society.

STRATEGY

- The Department, - a pioneer in imparting Mining Engineering education in India, aspires to enhance its diverse and vibrant characteristics encompassing all the sub-disciplines within Mining Engineering and allied fields. Backed by state-of-art laboratories and computational facilities, the students will be inculcated sound fundamental theories in engineering. The department shall enhance the intensity of its interactions with the industries; that will, hopefully, help the students to stay abreast of the latest developments.

PROGRAMME OBJECTIVES

- The B. Tech programme in Mining Engineering at the Indian Institute of Engineering Science and Technology (IIEST), Shibpur, is designed to align with the institute's mission of imparting quality education and training to prepare students for industry and higher studies. The programme emphasizes excellence in teaching, multidisciplinary research, collaborative activities, and positive contributions to society.

- The programme is designed to equip students with advanced knowledge, technical skills, and research expertise in mining and mineral processing. The programme aims to develop professionals capable of addressing industry challenges while promoting sustainable and responsible mining practices.

- To align with the National Board of Accreditation (NBA) framework, the B. Tech programme is structured with Programme Educational Objectives (PEOs), Programme Outcomes (POs), and Programme Specific Outcomes (PSOs) that ensure quality education, industry relevance, and sustainability. This structure ensures compliance with NBA accreditation requirements, fostering technical excellence, sustainability, and industry readiness**.**

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)

The B. Tech programme in Mining Engineering aims to achieve the following:

PEO1: Technical Proficiency and Advanced Knowledge

- Graduates will acquire advanced knowledge in mining engineering, including mine planning, rock mechanics, mineral processing, and sustainable mining technologies, enabling them to solve industry challenges.
- Within three to five years, graduates are expected to be advancing in their career in the minerals industry and adapting to new situations and emerging problems, through the application of general engineering-science skills and the core technical problem-solving and design practices of the mining engineering profession, with an understanding of the need for lifelong learning.
- Graduates should utilize and continue to develop skills in communication, technical writing, leadership, and working effectively in teams.
- Graduates are expected to demonstrate an understanding of the importance of mining to society, realizing that, in contemporary society, attention to safety and health, responsibility to the environment, and ethical behavior are required without exception.

PEO2: Research and Innovation

- Graduates will engage in research and innovation, contributing to advancements in mineral exploration, extraction, and beneficiation while addressing environmental and economic challenges.

PEO3: Sustainable and Safe Mining Practices

- Graduates will integrate sustainable and safe mining principles, adhering to regulatory standards, environmental conservation, and responsible resource utilization.

PEO4: Leadership and Industry Readiness

- Graduates will demonstrate leadership and managerial skills in mining operations, policy implementation, and project management while staying updated with industry advancements.

PEO5: Lifelong Learning and Ethical Responsibility

- Graduates will pursue lifelong learning through professional development, research, and engagement with industry and academic communities while upholding ethical, social, and environmental responsibilities.

PROGRAMME OUTCOMES (POS)

Graduates of the **B. Tech in Mining Engineering** programme will have the ability to:

- Apply advanced knowledge of mining and mineral engineering, mathematics, and allied sciences to solve complex mining problems.

- Identify, formulate, and analyze engineering challenges related to mineral exploration, extraction, and processing, using advanced research techniques.
- Develop innovative and sustainable solutions for mine design, mineral processing, and environmental management.
- Conduct independent research, interpret complex data, and apply modern tools and methodologies to address emerging issues in mining.
- Utilize state-of-the-art mining software, automation, and digital modeling tools to optimize mineral extraction and processing operations.
- Demonstrate proficiency in mine safety, hazard risk management, environmental impact assessment, and mitigation strategies.
- Uphold professional and ethical responsibilities in mining operations while adhering to national and international mining regulations.
- Apply engineering and management principles to efficiently plan and execute mining projects, ensuring cost-effectiveness and productivity.
- Communicate effectively with engineering professionals, stakeholders, and policy makers through technical reports, presentations, and documentation.
- Recognize the need for continuous learning and professional development to stay abreast of technological and regulatory advancements in the mining sector.

PROGRAMME-SPECIFICOUT COMES (PSOS)

Expected Programme-Specific Outcomes (PSOs) will be reflected in the enhanced ability of the graduates of this programme to:

PSO1: Advanced Mining Technologies and Automation

- Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- Develop and implement modern technologies, including automation, remote sensing, and digital mining solutions, to enhance productivity and safety in mining operations.

PSO2: Sustainable and Responsible Mining

- Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

- Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

- Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

- Acquire and apply new knowledge as needed, using appropriate learning strategies.

PSO3: Research and Innovation in Mineral Processing

- Design and optimize mineral beneficiation processes using advanced techniques such as hydrometallurgy, bioleaching, and nanotechnology to enhance resource efficiency.

COURSE STRUCTURE FOR B. TECH (MINING ENGINEERING) PROGRAMME

FIRST YEAR									
First Semester									
Sl. No.	Type	Course Name	Course code	Class Load/Week			Credit	Class load/ week	Marks
				L	T	P			
1	**BSC**	Engineering Mathematics – I		3	1	0	4	4	100
2	**BSC**	Engineering Physics		3	0	0	3	3	100
3	**ESC**	Introduction to AI and ML		3	0	0	3	3	100
4	**ESC**	Engineering Mechanics		3	0	0	3	3	100
5	**ESC**	Basic Electronics		3	0	0	3	3	100
6	**VAC**	Energy, Environment and Climate Change		2	0	0	2	2	50
		Theory Sub-total		17	1	0	18	18	550
7	**ESC**	Engineering Graphics		0	0	3	2	3	50
8	**BSC**	Physics Lab		0	0	3	2	3	50
9	**ESC**	Computer Programming Practice Lab		0	0	3	2	3	50
10		NSS/NCC/PT/Yoga					R*		
		Practical Sub-total		0	0	9	6	9	150
		First Semester Total		17	1	9	24	27	700
*R: Required (Non-credit but with grade)									

FIRST YEAR									
Second Semester									
Sl.	Type	Course Name	Course code	Class Load/ Week			Credit	Class load/ Week	Marks
				L	T	P			
	BSC	Engineering Mathematics – II		3	1	0	4	4	100
	BSC	Engineering Chemistry		3	0	0	3	3	100
	ESC	Basic Electrical Engineering		3	0	0	3	3	100
	VAC	Well-being and happiness		2	0	0	2	2	50
	HSC	Professional communication in English		2	1	0	3	3	100
	PC	Elementary Mining Engineering	**MN1201N**	3	0	0	3	3	100
		Theory Sub-total		16	2	0	18	18	550
	ESC	Workshop		0	0	3	2	3	50
	ESC	Basic Electrical Engineering Lab		0	0	3	2	3	50
	BSC	Chemistry Lab		0	0	3	2	3	50
1	**PC**	Introduction to labs of the department	**MN1251N**	0	0	3	2	3	50
1		NSS/NCC/PT/Yoga					R*		
		Practical Sub-total		0	0	12	8	12	200
		Second Semester Total		16	2	12	26	30	750
*R: Required (Non-credit but with grade)									

SECOND YEAR									
Third Semester									
Sl. No	Type	Course Name	Course	Class Load			Credit	Class load/ week	Marks
				L	T	P			
1	**BSC**	Mathematics-III		3	0	0	3	3	100
2	**ESC**	Heat Power and Machine Elements		3	0	0	3	3	100
3	**ESC**	Fluid Mechanics and Fluid Machines		3	0	0	3	3	100
4	**BSC**	Mining Geology		3	0	0	3	3	100
5	**PC**	Rock Mechanics	**MN2101N**	3	0	0	3	3	100
		Theory Sub-total		15	0	0	15	15	500
6	**ESC**	Heat Power and Machine Lab		0	0	3	2	3	50
7	**BSC**	Mining Geology Lab		0	0	3	2	3	50
8	**PC**	Coal Mine Visit	**MN2171N**	0	0	0	2	3	50
9	**PC**	Rock Mechanics Lab	**MN2151N**	0	0	3	2	3	50
		Practical Sub-total		0	0	9	8	12	200
		Third Semester Total		15	0	9	23	27	700

SECOND YEAR									
Fourth Semester									
Sl. No	Type	Course Name	Course Code	Class Load/Week			Credit	Class load/ week	Marks
				L	T	P			
1	**PC/PSE**	Drilling and Blasting	**MN2201N**	3	0	0	3	3	100
2	**PC/PSE**	Underground Coal Mining	**MN2202N**	3	0	0	3	3	100
3	**PC/PSE**	Mine Survey	**MN2203N**	3	0	0	3	3	100
4	**PC/PSE**	Underground Mine Environment	**MN2204N**	3	0	0	3	3	100
5	**OE**	OE1		3	0	0	3	3	100
		Theory Sub-total		15	0	0	15	15	500
6	**PC/PSE**	Mine Survey Practical	**MN2251N**	0	0	3	2	3	50
7	**PC/PSE**	Underground Mine Environment Lab	**MN2252N**	0	0	3	2	3	50
8	**PC/PSE**	Seminar	**MN2271N**	0	0	3	2	3	50
9	**PC/PSE**	Metal Mine Visit	**MN2272N**	0	0	0	2	0	50
		Practical Sub-total		0	0	9	8	9	200
		Fourth Semester Total		15	0	9	23	24	700

THIRD YEAR									
Fifth Semester									
Sl. No	Type	Course Name	Course	Class Load/Week			Credit	Class load/ week	Marks
			Code	L	T	P			
1	**PC/PSE**	Mine Ventilation Engineering	**MN3101N**	3	0	0	3	3	100
2	**PC/PSE**	Mining Machinery	**MN3102N**	3	0	0	3	3	100
3	**PC/PSE**	Surface Mining	**MN3103N**	3	0	0	3	3	100
4	**PC/PSE**	Underground Metal Mining	**MN3104N**	3	0	0	3	3	100
5	**OE**	OE2		3	0	0	3	3	100
		Theory Sub-total		15	0	0	15	15	500
6	**PC/PSE**	Mine Ventilation Lab	**MN3151N**	0	0	3	2	3	50
7	**PC/PSE**	Mining Machinery Lab	**MN3152N**	0	0	3	2	3	50
8	**PC/PSE**	Design of Mine Layout	**MN3153N**	0	0	3	2	3	50
9	**PC/PSE**	Training Evaluation	**MN3171N**	0	0	0	2	0	50
		Practical Sub-total		0	0	9	8	9	200
		Fifth Semester Total		15	0	9	23	24	700

THIRD YEAR									
Sixth Semester									
Sl. No	Type	Course Name	Course Code	Class Load/Week			Credit	Class load/ week	Marks
				L	T	P			
1	**PC/PSE**	Rock Engineering	**MN3201N**	3	0	0	3	3	100
2	**PC/PSE**	Environmental Engineering for Mines	**MN3202N**	3	0	0	3	3	100
3	**PC/PSE**	Mine Planning and Mineral Economics	**MN3203N**	3	0	0	3	3	100
4	**HSC**	Finance Economics and Management for Engineers		3	0	0	3	3	100
5	**OE**	OE3		3	0	0	3	3	100
		Theory Sub-total		15	0	0	15	15	500
6	**PC/PSE**	Rock Design Practical	**MN3251N**	0	0	3	2	3	50
7	**PC/PSE**	Environmental Engineering for Mines Lab	**MN3252N**	0	0	3	2	3	50
8	**PC/PSE**	Mine Planning Lab	**MN3253N**	0	0	3	2	3	50
		Practical Sub-total		0	0	9	6	9	150
		Sixth Semester Total		15	0	9	21	24	650

FOURTH YEAR									
Seventh Semester									
Sl. No	Type	Course Name	Course Code	Class Load/Week			Credit	Class load/ week	Marks
				L	T	P			
1	**PC/PSE**	Coal and Mineral Beneficiation	**MN4101N**	3	0	0	3	3	100
2	**PC/PSE**	Mine Legislation and Safety	**MN4102N**	3	0	0	3	3	100
3	**VAC**	Sociology & Professional Ethics		3	0	0	3	3	100
4	**OE**	OE4		3	0	0	3	3	100
		Theory Sub-total		9	0	0	9	9	300
5	**PC/PSE**	Training/Internship Evaluation	**MN4171N**	0	0	0	2	0	50
6	**PC/PSE**	Coal and Mineral Beneficiation lab	**MN4151N**	0	0	3	2	3	50
7	**I**	Internship							
		Practical Sub-total		0	0	3	4	3	100
		Seventh Semester Total		9	0	3	13	12	400

FOURTH YEAR									
Eighth Semester									
Sl. No	Type	Course Name	Course	Class Load/Week			Credit	Class load / week	Marks
			Code	L	T	P			
1	**OE**	OE5 (from NPTEL for the students opting Internship/ for others from Institute)		3	0	0	3	3	100
		Theory Sub-total		3	0	0	3	3	100

2	**I/P**	One Semester Internship / Project	**MN4291N**				8		300
3	**O**	Grand viva	**MN4292N**				2		50
		Practical Sub-total		0	0	0	10	0	350
		Eighth Semester Total		3	0	0	13	3	450

II-SEMESTER COURSES SYLLABI

Course Code	MN1201N	Course Name	ELEMENTARY MINING ENGINEERING	Course Category	PC	L	T	P
						3	0	0

Pre-requisite Courses	Basic School Science	Co-requisite Courses	None	Progressive Courses	Geology, Rock Mechanics
Course Offering Department		MINING ENGINEERING		Data Book/ Codes/ Standards	CMR, MMR, UNFC

Course Objectives	• To know in detail about mineral body and the associated rocks and structures • How to explore mineral resources in earth crust in detail • To know about the development methodology of the mineral deposit

Sl. No	Module name and Syllabus	No. of Classes	Learning Outcome
1	Mining Terminologies	4	Acquaintance with mining specific terms
2	**Minerals:** Origin theories (Coal & Metallic minerals), Their properties, Classification, Quality, Use, Importance, Composition, Components, Indian and Global Scenario	9	Understanding formation of coal/ mineral deposits. Indian and global utility and inventory of minerals.
3	**Rocks:** Types, classification, Rock structures and shapes around mineral deposit- lava, dykes, sills, batholith, lopolith, laccolith, bedding plane, outcrop, Fold and their types, swilley, faults- components and types	4	Features and properties of rocks and rock deposits.
4	**Mineral Exploration:** General, Objectives, Principles, Methods-Geological, Geochemical, Geophysical with their instrumental techniques, Stages of exploration (G1, G2, G3 & G4), Locating Outcrop, Pitting, Trenching, Sampling, Assaying, Tracing and Cutting deposits; Exploratory drilling- Diamond core drilling, Core Recovery, Bore hole deviation, Bore hole survey and Bore hole deflection, Difficulties in Boring, Exploration grids, Classification of Mineral Reserves (UNFC, JORC etc.),	12	Preliminary understanding of exploration, classification and estimation of mineral deposits.
5	**Development of Mineral Deposit:** Mineral Deposit types & shapes (Tabular; Irregular, Tubular and other) and their characteristics (Depth, dip, strike, ore strength, quality etc.), Characteristics of Roof, Floor, Hangwall, Footwall. Pre-mining stresses in the rock**,** Mechanics of strata behaviour- Dome or Arch Theory, Beam Theory or Plate Theory, Access to the deposit- Shaft, Incline and adit and their selection, Rock mass rating and support. Support types- Timber, Props, Safari, Wooden cog, Chock, Bars, Bolt (rope or cable, cement grouted, resin, slot & wedge types,	13	Features of Mineral deposits and pre-production level operations in mining

	expansion shell type etc.), roof stitching, Wire mesh, self-advancing supports, SSR in development district		
TOTAL		**42**	

Course Outcomes	After going through the course, the students will be able to: • explain the principles of exploration and know the various methods of exploration of minerals. • be able to know the various equipment used for boring • describe the various types of means of access to mineral deposits and supporting the accesses. • explain rudimentary aspects of designing shafts/inclines/adits etc. and apply the knowledge in designing means of access to mines.

Learning Resources	Darling P. (Editor). 2011. *SME Mining Engineering Handbook*. Third edition. Society for Mining Metallurgy and Exploration. 1984 p. Deshmukh D. J. (2010) *Elements of Mining Technology. Vol.1* (8th Edition). Denett and Company, Nagpur. 424 p. Hartman H. L. and Mutmansky J. M. 2002. *Introductory Mining Engineering*, 2nd Edition. John Wiley. 584 p. Marjoribanks, R.W. Geological Methods in Mineral Exploration and Mining, Chapman & Hall, London, 1997 Chugh, C.P. High Technology in Drilling and Exploration, Oxford & IBH, New Delhi, 1992 Edwards, R.P and Atkinson, K. Ore Deposit Geology and its Influence on Mineral Exploration, Chapman & Hall, New York, 1986 Principles and Practices of Modern Coal Mining by R. D. Singh Longwall Mining by S. S. Peng Mine Circulars by L. C. Kaku Coal Mine Regulations 2017, DGMS India Metal Mine Regulations 2019, IBM India Metal Mines (Development and Regulation) Act, 1957 Coal Mines (Conservation and Development) Act, 1974

Course Code	MN1251N	Course Name	Introduction to labs of the department	Course Category	PC	L	T	P
						0	0	3

Pre-requisite Courses	Basic School Science	Co-requisite Courses	Elementary Mining Engineering	Progressive Courses	Geology Rock Mechanics Mining Methods
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	ISRM Suggested Methods APHA standard Methods, BIS

Course Objectives	• To familiarize first-year undergraduate mining engineering students with the departmental laboratories, their equipment, safety protocols, and foundational experimental practices. This course serves as a hands-on introduction to the scope of mining engineering and lays the groundwork for future laboratory work.

COURSE CONTENT

Sl. No	Laboratory to Visit	Activities/ Topics Covered	No of Classes	Learning Outcomes
1	Orientation & Safety	Intro to Departmental lab layout, general lab safety, Safety demonstration, PPE identification	3	Comprehension of laboratory protocols
2	Mining Geology Lab	Demonstration of Rock and mineral identification procedure, map reading, Hand specimen observation, simple plotting	6	Familiarity with instruments and processes of mineral identification
3	Mine Surveying Lab	Instruments: chain, compass, theodolite, Demo and trial measurements	6	Familiarity with the instruments in the Mine Surveying Laboratory
4	Rock Mechanics Lab	Properties of rocks, uniaxial compression test demo; Sample handling and observation	6	Basic understanding of the equipment and instruments in the rock Mechanics laboratory
5	Mine Ventilation Lab	Demonstration of Measurement of air velocity, gas detection, Anemometer, Flame Safety lamps	3	Rudimentary idea of the instruments in the Mine Surveying Lab
6	Mineral Processing Lab	Size reduction, screening, separation, Jigging, froth flotation – Instruments and process overview	3	Familiarity with the instruments in the Mineral Processing Laboratory
8	Mine Machinery Lab	Belt conveyors, loaders, mine hoists, Machinery models and function demo	3	Ideas on mining machinery through scale models and actual machine elements
9	Computer Lab	Intro to mining software, CAD basics, Basic AUTOCAD, Flac 3d demonstration	3	Familiarity with the mining/ CAD software and their utilities.

Sl. No	Laboratory to Visit	Activities/ Topics Covered	No of Classes	Learning Outcomes
10	Environmental Lab	Mine water, dust and noise monitoring basics, Monitoring equipment demo	3	Familiarity with the instruments in the Environmental Lab
11	Safety & Rescue Lab	Mine rescue operations, breathing apparatus, Visit to rescue gallery or simulation	3	Ideas on the instruments and equipment in the Safety and Rescue Laboratory
TOTAL			**42**	

Course Outcomes	By the end of the course, students will be able to: • Identify the roles and functions of key departmental laboratories in mining engineering. • Understand the basic operating principles of essential lab equipment and machinery. • Demonstrate knowledge of standard safety protocols and PPE use in different lab environments. • Develop teamwork and communication skills during collaborative lab activities. • Relate laboratory experiences to core areas of mining engineering (geology, rock mechanics, ventilation, mineral processing, etc.).

Learning Resources	Departmental lab manuals and SOPs ISRM Suggested Methods for Rock Characterization, Testing and Monitoring. BIS/ OSHA Safety Guidelines for Laboratories APHA Standard Methods for the Examination of Water and Wastewater Abouzeid A.Z.M. (1990) Mineral Processing Laboratory Manual. Trans Tech Publications. 181 p.

III-SEMESTER COURSES SYLLABI

Course Code	MN2101N	Course Name	ROCK MECHANICS	Course Category	PC	L	T	P
						3	0	0

Pre-requisite Courses	ENGINEERING MECHANICS	Co-requisite Courses	None	Progressive Courses	GEOLOGY ROCK ENGINEERING
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	CMR, MMR, UNFC

Course Objectives	The primary objectives of this course are to: • Introduce the fundamental principles of rock mechanics and its applications in mining engineering. • Develop understanding of the behavior of rock materials and rock masses under various loading conditions. • Provide knowledge on methods for in-situ stress measurements, rock testing, and failure criteria. • Equip students with techniques to evaluate the stability of rock slopes, tunnels, and underground excavations. • Familiarize students with field investigations, instrumentation, and numerical modeling concepts related to rock mechanics.

Sl. No.	Module Name and topics	No. of Classes	Learning Outcome
1	**Analysis of Stress and Strain on Rock: –** Concept of normal and shear stresses - stresses in two-dimension, stress tensor and transformation, Mohr's circle of stress, stresses; Displacement and strain, infinitesimal strain in two dimensions, Elastic Constants in Rock	06	Ability to explain the principles and practice of Stress and Strain analysis on Rock
2	**Physico-Mechanical Properties of Rock: –** Physical properties- density, porosity, permeability, weatherability etc.; Mechanical properties- elastic, non-elastic, dynamic, and time-dependent behavior including strength and deformability	04	Ability to explain the Physico-Mechanical Properties of Rock
3	**Failure in Rocks: –** Mohr-Coulomb, Hoek-Brown, and Griffith's theory of failure	04	Ability to explain Rock failure criteria
4	**Rock Mass Classification: –** Rock and rock mass, RQD, stand-up time; Terzaghi's classification, RMR and Q systems	04	Ability to classify Rock Mass following acceptable norms and protocols.
5	***In-situ* Stresses: –** State of stresses in earth's crust, Anderson's stress classification; Determination of in situ stresses- flat jack, hydraulic fracturing, and other techniques	04	Ability to explain the state of stress in the earth's crust and to determine in situ stresses

Sl. No.	Module Name and topics	No. of Classes	Learning Outcome
6	**Induced Stresses and Deformation: –** Induced stresses and deformation around various mine openings- closed form solutions; Numerical solution of induced stresses and deformation	04	Ability to Explain the phenomena of Induced Stresses and Deformation around mine openings
7	**Surface Subsidence: –** Basic concepts, fundamental parameters, measurement and prediction; Steps to control subsidence	04	Ability to explain the basic cause condition effects of Surface Subsidence
8	**Design of Pillars and Supports: –** Design of coal pillars using different empirical formulations, Calculation of capacity of different underground support systems	04	Ability to design coal pillars in mines and compute capacity of underground support systems.
9	**Stability of Open Pit Slopes** Different modes of instability in open pit mine slopes and calculation of factor of safety	06	Ability to explain different modes of instability in open pit mine slopes and to calculate factor of safety
TOTAL		**42**	

Course Outcomes	After completing this course, the students will be able to: • Describe the mechanical properties and classification of rocks and rock masses. • Apply different laboratory and in-situ testing methods to determine rock strength and stress. • Analyze stress distribution and failure conditions around underground openings. • Evaluate slope stability and propose suitable remedial measures. • Interpret the results from rock mechanics instrumentation and monitoring techniques. • Integrate rock mechanics concepts for safe and economic mine design.

Learning Resources	Brady B. H. G. 2012. Rock Mechanics for Underground Mining. Springer Science & Business Media. 528 p Jaegar J.C., Cook N.G.W. and Zimmerman R.W. 2007. Fundamentals of Rock Mechanics. Blackwell Publishing, 488 p Hudson, J.A. and Harrison, J.P. 2000. Engineering Rock Mechanics - An Introduction to the Principles. Elsevier. 456 p Read J. and Stacey P. 2009. Guidelines for Open Pit Slope Design. CSIRO Publishing, Collingwood, Victoria, Australia. 512p

Course Code	MN2171N	Course Name	Coal Mine Visit	Course Category	PC	L	T	P
						0	0	0

Pre-requisite Courses	Elementary Mining Engineering	Co-requisite Courses	None	Progressive Courses	Underground Coal Mining Underground Mine Environment Mine Ventilation Engineering
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	CMR 2017

Course Objectives	The primary objectives of this course are to: • Provide first-hand exposure to underground or open-cast coal mining operations. • Understand the various stages of coal extraction, haulage, ventilation, and safety practices. • Observe mine infrastructure, machinery, and environmental control measures. • Encourage students to relate theoretical knowledge to practical, real-world mining scenarios.

Sl. No.	Module Name and topics	No. of Classes	Learning Outcome
1	**Pre-Visit Orientation:** Lectures/briefings on mine safety, PPE, visit objectives, and expected observations.	00	Comprehension of visit protocols, objectives, and expected observations
2	**Industrial Visit (1–2 days):** Field trip to operational coal mine (open-cast or underground) coordinated with the mining company.	00	Understanding of basic operational aspects and features of coal mines (open-cast or underground)
3	**Post-Visit Debriefing:** Reflection session, discussion on observations, Q&A with instructors.	00	Further clarity of operational aspects and features of coal mines
4	**Report Submission:** Individual or group report summarizing findings, diagrams, photographs, and analysis.	00	Document preparation and structurisation.
5	**Presentation & Viva:** Oral presentation of observations with Q&A.	00	Soft skill application to explain information and knowledge gathered through mine visits
TOTAL		**00**	

Course Outcome	After completing this course, the students will be able to: • Identify and describe the key components and processes involved in coal mining operations (surface or underground).

	• Interpret mine layouts and working practices related to drilling, blasting, loading, transportation, and ventilation systems. • Evaluate mine safety practices including the use of personal protective equipment (PPE), gas monitoring systems, and emergency protocols. • Observe and document environmental control measures such as dust suppression, overburden management, and water drainage systems. • Demonstrate professional behaviour, teamwork, and communication skills during the field visit and in post-visit reporting and presentation. Integrate rock mechanics concepts for safe and economic mine design.

Learning Resources	• Mine visit guidelines (provided by department) • DGMS safety regulations (overview) • Basic mining engineering textbook chapters • Virtual mine tours (if available)

Course Code	MN2151N	Course Name	ROCK MECHANICS LAB	Course Category	PC	L	T	P
						0	0	3

Pre-requisite Courses	Engineering Mechanics	Co-requisite Courses	None	Progressive Courses	Geology, Rock Mechanics
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	CMR, MMR, UNFC

Course Objectives	The primary objectives of this course are to: • Introduce laboratory procedures for testing rock strength and deformation characteristics. • Develop hands-on skills in operating rock testing equipment. • Enable interpretation of rock behaviour under different stress conditions. • Train students in safe and accurate sample preparation and test data recording. • Relate laboratory results to practical mining engineering applications. • Clear concepts related to rock mechanics.

Sl. No.	Experiment Title	No. of Classes	Learning Outcome
1	Introduction, Safety, and Sample Preparation	3	Understand lab safety protocols; core trimming, end preparation
2	Determination of Rock Density and Porosity	6	Measure basic physical properties of rocks
3	Point Load Strength Test	3	Estimate uniaxial compressive strength (UCS) indirectly
4	Uniaxial Compressive Strength (UCS) Test	6	Determine strength and stress-strain characteristics
5	Brazilian Tensile Strength Test	3	Determine tensile strength of rocks
6	Triaxial Compression Test	3	Assess strength under confining pressure, Mohr-Coulomb parameters
7	Slake Durability Test	3	Evaluate durability of weak rocks under wetting-drying cycles
8	P-wave and S-wave Velocity Test (Ultrasonic)	3	Assess dynamic elastic properties and rock quality
9	Direct Shear Test on Discontinuities	3	Understand shear strength along joints/planes
10	Swelling Pressure Test (for expansive rocks)	3	Measure the swelling behavior of clayey rocks
11	Permeability Test (Falling Head or Constant Head)	3	Determine flow characteristics of fractured or porous rock

12	Data Analysis & Report Writing	3	Interpretation of results, error analysis, technical reporting
TOTAL		**42**	

Course Outcomes	After completing this course, the students will be able to: • Identify and classify different rock types used in laboratory testing. • Prepare standard rock samples and perform physical property tests. • Conduct mechanical property tests (UCS, tensile, shear) as per ISRM/ASTM standards. • Analyze and interpret test data to determine rock strength parameters. • Apply laboratory results to basic rock engineering problems in mining.

Learning Resources	ASTM/IS Codes for Rock Testing Brady B. H. G. 2012. Rock Mechanics for Underground Mining. Springer Science & Business Media. 528 p Department Lab Manual (provided during the course) Hudson, J.A. and Harrison, J.P. 2000. Engineering Rock Mechanics - An Introduction to the Principles. Elsevier. 456 p ISRM Suggested Methods for Rock Characterization Read J. and Stacey P. 2009. Guidelines for Open Pit Slope Design. CSIRO Publishing, Collingwood, Victoria, Australia. 512p

IV-SEMESTER COURSES SYLLABI

Course Code	MN2201N	Course Name	Drilling and Blasting	Course Category	PC	L	T	P
						3	0	0

Pre-requisite Courses	Engineering Mechanics Elementary Mining Engineering	Co-requisite Courses	None	Progressive Courses	Surface Mining Underground Metal Mining
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	CMR, MMR, UNFC

Course Objectives	The primary objectives of this course are to: • Understand the fundamentals of rock fragmentation and mechanics of blasting. • Learn various types of drilling machines and techniques used in mines. • Analyse and design blasting patterns for surface and underground applications. • Understand safe handling, storage, and transportation of explosives. • Address environmental impacts like vibration, noise, and fly rock.

Sl. No.	Module Name and topics	No. of Classes	Learning Outcome
1	**Principles of Drilling**: Principles of rock drilling, drillability, and mechanics of drilling. Different exploratory and production drilling systems- classification and equipment	06	Ability to explain the principles and mechanics of exploratory and production drilling systems
2	**Drill Bits:** Various types of drill bits. Thrust feed and rotation, alignment and deviation in drilling	04	Ability to explain the features and functions of various types of drill bits and the associated mechanisms of rock penetration
3	**Oil and Gas Drilling:** components of drill rigs, rods, casing, mud systems, and monitoring, directional drilling	04	Ability to explain the features of drill rigs used for Oil and Gas drilling
4	**Explosives:** Properties of explosives. Different low and high explosives, Bulk Explosive systems	04	Ability to explain the characteristics of various low and high explosives and the system of bulk explosives
5	**Accessories to Explosives:** Fuses, detonators, and shock tube initiation system	04	Ability to explain various accessories to explosives needed for blasting
6	**Blasting Methods:** Systems of blasting in underground and surface mines. Misfires, blown out shots, incomplete detonation-	04	Ability to explain the systems of blasting in both underground and surface mines

Sl. No.	Module Name and topics	No. of Classes	Learning Outcome
	causes and remedial measures. Secondary and Controlled Blasting techniques.		and to deal with misfires.
7	**Blast Design:** Design of blasting rounds in underground and surface mines	04	Ability to design blasting rounds for both underground and surface mines.
8	**Handling of Explosives:** Transport of explosives, storage and handling	04	Ability to explain the methods of Transport, storage and handling explosives:
9	**Alternate Rock Breaking systems:** Substitutes for explosives and their applications-hydrox, Cardox, Hydraulic coal burster, airdox, pulsed infusion shot firing.	04	Ability to explain various alternative rock breaking systems.
10	**Mechanics of Blasting:** Factors affecting rock breakage, Crater theory and its applications, theories of rock breakage using explosives.	04	Ability to apply and explain the mechanics of rock blasting
TOTAL		**42**	

Course Outcomes	By the end of this course, students will be able to: • Explain the mechanics of rock breakage and principles of explosive energy release. • Identify and select appropriate drilling equipment and methods based on rock and mining conditions. • Design and evaluate blasting patterns for both surface and underground operations. • Explain explosive characteristics, types, and safe handling procedures. • Analyse blast-induced environmental effects and suggest control measures.

Learning Resources	Das S. K. 2001. *Explosives and Blasting Practices in Mines*. Lovely Prakashan, Dhanbad. Fanchi J. R., Arnold K., Clegg J D, Holstein E. D. and Warner H. R. 2007. *Petroleum Engineering Handbook: Drilling Engineering*. Society of Petroleum Engineers. 763 p. Konya K. J. and Walter E. J. 1990. Surface Blast Design. Prentice Hall. 303 p. Mitchell R. F. and Miska S. 2010. Fundamentals of Drilling Engineering. Society of Petroleum Engineers.696 p. Pradhan G. K. and Sandhu M. S. 2002. *Blasting Safety Manual*. IME Publications, Calcutta. 271 P.

Course Code	MN2202N	Course Name	UNDERGROUND COAL MINING	Course Category	PC	L	T	P
						3	0	0

Pre-requisite Courses	Rock Mechanics	Co-requisite Courses	Drilling and Blasting	Progressive Courses	Mine Planning and Design
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	CMR,

Course Objectives	The principal objectives of the Course are: • To impart knowledge of different methods of underground coal mining. • To understand the selection criteria and design principles for underground mining methods. • To study coal face mechanization, strata control, ventilation, haulage, and safety. • To familiarize students with environmental issues and mine planning in underground coal mining

Sl. No.	Modules and topics	No. of Classes	Learning Outcome
1.	Coal mining methods; factors affecting choice of mining methods; in-seam and horizon mining; underground coal mining methods, comparison of underground mining methods	03	Ability to explain the characteristic features of underground Coal mining methods and to compare the methods
2.	Panel system of work; concept of panel; different layouts; panel barriers; pillar sizes; panel size; calculation of safety factors of pillars; relevant regulations	03	Ability to carry out preliminary design of panel system of work and to compute the regulation compliant dimensions of its various components
3.	Preparatory arrangements before depillaring operation; calculation of safety factors of pillars in different phases for suggested for depillaring operation; flow diagram on steps of depillaring, types of mine plans required to be maintained during depillaring operation.	04	Ability to explain the steps involved in carrying out safe and systemic depillaring operations and to carry out the steps.
4.	Line of operation; different types of line of operation- merits and demerits, sequence of pillar extraction and conditions governing pillar extraction, concept on goaf line velocity and its importance, relevant coal mine regulations.	03	Ability to explain different types of line of operation and the sequence of pillar extraction with governing conditions.
5.	Bord & Pillar method using LHDs / SDLs; layouts; support system including goaf-edge support.	02	Ability to design layouts and support system for Bord and Pillar method using LHDs / SDLs
6.	Bord & Pillar method using continuous miner; layouts, support system during development and	06	Ability to design comprehensive layouts and support system for Bord

Sl. No.	Modules and topics	No. of Classes	Learning Outcome
	depillaring; extraction by split and fender method; extraction by Nevid-angle method, concept of safety factors of snook; instrumentations during development and depillaring; concept of numerical modelling.		and Pillar method using continuous miners.
7.	Longwall mining method; factors affecting longwall mining; advancing and retreating faces; longwall face layouts, factors affecting panel length and width of longwall panel.	03	Ability to explain the characteristic features of longwall mining methods; to design longwall face layouts, and to optimize panel length and width.
8.	Strata mechanics in longwall; concept of immediate roof; main roof; overburden movements in longwall panel; abutment pressures; estimation of support requirements.	04	Ability to elucidate strata mechanics in relation to longwall mine and to estimate support requirements.
9.	Longwall support: frame, chock, shield and chockshield support; setting pressure; yield pressure.	03	Ability to select/ design/ utilize longwall support systems.
10.	Equipment in longwall panel; energy train; powerpack; shearer; AFC; stage loader; lump breaker.	03	Understanding of equipment in longwall panel and their utilisation.
11	Different stages of longwall; development, installation of longwall packages, operations and salvaging of longwall face equipment.	06	Knowledge of installation, Operation and salvaging of longwall face equipment.
12.	Thick seam mining; blasting gallery; slicing methods.	02	Ability to Understand the challenges of thick seam mining; Describe and analyze the Blasting Gallery (BG) method; Explain the slicing methods for thick seam extraction
TOTAL		**42**	

Course Outcomes	By the end of this course, students will be able to: • Explain the mechanics of rock breakage and principles of explosive energy release. • Identify and select appropriate drilling equipment and methods based on rock and mining conditions. • Design and evaluate blasting patterns for both surface and underground operations. • Explain explosive characteristics, types, and safe handling procedures. • Analyse blast-induced environmental effects and suggest control measures.

Learning Resources	Darling P. (ed). 2011. *SME Mining Engineering Handbook*, Third Edition. Society for Mining, Metallurgy, and Exploration, Liitleton. CO,1840 pages Das S. K. 1994. *Modern Coal Mining Technology*, Second Edition. Lovely Prakashan,

	Dhanbad Deshmukh D. J.2010. *Elements of Mining Technology* Vol. 1. 8th Edition. Denett& Company, Nagpur. 424 pages Hartman H. L. and Mutmansky J. M. 2002. *Introductory Mining Engineering*. John Wiley & Sons. 570 pages. Peng S. S. 2006. *Longwall Mining*. Second edition. Published by Syd S. Peng. 636p. Singh J. G. 2000. *Underground Coal Mining Methods*. Braj-Kalpa Publishers. Varanasi, India. 538 pages. Singh R.D. 2005. *Principles and Practices of Modern Coal Mining*. New Age International. 696 pages

Course Code	MN2203N	Course Name	MINE SURVEY	Course Category	PC	L	T	P
						3	0	0

Pre-requisite Courses	None	Co-requisite Courses	None	Progressive Courses	Mine Planning and Design
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	CMR, MMR, BIS Standards

Course Objective	The principal objectives of the Course are: • To provide fundamental knowledge and skills in mine surveying techniques. • To enable students to use surveying instruments for surface and underground mining operations. • To understand the principles of error correction, data plotting, and mine plan preparation. • To prepare students for real-world surveying tasks in exploration, development, and operations.

Sl. No.	Module and Topic	No of Classes	Learning Outcome
1.	**Introduction***: –* Importance and application; Principles of surveying	02	Ability to: explain the importance of surveying in mining engineering; Understand and articulate the fundamental principles of surveying; Identify various branches and types of surveying relevant to mining; Develop a conceptual foundation for advanced modules in mine surveying
2.	**Linear Measurements***: –* Linear measurements using various instruments; Errors in measurement; Triangulation,	03	**Ability to:** Understand the principles and techniques of linear measurement; Demonstrate the use of various instruments for linear measurements; Identify and analyze errors in linear measurements; Explain and apply the concept of triangulation in surveying; and, Apply theoretical knowledge to practical surveying tasks
3.	**Angular Measurements***: –* Basic construction of theodolite; Different methods of angle measurements using theodolite.	04	Ability to: Understand the construction and components of a theodolite; Demonstrate the use of a theodolite for angular measurement; Compare different methods of angular measurement; Detect and minimize errors in angular measurements; and Apply angular measurement techniques in mine surveying tasks.
4.	**Traversing***: –*Concept of bearing, open and closed traverse, compasses and traversing with compass, traversing with theodolite, traverse calculations, error	10	**Ability to:** Understand the fundamental concepts of traversing in mine surveying; Perform compass and theodolite traversing; Carry out traverse computations and plotting; Apply methods of error detection and correction; and, Integrate traversing knowledge into practical surveying applications

	corrections and adjustments		
5.	**Levelling***: –*Principles and concepts of levelling, construction of different levelling instruments; Levelling calculations and adjustments; Different types of levelling -reciprocal levelling, trigonometric levelling	06	Ability to: understand the fundamental principles and objectives of leveling; describe the construction and working of leveling instruments; perform leveling calculations and apply error adjustments; differentiate and apply types of leveling methods; and, apply leveling techniques in field scenarios
6.	**Contouring***: –*Fundamental principles and concepts, field measurements and generation of contours	03	Ability to: understand the fundamental principles and significance of contouring; conduct field measurements for contouring; generate and interpret contour maps; and, apply contouring techniques in mining and civil applications;
7.	Development in Surveying Instrumentation*: –* GPS, Total Station, EDM.	04	Ability to: understand recent advancements in surveying instrumentation; describe the components and functions of modern surveying instruments; demonstrate the use of modern instruments in surveying tasks; evaluate the advantages and limitations of modern surveying technologies; and, apply digital surveying tools in mining applications
8.	**Correlation***: –*Single and double shaft methods, precautions taken and equipment used.	04	Ability to: understand the purpose and importance of correlation in mine surveying; describe various correlation methods; identify and use correlation equipment; apply correlation methods in practical mining scenarios; follow safety precautions and best practices
9.	**Plans and Sections***: –* Different plans and sections in mines	02	Ability to: understand the purpose and importance of mine plans and sections; identify various types of plans and sections used in mining; interpret and prepare standard mine plans and sections; apply knowledge of plans in practical mining contexts; and, ensure regulatory compliance in preparation and updating of mine plans.
10.	Area and Volume computation and dip fault problems	04	Ability to: understand the principles of area and volume computation in mine surveying; perform area and volume calculations for mining applications; understand geological structures and their impact on surveying; solve dip and fault-related surveying problems; apply area, volume, and structural analysis in real-world mining scenarios
TOTAL		**42**	

Course Outcomes	By the end of this course, students will be able to: • explain the method of linear measurements, the instruments used and accuracy, • explain the method of angular measurements processes particularly the adjustment of traverse, • solve problems related to levelling, • estimate the topological undulations by contouring,

	• explain the process of correlation, • solve problems on volumes, dip and fault.

Learning Resources	Bannister A., Raymond S. and Baker R. 1998. Surveying, Pearson Education Ltd., 498p Barry F., Kavanagh S.J. and Bird G. 1984, Surveying: Principles and Applications. Reston Publishing Company, 900p Kanetkar T.P. and Kulkarni S.V. 2015.Surveying and Levelling. Vo I & II, Universities Press, 680p. Madhu N, Sathikumar R. and. Gopi S.2006. Advanced Surveying: Total Station, GIS and Remote Sensing. Pearson Education India, 386P Winniberg F. 1957.Metalliferous Mine surveying, Mining Publications Ltd., London. 402p.

Course Code	MN2204N	Course Name	UNDERGROUND MINE ENVIRONMENT	Course Category	PC	L	T	P
						3	0	0

Pre-requisite Courses	None	Co-requisite Courses	None	Progressive Courses	Mine Planning and Design
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	CMR, MMR, BIS Standards

Course Objectives	The principal objectives of the Course are to: • Impart comprehensive knowledge about the occurrence, detection, behaviour, and control of mine gases, fires, and inundations. • Introduce students to the physical and chemical properties of various gases encountered in underground coal and metal mines. • Develop an understanding of the causes, prevention, detection, and control of mine fires and spontaneous heating. • Explain the mechanisms and consequences of mine inundations and methods for their prevention and management. • Foster a safety-first mindset and an understanding of risk assessment, emergency preparedness, and disaster response in mining operations.

Sl. No.	Modules and topics	Lecture Hours	Learning Outcome
1	**Composition of mine atmosphere and Mine gases**: composition of atmospheric air, impurities in mine air; noxious gases - properties, physiological effects, and analysis, dust, suspended liquid droplets, solid impurities, etc.	5	Ability to: understand the composition and characteristics of mine atmosphere; identify and explain the properties of noxious mine gases; evaluate the physiological effects of mine gases; understand the presence and impact of particulate impurities; and, apply methods for sampling and analysis of mine gases and air quality
2	**Mine climate:** heat and humidity: air pressure, temperature, moisture, cooling power of mine air and its improvement, refrigeration, effective temperature, WBGT etc.	5	Ability to: understand the components of mine climate; evaluate the impact of heat and humidity in underground mines; assess the cooling power and comfort level of mine air; explain methods to improve thermal conditions in mines; apply climate control principles in mine design and operations.
3	**Dust:** Sources of dust in mines, dust hazards, collagenous and non-collagenous dust properties, dust particle sizes responsible to respiratory diseases and possible measures to combat the problems.	4	Ability to: identify the sources of dust generation in underground mines; understand the types and properties of mine dust; analyze dust particle size and its relation to respiratory diseases; evaluate the health and safety hazards associated with mine dust; propose and assess dust control measures
4	**Measurement of dust and its prevention:** MAC of dust, measures	4	Ability to: understand and apply the concept of maximum allowable concentration (mac) of dust;

Sl. No.	Modules and topics	Lecture Hours	Learning Outcome
	to limit production of airborne dust and prevention of LAP of dust. Stone dust barriers – types, construction and erection. Related statutes from CMR 1957.		measure and assess airborne dust levels in underground mines; evaluate and implement dust control strategies; understand the design and application of stone dust barriers; interpret and apply relevant mining regulations
5	**Dust Abetment:** Various control measures of dust and scheme developed on dust monitoring, control and sampling in mines (pre and post dusting period).	4	Ability to: understand the concept and importance of dust abatement in mines; identify and evaluate various dust control measures; explain dust monitoring schemes and sampling strategies; analyze and interpret dust sampling data; apply dust abatement strategies in operational mining scenarios
6	**Fire:** Possible sources of fire in mines and their precautionary measures in surface and underground, Statutes on mine fire and spontaneous heating.	4	Ability to: identify potential sources of fire in mining environments; understand the phenomenon of spontaneous heating; recommend precautionary and preventive measures against mine fires; apply statutory requirements related to mine fires and spontaneous heating; and, integrate fire risk management into mine safety planning
7	**Inundation:** Potential sources of mine inundation, concept on naturally wet and abnormal seepage in relation to mines, measures to restrict inundation related problems, relevant statutes on different conditions imposed on working susceptible to inundation.	4	Ability to: identify potential sources and types of mine inundation; understand the concepts of natural wetness and abnormal seepage; evaluate the risks and impacts of mine inundation; apply preventive and control measures against inundation; and, interpret and apply statutory provisions related to inundation
8	**Mine explosions:** causes, prevention, and control: firedamp explosion & coal dust explosion, explosive limit, affecting factors, characteristics, etc.	4	Ability to: understand the types and causes of mine explosions; explain the concepts of explosibility and explosive limits; describe the characteristics and consequences of mine explosions; evaluate preventive and control measures for mine explosions; and, integrate explosion risk management into mine safety planning
9	**Rescue and Recovery operations:** human respiratory system, mine rescue apparatus, rescue organization, rescue stations & rescue rooms, recovery work, etc.	4	Ability to: understand the physiological aspects relevant to mine rescue; identify and explain various types of mine rescue apparatus; understand the organization of mine rescue services; demonstrate knowledge of rescue and recovery procedures; interpret statutory provisions and best practices.
10	**Illumination:** standards and arrangements: concepts, statutory provisions, arrangements in opencast & in underground mines, etc.	4	Ability to: understand the basic concepts and significance of mine illumination; identify appropriate lighting standards for mining environments; differentiate lighting arrangements in opencast and underground mines; evaluate lighting equipment and technologies used in mines; and, interpret and apply

Sl. No.	Modules and topics	Lecture Hours	Learning Outcome
			statutory provisions related to mine lighting.
TOTAL		**42**	

Course Outcomes	After going through the course, a student may be expected to: • narrate and explain the composition and characteristics of mine atmosphere and the properties and physiological effects of its constituents. • identify the sources of dust and explain the hazards associated with mine dust. Design campaign for dust measurement in mines and carry out the same. Design effective measures for dust suppression and control. • identify possible sources of fires in underground coal-mine and take precautions and safety measures against occurrence of fire. They should also be able to take measures for dealing with underground mine. • identify possible sources of inundation in a mine and take precautions measures for prevention of mine inundation. • identify causes of mine explosion; design and execute effective action plans for rescue and recovery operations in mines.

Learning Resources	Banerjee S P (2003): *Mine Ventilation*. Lovely Prakashan, Dhanbad. 457p Deshmukh D.J. (2010): *Elements of Mining Technology* Vol. 2. (8th Edition). Denett& Company, Nagpur. 424p Hartman H L, Mutmansky J M, Ramani R V and Wang Y J (1997): *Mine Ventilation and Air Conditioning* (3rd edition). John Wiley and Sons. 730p ILO (1986): Safety and Health in Coal Mines: An ILO Code of Practice. International labour Office Geneva. 176p Kaku L C (2002): Numerical Problems on Mine Ventilation – Coal and Metal. 186 McPherson M J (1993): *Subsurface Ventilation Engineering* (web edition). Downloadable from http://www.mvsengineering.com McPherson M J (2009): *Subsurface Ventilation and Environmental engineering* (2nd edition).Chapman and Hall, 824p Misra G B (1986): *Mine Environment and Ventilation*. Oxford University Press. 619p Misra G B (2001*)*: *Problems on Mine Ventilation*. Geeta Book Stores, Dhanbad. 213p Ramlu M A (2007): *Mine Disasters and Mine Rescue*. (2nd Edition). Universities Press, Hyderabad. 448p.

Course Code	MN2251N	Course Name	MINE SURVEY PRACTICAL	Course Category	PC	L	T	P
						0	0	3

Pre-requisite Courses	None	Co-requisite Courses	Mine Survey	Progressive Courses	Mine Planning and Design
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	CMR, MMR, BIS Standards

Course Objectives	The principal objectives of the Course are: • To develop practical skills in mine surveying techniques relevant to surface and underground mining. • To familiarize students with conventional and modern surveying instruments. • To enable students to conduct and analyze various mine surveys including levelling, traversing, and contouring. • To train students in data recording, plotting, and interpretation using modern software and field equipment.

Week	Experiment Title	Class Hours	Learning Outcome
1	Introduction to Surveying Instruments	3	Understanding principles, types, and care of instruments
2	Chain Surveying and Ranging	3	Linear measurement, offsetting, field book maintenance
3	Compass Surveying	3	Measurement of bearings, magnetic declination, traverse plotting
4	Levelling with Dumpy/Auto Level	3	Fly levelling, reduced level calculation (Height of Instrument & Rise and Fall methods)
5	Theodolite Surveying – Angle Measurement	3	Measurement of horizontal and vertical angles
6	Theodolite Traverse	3	Closed traverse, computation of coordinates
7	Tacheometric Surveying	3	Stadia readings, calculation of horizontal distances and elevations
8	Contouring	3	Use of level/theodolite, preparation of contour maps
9	Use of Total Station	3	Measurement of distance, angle, and coordinates; data downloading
10	Underground Surveying Simulation	3	Setting out line, transferring alignment using a theodolite or laser plummet
11	Correlation Survey Methods	3	Connecting surface and underground surveys, demonstration
12	GPS Survey (Demonstration or Field Use)	3	Basics of GPS, coordinate collection, accuracy limitations
13	Mine Plan Preparation and Plotting	3	Use of survey data to draw mine layouts (manual or CAD-based)
14	Project / Mini Exercise	3	Complete survey and plotting of an assigned area or mine model

Week	Experiment Title	Class Hours	Learning Outcome
TOTAL		**42**	

Course Outcomes	On successful completion of this course, students will be able to: • Handle and operate basic and advanced mine surveying instruments. • Conduct surveys in surface and underground environments. • Apply modern techniques such as Total Station and GPS in mine surveying. • Process and interpret survey data using CAD/GIS software. • Understand statutory and safety considerations in mine surveying.

Learning Resources	Bannister A., Raymond S. and Baker R. 1998. Surveying, Pearson Education Ltd., 498p Barry F., Kavanagh S.J. and Bird G. 1984, Surveying: Principles and Applications. Reston Publishing Company, 900p Kanetkar T.P. and Kulkarni S.V. 2015.Surveying and Levelling. Vo I & II, Universities Press, 680p. Madhu N, Sathikumar R. and. Gopi S.2006. Advanced Surveying: Total Station, GIS and Remote Sensing. Pearson Education India, 386P Winniberg F. 1957.Metalliferous Mine surveying, Mining Publications Ltd., London. 402p. OEM Manuals for Total Station and GPS DGMS Guidelines on Mine Surveying in India

Course Code	MN2252N	Course Name	UNDERGROUND MINE ENVIRONMENT LAB	Course Category	PC	L	T	P
						0	0	3

Pre-requisite Courses	None	Co-requisite Courses	Underground Mine Environment	Progressive Courses	Mine Ventilation Mine Planning and Design
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	CMR, MMR, BIS Standards

Course Objectives	The principal objectives of the Course are: • To develop practical knowledge of environmental monitoring in underground coal and metal mines. • To familiarize students with detection and measurement of mine gases, dust, temperature, humidity, and illumination. • To impart hands-on training in using gas detection instruments, dust samplers, and environmental monitoring tools. • To understand safety procedures and statutory standards related to underground mine environment.

LIST OF EXPERIMENTS

Sl. No.	Experiment Title	Contact Hours	Learning Outcome
1	Study of environmental hazards in underground mines (introductory session)	3	Overview of hazards and regulatory limits
2	Detection of methane using flame safety lamp	3	Basic gas detection method
3	Methanometer: Calibration and measurement of methane concentration	3	Electronic gas monitoring
4	Detection of carbon monoxide (CO) using detector tubes and digital CO meters	3	Toxic gas detection
5	Detection of hydrogen sulfide (H_2S) and sulfur dioxide (SO_2)	3	Use of chemical detector tubes
6	Study of multi-gas detectors (e.g., MSA Altair, Dräger X-am) and practical application	3	Advanced real-time monitoring
7	Measurement of oxygen deficiency and oxygen enrichment in mine atmospheres	3	Safety in confined spaces
8	Collection and analysis of dust samples using respirable dust sampler (e.g., Sidekick/Gravimetric sampler)	3	Airborne dust monitoring
9	Personal Dust Sampler (PDS): Operation and analysis	3	Occupational exposure evaluation
10	Determination of dust concentration using konimeter or digital particle counter	3	Suspended particulate analysis
11	Measurement of ambient temperature, wet bulb and dry bulb temperature, and relative humidity	3	Heat and humidity hazards

Sl. No.	Experiment Title	Contact Hours	Learning Outcome
12	Study and use of digital hygrometers and psychrometers	3	Humidity measurement tools
13	Measurement of noise levels using sound level meter and understanding permissible exposure limits	3	Occupational noise hazard assessment
14	Measurement of mine illumination using digital lux meter and comparison with statutory requirements	3	Lighting safety and standards
TOTAL		**42**	

Course Outcomes	On successful completion of this course, students will be able to: • Identify and measure common hazardous gases found in underground mines. • Use gas detectors, multi-gas monitors, and flame safety lamps effectively. • Conduct dust sampling and analyze respirable dust concentrations. • Measure and interpret temperature, humidity, and noise levels in mines. • Understand safety regulations and thresholds for underground mine environment parameters.

Learning Resources	Banerjee S P (2003): *Mine Ventilation*. Lovely Prakashan, Dhanbad. 457p Hartman H L, Mutmansky J M, Ramani R V and Wang Y J (1997): *Mine Ventilation and Air Conditioning* (3rd edition). John Wiley and Sons. 730p McPherson M J (2009): *Subsurface Ventilation and Environmental engineering* (2nd edition).Chapman and Hall, 824p Misra G B (1986): *Mine Environment and Ventilation*. Oxford University Press. 619p Ramlu M A (2007): *Mine Disasters and Mine Rescue*. (2nd Edition). Universities Press, Hyderabad. 448p. OEM Manuals for the instruments and equipment used DGMS Circulars and Guidelines

Course Code	MN2271N	Course Name	SEMINAR	Course Category	PC/ PSE	L	T	P
						0	0	3

Pre-requisite Courses	Professional Communication in English	Co-requisite Courses	None	Progressive Courses	None
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	None

Course Objectives	The objectives of the Course are: • To train students in the skills of writing technical papers on mining related topics. • To develop the ability to conduct literature reviews, analyze data, and synthesize findings. • To prepare students for effective oral communication of technical content through seminars and presentations.

COURSE CONTENT AND SCHEDULE:

Module	Topic/Activity	Hours
1	Introduction to Technical Communication: Purpose, Audience, Format	3
2	Elements of a Technical Paper: Title, Abstract, Introduction, Methods, Results, Discussion, Conclusion, References	3
3	Literature Survey Techniques: Using Journals, Databases, and Citation Tools	3
4	Selection of Seminar Topics (focused on Mining Machinery) and Approval	3
5	Structure of an Effective Technical Presentation (Slides, Visuals, Delivery)	3
6	Writing Workshop I: Abstract and Introduction	3
7	Writing Workshop II: Methods and Results	3
8	Writing Workshop III: Discussion and Conclusion	3
9	Writing Workshop IV: References and Plagiarism Check	3
10	Draft Paper Submission and Review	3
11	Seminar Presentation Preparation and Feedback Round	3
12–14	Final Technical Seminar Presentations (Student-wise)	9
TOTAL		**42**

Course Outcomes	On successful completion of the course, students will be able to: • Select relevant and current topics related to mining machinery for technical exploration. • Conduct background research and review technical literature. • Structure and write technical papers in a professional and academic format. • Use technical illustrations, graphs, and references appropriately. • Deliver oral presentations and engage in academic discussions confidently.

Learning Resources	1. Report Writing and Communication Skills • **Day, R.A. &Gastel, B.** – *How to Write and Publish a Scientific Paper*, Cambridge University Press. • **Sharma, R.C. & Mohan, K.** – *Business Correspondence and Report Writing*, McGraw-Hill. • **Michael Alley** – *The Craft of Scientific Writing*, Springer. • **Myneni, S.R.** – *English for Engineers*, Pearson Education. 2. Technical Writing Guides • Departmental **Training Report Guidelines** and **Templates** • IEEE/ASME style guides (for referencing and formatting) • Plagiarism checking tools: **Turnitin**, **Grammarly**, **PlagScan** 3. Oral Presentation and Viva Skills • **Duarte, Nancy** – *Slide:ology – The Art and Science of Creating Great Presentations*, O'Reilly. • **TED Talks (YouTube)** – For examples of structured and engaging presentations. • **University of Leicester – Study Skills Resources**: https://www2.le.ac.uk/offices/ld/resources • **Toastmasters International** – Public speaking tips and structured speech delivery techniques.

Course Code	MN2272N	Course Name	METAL MINE VISIT	Course Category	PC	L	T	P
						0	0	3

Pre-requisite Courses	Elementary Mining Engineering	Co-requisite Courses	None	Progressive Courses	Underground Metal Mining
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	MMR, IBM Guidelines

Course Objectives	The primary objectives of this course are to: • Provide first-hand exposure to underground Metalliferous mining operations. • Understand the various stages of ore extraction, haulage, ventilation, and safety practices. • Observe mine infrastructure, machinery, and environmental control measures. • Encourage students to relate theoretical knowledge to practical, real-world mining scenarios.

Sl. No.	Module Name and topics	No. of Classes
1	**Pre-Visit Orientation:** Lectures/briefings on mine safety, PPE, visit objectives, and expected observations.	00
2	**Industrial Visit (3-5 days):** Field trip to operational metalliferous mine (open-cast or underground) coordinated with the mining company.	00
3	**Post-Visit Debriefing:** Reflection session, discussion on observations, Q&A with instructors.	00
4	**Report Submission:** Individual or group report summarizing findings, diagrams, photographs, and analysis.	00
5	**Presentation & Viva:** Oral presentation of observations with Q&A.	00
TOTAL		**00**

Course Outcomes	After completing this course, the students will be able to: • Identify and describe the key components and processes involved in metal mining operations (surface or underground). • Interpret mine layouts and working practices related to drilling, blasting, loading, transportation, and ventilation systems. • Evaluate mine safety practices including the use of personal protective equipment (PPE), gas monitoring systems, and emergency protocols.

	• Observe and document environmental control measures such as dust suppression, overburden management, and water drainage systems. • Demonstrate professional behaviour, teamwork, and communication skills during the field visit and in post-visit reporting and presentation. Integrate rock mechanics concepts for safe and economic mine design.

Learning Resources	Darling P (ed.) (2011): *SME Mining Engineering Handbook, Third Edition*. Two Volume Set. *Society for Mining*, Metallurgy, and Exploration Inc. Littleton, CO, USA.1984 pages Hustrulid W. A. and Bullock R. A. (Eds). 2001. *Underground Mining Methods: Engineering Fundamentals and International Case Studies*. Society for Mining, Metallurgy, and ExplorationInc. Littleton, CO, USA. 728 pages Hartman H.L. and Mutmansky J.M. 2002. *Introductory Mining Engineering*. John Wiley & Sons. 570p. IBM Guidelines for Mine Planning

V-SEMESTER COURSES SYLLABI

Course Code	MN3101N	Course Name	MINE VENTILATION ENGINEERING	Course Category	PC/ PSE	L	T	P
						3	0	0

Pre-requisite Courses	Underground Coal Mining	Co-requisite Courses	Underground Metal Mining	Progressive Courses	Mine Planning and Design
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	CMR, MMR, DGMS Circulars

Course Objectives	The primary objectives of this course are: • To introduce the fundamental principles and laws governing air movement in mines. • To understand mine ventilation network design, control, and optimization. • To ensure safety and health standards in underground environments by proper ventilation practices. • To analyze environmental hazards such as gases, heat, and dust in underground mines.

Sl. No.	Module Name and topics	No. of Classes	Learning Outcome
1	**Introduction: –** Purpose and importance; Historical overview	2	Ability to: Explain the purpose and significance of mine ventilation; Trace the historical development of mine ventilation practices; Appreciate the multidisciplinary nature of mine ventilation engineering
2	**Main Elements of Ventilation: –** Standards of ventilation. Permissible air velocities in different types of workings/openings.	3	Ability to: describe the key elements of a mine ventilation system; understand and apply ventilation standards; recognize and evaluate permissible air velocities; and, apply knowledge to real-world mine layouts
3	**Air Flow Through Mine Openings: –** Review of Fluid Mechanics -types of fluid flow, Poiseuille's equation, Chezy-D'Arcy equation; Atkinson's equation and the square law, Resistance in series and parallel, equivalent Orifice; Power requirement for air flow and ways for its reduction; Shock Pressure Loss; shock losses due to obstructions, formation of wake, variation of drag coefficient,	6	Ability to: apply principles of fluid mechanics to mine ventilation systems; analyze resistance and energy losses in mine ventilation networks; estimate power requirements and suggest energy-saving measures; evaluate shock losses and airflow disruptions; and, design basic ventilation models with optimized flow characteristics.

	losses due to bends and area changes		
4	**Natural Ventilation: –** Natural ventilation Pressure in shafts, direction and amount of natural ventilation, motive column; Calculation of NVP and motive column; Thermodynamic aspects of mine airflow	4	Ability to: explain the principles of natural ventilation in mines; calculate natural ventilation pressure (nvp) and motive column; analyze factors affecting natural ventilation efficiency; and, interpret thermodynamic aspects of mine airflow
5	**Mechanical Ventilation: –** Devices, characteristics, selection; Auxiliary and booster ventilation; Centrifugal fan - theoretical head, volute, power requirement; Axial flow fan - pressure developed, losses in fans; Fan characteristic curves, operating point; Selection of Fan; Auxiliary and booster ventilation	10	Ability to: classify different mechanical ventilation systems and their components; analyze fan performance and system requirements; evaluate factors affecting fan selection and efficiency; design ventilation systems using mechanical aids; ensure compliance with ventilation standards and safe operating conditions.
6	**Ventilation Survey: –** Quantitative and qualitative survey, related laws, selection of stations, instruments	4	Ability to: explain the purpose and scope of mine ventilation surveys; select appropriate survey methods and instruments; conduct and interpret ventilation survey data; apply relevant laws and standards in conducting ventilation surveys.
7	**Ventilation Control Devices: –** Distribution of air current - airlock, ventilation stopping, air crossings advantages of splitting; Auxiliary Ventilation - forcing, exhaust and overlap ventilators, precautions against recirculation; Booster fan - advantages and disadvantages, location of booster fans, critical pressure, related laws	9	Ability to: describe the function and types of ventilation control devices; analyze air distribution techniques and their effectiveness; differentiate between types of auxiliary ventilation systems; explain the role and implications of booster fans in mine ventilation; and, apply statutory requirements and best practices
8	**Ventilation Planning: –** Planning of ventilation systems and economic considerations; Ventilation layouts for underground coal and metal mines; Calculation of air quantity required for ventilating a mine, calculation of total mine head; Ventilation network analysis - principles and computer applications.	4	Ability to: explain the principles and objectives of mine ventilation planning; design ventilation layouts for different underground mining scenarios; calculate ventilation parameters for mine planning; apply network analysis techniques for mine ventilation systems; and, assess the effectiveness and efficiency of ventilation plans
TOTAL		**42**	

Course Outcome	After completing this course, the students will be able to: • explain mine ventilation related phenomena, particularly the laws governing flow of air to different underground locations, in terms of the principles of fluid mechanics, • estimate the amount of fresh air required at various places in underground workings,

	• explain turbo-mechanic principles of mine fans and select appropriate fans for underground mines, • explain the functioning of various instruments used in ventilation survey, • solve problem relating to simple and complex ventilation networks and design appropriate mine ventilation network, • carry out elementary level mine ventilation planning.

Learning Resources	Banerjee S P (2003): *Mine Ventilation*. Lovely Prakashan, Dhanbad. 457p Ganguli R and Bandopadhyay S (2004): *Mine Ventilation*. Taylor & Francis. 536p. Hartman H L, Mutmansky J M, Ramani R V and Wang Y J (1997): *Mine Ventilation and Air Conditionin*g (3rd edition). John Wiley and Sons. 730p Kaku L C (2002): Numerical Problems on Mine Ventilation – Coal and Metal. 186p McPherson M J (2009): *Subsurface Ventilation and Environmental engineering* (2nd edition). Chapman and Hall, 824p Misra G B (2001*): Problems on Mine Ventilation*. Geeta Book Stores, Dhanbad. 213p

Course Code	MN3102N	Course Name	MINING MACHINERY	Course Category	PC/ PSE	L	T	P
						3	0	0

Pre-requisite Courses	Fluid Mechanics and Fluid Machines Heat Power and Machine Elements	Co-requisite Courses	Underground Metal Mining	Progressive Courses	Mine Planning and Design
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	CMR, MMR, DGMS Circulars

Course Objectives	The primary objectives of this course are: • To understand the types, functions, and applications of mining machinery. • To learn about selection criteria for equipment in various mining methods. • To gain practical knowledge of operation, maintenance, and troubleshooting of mining machines. • To analyze the economic and safety aspects of mining machinery.

COURSE CONTENT

Sl. No.	Module/ Topics	Class Hours	Learning Outcome
1	**INTRODUCTION TO MINING MACHINERY —** Importance and evolution of Mining Machinery, Classification of Mining Machinery –based on mining (surface/underground) operations, Trends in mining machinery – automation, digitalization, sustainability; Drives used in Mining machineries: Electric drives, Hydraulic and Pneumatic drives, IC Engines, Turbo-charged diesel engine; **Materials and Components of Mining Machinery —** Wear-resistant materials, high-strength steels, Bearings, gears and clutches.	**4**	Ability to: explain the significance and evolution of mining machinery; classify mining machinery based on functional and operational parameters; understand and compare various power systems used in mining equipment; identify materials and components used in mining machinery; evaluate the selection of machinery components based on operational requirements
2	**DRILLING EQUIPMENT: —** Mechanism of Rock breakage by drilling**,** **Surface Drilling Machinery:** Rotary, Percussive, Rotary-percussive, Types of Drill Bits and their uses; Types of Drill machines used in Surface Mining operations: Blast Hole Drill (Rotary), DTH Drill, Wagon Drill; Drill rigs – components, operation and maintenance; **Underground Drilling Machinery —** Drifters: Pneumatic, hydraulic, Jumbo drills – single	**8**	Ability to: understand and explain the fundamental principles of drilling in mining operations; differentiate between surface and underground drilling equipment; describe the configuration and functioning of drilling rigs and associated components; apply basic knowledge of maintenance and troubleshooting for drilling equipment; select suitable drilling equipment for

	boom, multi-boom, Long-hole drills, raise borers (brief overview); **Coal drill: Hand held coal drill, UDM; Accessories and Maintenance of Drilling Equipment —** Drill rods, couplings, drill steels. Maintenance practices, troubleshooting common issues.		specific mining conditions
3	**EXCAVATION AND LOADING EQUIPMENT: — Surface Mining operation:** Shovels (Rope shovels, Hydraulic shovel), Draglines: Walking draglines, Bucket wheel excavators (BWEs) for continuous mining, Scraper, FEL, Dozers, Grader and Compactor: types, Operational and Safety aspects of HEMM; Selection and application of HEMM. **Underground Mining operations:** Load-Haul-Dump (LHD) machines, Side dump loaders, Rocker Shovel, Auto Loader; **Continuous Miners and Road-headers; Shearer, Plow;** Basic productivity calculations (cycle time, bucket fill factor).	**10**	Ability to: understand the working principles and classifications of surface and underground excavation and loading equipment; explain the operation and applications of continuous excavation equipment; evaluate equipment selection criteria based on mining conditions; perform basic productivity calculations for excavation and loading operations; develop a practical perspective on equipment application and deployment
4	**HAULAGE AND TRANSPORTATION EQUIPMENT: — Surface Haulage Equipment —** Off-highway trucks: Rigid dump trucks, Articulated dump trucks, Electric Dumper; Conveyor systems: Belt conveyors, Pipe Conveyor, Cable Belt Conveyor, High Angle Conveyor, In-Pit Crushing and Conveying System. **Underground Haulage Equipment —** Shuttle cars; Ram Car, Chain Conveyor; Mine locomotives and Mine cars: Battery, Trolley Wire, Diesel locomotives, Man Riding Systems: Man Riding Car, Chairlift Car, Mono rail, Personal Carrier. Vertical Shat Hoisting: Mine Winder:- Drum Winder, Friction Winder; Headgear structure, pulleys, cages and skips, Suspension gear, Keps and guides; Drives of Mine Winders; Safety devices in winders, Automatic Contrivances, Duty cycle diagram; Capacity and Power calculations; **Material Handling Equipment (General) –** Feeders: Apron feeders, Vibrating feeders, Belt Feeder, Drum Feeder; Bins, Silos and Bunkers;	**10**	Ability to: identify and explain various surface and underground haulage systems used in mining; understand the configuration and applications of mine material handling equipment; evaluate factors influencing the selection and deployment of haulage equipment; perform basic performance and capacity calculations; and, develop insight into integration and optimization of haulage systems in mining operations

	Crushers: primary, secondary, tertiary; Screens: vibrating screens, grizzly screens; Stackers and Reclaimers.		
5	**SUPPORT AND ANCILLARY EQUIPMENT: — Ground Support Equipment —** Rock bolters: drill rigs for rock bolting, – Shotcreting machines - wet mix, dry mix, – Grouting equipment; **Pumping and Ventilation Equipment —** Mine dewatering pumps: submersible, centrifugal, piston pumps, Discharge and Power estimation of pumping system; Mine ventilation fans: Axial flow, centrifugal fans (main and auxiliary); **Service and Utility Vehicles —** Personnel carriers, utility vehicles, service trucks, – Fuel and lube trucks, tire handlers; **Lighting and Communication Systems —** Mine lighting equipment, – Communication systems: two-way radios, leaky feeder systems.	**6**	Ability to: understand the types and applications of ground support equipment in mining; identify various mine pumping and ventilation equipment and their roles; recognize the importance of service and utility vehicles in mining operations; describe lighting and communication systems in mines; and, evaluate selection criteria for support and ancillary equipment.
6	**MAINTENANCE, SAFETY, AND EMERGING TECHNOLOGIES: — Maintenance of Mining Machinery —** Types of maintenance - preventive, predictive, breakdown, – Maintenance management systems (CMMS), – Spare parts management, – Troubleshooting common equipment failures; **Safety in Mining Machinery Operations —** Hazards associated with mining equipment, – Safety devices and interlocks, – Operator training and certification, – Regulatory requirements (e.g., DGMS regulations in India); **Emerging Technologies in Mining Machinery —** Automation and robotics in mining, – Remote control operation, – Autonomous haulage systems (AHS), – Data analytics and predictive maintenance,	**4**	Ability to: understand various maintenance strategies used for mining machinery; analyze safety aspects in mining machinery operation; evaluate the role of emerging technologies in enhancing productivity and safety; develop a systems-thinking approach to equipment lifecycle and technology integration
TOTAL		**42**	

Course Outcomes	After completing this course, the students will be able to: • Identify and classify various types of mining machinery used in both surface and underground mines. • Explain the working principles and components of key mining equipment. • Analyze the factors influencing the selection of appropriate machinery for different mining conditions.

	• Understand the operational parameters and performance characteristics of mining equipment. • Recognize common maintenance issues and safety considerations associated with mining machinery. • Apply basic calculations for equipment sizing and productivity estimation.

Learning Resources	Burch D. 1997. Estimating Excavation. Craftsman Book Company. 446 p. Chakrabarti P.K. 1999. Electricity in Underground Coal Mining. CMPDIL, Ranchi.297 p. Czaplicki J. M. 2009. Mining Equipment and Systems: Theory and Practice of Exploitation and Reliability. CRC Press. 296 pages Datta N.K. 1996. *Electrical Engineering in Mines.* New Central Book Agency, Delhi. 239 p De A. 2014. Latest Development of Heavy Earth Moving Machinery. Galgotia Publications Pvt. Ltd. 312 p. Khurmi R. S and Gupta. J.K. 2005.A Text Book of Machine Design. Eurasia Publishing House 1251 p *Martin* J. W., Martine T.J., Bennett T.P., and *Martin* K.M. 1982. Surface Mining Equipment. Martin Consultants, Golden, CO. 455 p. Nichols H., Day D. and Herbert N. 2010. Moving The Earth: The Workbook of Excavation Sixth Edition / Edition 6. McGraw-Hill Professional Publishing. 1232 p. Peurifoy R.L., Schexnayder C.J. and Shapira A. 2010.Construction Planning, Equipment and Methods. McGraw-Hill Education.800 p. Woodcock C.R. and Mason J.S. 2012. Bulk Solids Handling: An Introduction to the Practice and Technology. Springer Science and Business Media. 522 p.

Course Code	MN3103N	Course Name	SURFACE MINING	Course Category	PC/ PSE	L	T	P
						3	0	0

Pre-requisite Courses	Elementary Mining Engineering Rock Mechanics	Co-requisite Courses	Mining Machinery	Progressive Courses	Mine Planning and Design
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	CMR, MMR, DGMS Circulars

Course Objectives	The primary objectives of this course are: • To distinguish between various surface mining methods and identify their applicability based on geological, topographical, and economic factors. • To explain the principles and operational characteristics of different drilling, blasting, loading, and hauling equipment used in surface mines.

COURSE CONTENT

Sl. No.	Module Name and Topics	No. of Lectures	Learning Outcome
1.	**Introduction: –** Current status and future trends in production; Productivity and technological developments; Surface mining methods - classification, applicability; Factors and conditions affecting selection; Advantages and disadvantages	02	Ability to: explain the current status and future trends in surface mining; classify and compare surface mining methods; evaluate key factors influencing method selection; assess the advantages and limitations of surface mining techniques
2.	**Planning and Design of Surface Mines: –** Definition of mining parameters -bench height, pit slopes, cut-off grade, strip ratio; Ultimate pit definition - manual and computer methods, Lerchs-Grossman method, incremental pit expansion, floating cone method; Waste disposal -planning, design, construction, stability, and environmental protection aspects	05	Ability to: define and explain key surface mine planning parameters; apply methods for ultimate pit limit design; plan waste disposal systems in surface mining; and, integrate technical and environmental considerations in mine design
3.	**Opening up of Deposits: –** Surface preparations; Box cut - objective, types, parameters, methods; Factors affecting selection of box cut site; Production benches - formation, parameters and factors affecting their selection.	04	Ability to: explain the steps involved in opening up surface deposits; define the purpose and design considerations of box cuts; describe the formation and optimization of production benches; apply basic design principles to initial mine development

4.	**Preparation for Excavation: –** Ripper - applicability and limitations; Concept of rippability - method and cycle of operation, estimation of output; Blast hole drilling - estimation of number of drills required for a given mine production.	02	Ability to: **E**xplain the role of rippers in excavation preparation; Assess rippability of rock formations; Describe blast hole drilling practices in surface mines; Integrate excavation preparation techniques into mine planning
5.	**Blasting: –** Design of blasting rounds- general considerations, blast pattern and delay selection, explosive consumption; Blasting mechanics; Design guidelines	04	Ability to: Understand the fundamentals of surface blasting operations; Design effective blasting rounds; Evaluate blast performance; Apply design guidelines to real-world blasting problems
6.	**Discontinuous/Cyclic Methods of Excavation and Transport: –** Shovel-dumper operation - cycle time and productivity calculation, fleet size estimation, application of shovel-dumper combination in various types of deposits; Dragline operation - applicability and limitations, different modes of operation, reach calculation, cycle time and productivity calculation; Calculation of bucket capacity; Scrapers - applicability and limitations, various types, method and cycle of operation, pusher dozer and push-pull operation; Dozers - applicability and limitations, types and classification, types of blade and corresponding merits and demerits, method and cycle of operation; Front-end-loaders - applicability and limitations, method and cycle of operation, concept, estimation and significance of minimum tipping- load, calculation of maximum working load and selection of bucket capacity.	08	Ability to: Explain the working principles and applications of discontinuous excavation and transport equipment; Perform productivity analysis for surface mining equipment; Select suitable excavation and transport systems based on deposit characteristics; Apply design and operational guidelines to equipment deployment
7.	**Continuous Methods of Excavation and Transport: –** Bucket wheel excavators - applicability and limitations, types and principle of operation, half and full block methods and their corresponding merits and demerits, productivity calculation; Continuous surface miners - types, classification, applicability and limitations, principles of operation, classification of operational methods - wide / full bench method, block mining method and stepped cut method, empty travel back method, turn back method and continuous mining method, conveyor/ truck loading method, side casting method and windrowing method, merits, demerits, applicability and limitations of these methods; Conveyors - shiftable and high angle conveyors, mode of operation, merits, demerits, applicability and	07	Ability to: Describe the principles, types, and operational characteristics of continuous surface excavation systems; Evaluate the applicability and limitations of continuous excavation and transport equipment; Differentiate between various operational methods used with continuous miners; Perform productivity calculations for continuous excavation systems; Analyze the role of shiftable and high-angle conveyors in integrated continuous mining systems.

	limitations.		
8.	**Semi-Continuous Methods of Excavation and Transport: –** Continuous excavation and partly/fully cyclic transport system - different methods and applicability and limitations; Cyclic excavation and partly/fully continuous transport system, - different in-pit crushing and conveying methods and their respective applicability and limitations.	07	Ability to: Explain the concept and classification of semi-continuous excavation and transport systems; Identify and describe the operational principles of various semi-continuous systems; Analyze the applicability, advantages, and limitations of semi-continuous systems; Describe in-pit crushing and conveying (IPCC) systems and their types; and, Assess the impact of semi-continuous systems on mine planning and productivity
9.	**Dimensional Stone Mining: –** Dimensional stones - types, occurrences and uses, methods vis-à-vis equipment for extraction of primary blocks in granite and marble quarries	03	Ability to: identify the major types of dimensional stones; explain the principles and practices of dimensional stone mining; describe the methods of primary block extraction; select suitable equipment for dimensional stone mining operations; evaluate factors affecting block quality and quarry economics.
TOTAL		**42**	

Course Outcomes	After completing this course, the students will be able to: • **Distinguish** between various surface mining methods and **identify** their applicability based on geological, topographical, and economic factors. • **Explain** the principles and operational characteristics of different drilling, blasting, loading, and hauling equipment used in surface mines. • **Analyze** and **design** fundamental aspects of surface mine layouts, including pit geometry, haul roads, and dumps. • **Evaluate** the environmental impacts of surface mining and **propose** appropriate mitigation and reclamation strategies. • **Apply** safety regulations and best practices relevant to surface mining operations to ensure a secure working environment. • **Discuss** emerging trends, automation, and sustainable practices in modern surface mining operations.

Learning Resources	Czaplicki J. M. 2009. Mining Equipment and Systems: Theory and Practice of Exploitation and Reliability. CRC Press. 296 pages

	Hustrulid W A (2005) Blasting Principles for Open Pit Mining. Set of 2 Volumes, Volume 1: General Design Concepts Volume 2: Theoretical Foundations. Taylor & Francis. 1032p. Hustrulid W and Kuchta M and MartinR K (2013) Open Pit Mine Planning and Design. 3rd edition. (Two Volume Set & CD-ROM Pack)CRC Press. 1500p Kennedy B A (Editor) (1990): Surface Mining, 2nd Edition. Society for Mining, Metallurgy, and Exploration, Littleton, CO, USA. 1206 pages Rzhevsky V V (1985): Opencast Mining: Unit Operations. Mir Publishers, Moscow. 479p Rzhevsky V V (1987) Opencast Mining: Technology and Integrated Mechanization. Mir Publishers, Moscow. 495p

Course Code	MN3104N	Course Name	UNDERGROUND METALMINING	Course Category	PC/ PSE	L	T	P
						3	0	0

Pre-requisite Courses	Rock Mechanics Mine Surveying Mining Geology	Co-requisite Courses	Mining Machinery	ProgressiveCourses	Mine Planning and Design
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	CMR, MMR, DGMS Circulars

Course Objectives	Primary Objectives of the Course are: • To teach how to identify and classify various underground ore bodies and their geological settings. • To describe and differentiate between common underground mine development methods (shafts, declines, adits). • To teach how to analyse and select appropriate underground stoping methods. • To explain the principles of ground control and rock mass classification in underground environments. • To evaluate various materials handling systems used in underground mines. • To apply fundamental safety protocols and risk management strategies in underground metal mining.

Sl. No.	Module Name and topics	No. of Classes	Learning Outcome
1	**Driving /Crosscutting: –** Conventional -cycle of operation, equipment used and time cycle; Mechanised - cycle of operation, equipment used and time cycle.	04	Ability to: explain the purpose and process of driving and crosscutting in underground metalliferous mines.**;** differentiate between conventional and mechanised methods; identify and classify the equipment used; compare time cycles and productivity of different methods; and, assess selection criteria for method and equipment based on geological and operational parameters
2	**Raising: –** Conventional - cycle of operation, equipment used and time cycle; Mechanised - Long hole raising, raising by ALIMAK raise climber, raise boring	04	Ability to: describe the objectives and applications of raising in underground metalliferous mining; explain the cycle of operation, equipment used, and time cycle; describe mechanised raising techniques; compare conventional and mechanised raising methods; evaluate the selection criteria for different raising methods and equipment
3	**Winzing: –** Cycle of operation, equipment used and time cycle	01	Ability to: explain the concept and purpose of winzing in underground metalliferous mining; describe the conventional cycle of operation involved in winze development; identify and explain the use of equipment employed in winzing operations; illustrate the typical time cycle associated with winze sinking; assess the factors influencing method

Sl. No.	Module Name and topics	No. of Classes	Learning Outcome
			selection and productivity in winzing operations.
4	**Other Development Openings: –** Ore and waste bin; Ore pass; Shaft stations,	06	Ability to: explain the purpose and functional requirements of key underground infrastructure elements; describe the design considerations, construction methods, and typical layouts of ore and waste bins used in metalliferous mines; illustrate the structure and operational role of ore passes, and analyze factors affecting their location, design, and maintenance; discuss the design features and utility of shaft stations, including layout, equipment accommodation, and safety provisions; evaluate operational challenges and safety concerns associated with these development openings and propose mitigation strategies.
5	**Underhand and Overhand Methods of Breaking Ore: –** Underhand and overhand principle; Underhand and overhand stoping.	02	Ability to: explain the fundamental principles of underhand and overhand methods of ore breaking in underground metalliferous mines. differentiate between underhand and overhand stoping techniques in terms of their applicability, advantages, limitations, and safety considerations. describe the sequence of operations and layout of stopes in both underhand and overhand mining methods. evaluate the suitability of these methods based on ore body geometry, rock conditions, and mine layout. interpret real-life applications of these stoping methods through case studies or field examples.
6	**Breast Stoping: –** Application, method of stoping and equipment used	02	Ability to: describe the principle and application of breast stoping in underground metalliferous mining. explain the method of breast stoping, including layout, sequence of operations, and conditions suitable for its use. identify the equipment used in breast stoping and their functions. evaluate the advantages, limitations, and safety considerations of breast stoping relative to other stoping methods. assess the suitability of breast stoping for various ore body geometries and ground conditions.
7	**Selection of Stoping Methods**	01	Ability to: Identify key geological, geotechnical, and economic factors influencing the selection of stoping methods. Compare and contrast different stoping methods (e.g., overhand, underhand, breast, cut-and-fill, sublevel, shrinkage) based on ore body characteristics and mine conditions. Evaluate the suitability of stoping methods for different ore

Sl. No.	Module Name and topics	No. of Classes	Learning Outcome
			geometries, dip, thickness, rock mechanics, and ventilation requirements. Apply decision-making criteria to recommend the most appropriate stoping method for a given mining scenario. Understand the implications of stoping method selection on safety, productivity, recovery, and environmental impact.
8.	**Open Stoping Methods: –** Shrinkage stoping - application, development, stoping operations, ventilation, machinery used; Sublevel stoping -application, development, stoping operations, ventilation, machinery used. V.C.R. and blast hole stoping -application, development, stoping operations, ventilation, machinery used; Stope and Pillar stoping - application, development, stoping operations, ventilation, machinery used.	06	Ability to: Describe the principles, development sequences, and stoping operations. Identify the geological and geotechnical conditions. Compare the advantages, limitations, and equipment requirements. Evaluate ventilation strategies. Select an appropriate open stoping method.
9.	**Filled methods: –**Cut and fill stoping -application, development, stoping operations and machinery used; Variations of cut and fill - underhand cut and fill, overhand cut and fill and 'post and pillar'stoping; Mechanical, hydraulic and pneumatic filling of stopes; Square set stoping - application, development, stoping operations and machinery used.	06	Ability to: Explain the principles and applications of various filled stoping methods such as cut and fill stoping (overhand, underhand, post and pillar) and square set stoping. Describe the development and operational procedures involved in each of the filled methods. Identify and evaluate different stope filling techniques, including mechanical, hydraulic, and pneumatic systems, and their applicability. Assess the suitability of filled stoping methods based on ore body geometry, rock mechanics, and safety requirements. Select appropriate equipment and machinery used in filled stoping methods and justify their use for specific conditions. Appreciate the role of stope filling in ground control, environmental management, and resource recovery.
10.	**Caving Methods of Stoping: –** Application, development, stoping operations and machinery used inblock caving and sublevel caving methods of stoping	04	Ability to: Describe the principles and mechanisms of caving methods of stoping, specifically block caving and sublevel caving. Identify the geological and geotechnical conditions suitable for the application of caving methods. Explain the development procedures and layout requirements for block caving and sublevel caving operations. Discuss the sequence of stoping operations involved in each

Sl. No.	Module Name and topics	No. of Classes	Learning Outcome
			method and their impact on safety and production. Evaluate the advantages, limitations, and risks associated with caving methods in underground metalliferous mining. Select and describe the equipment and machinery used in development and stoping stages of block and sublevel caving.
11.	**Metal mine planning: –** Scheduling; Basic planning of different unit operations in a metal mine.	06	Ability to: Explain the fundamental principles and stages of the metal mine planning process, from conceptual design to detailed operational planning; Develop and analyze basic mine production schedules, considering factors like ore body geometry, production rate requirements, and equipment constraints; Propose a basic plan for each unit operation, including equipment selection, cycle times, and resource allocation; and, Identify and analyze the key geological, geotechnical, and economic factors that influence mine planning decisions.
TOTAL		**42**	

Course Outcome	After completing this course, the students will be able to: • **Distinguish** between various underground metal mining methods and **identify** their applicability based on geological, topographical, and economic factors. • **Explain** the principles and operational characteristics of different drilling, blasting, loading, and hauling equipment used in underground metal mines. • **Analyze** and **design** fundamental aspects of underground metal mine layouts. • **Evaluate** the environmental impacts of underground metal mining and **propose** appropriate mitigation and reclamation strategies. • **Apply** safety regulations and best practices relevant to underground metal mining operations to ensure a secure working environment. • **Discuss** emerging trends, automation, and sustainable practices in modern underground metal mining operations.

Learning Resources	Darling P (ed.) (2011): *SME Mining Engineering Handbook, Third Edition*. Two Volume Set. *Society for Mining*, Metallurgy, and Exploration Inc. Littleton, CO, USA.1984 pages Gertsch R. E. and Bullock R. L. 1998.*Techniques in Underground Mining: Selections from Underground Mining Methods Handbook*. Society for Mining, Metallurgy, and Exploration. 823 pages Hartman H. L. (Editor). 1992. *SME Mining Engineering Handbook; 2nd edition*. Volume-1 and volume2. Society for Mining, Metallurgy, and Exploration. 2394 pages Hustrulid W. A. and BullockR. A. (Eds). 2001. *Underground Mining Methods: Engineering Fundamentals and International Case Studies*. Society for Mining, Metallurgy, and ExplorationInc. Littleton, CO, USA.. 728 pages

	Hartman H.L. and Mutmansky J.M. 2002. *Introductory Mining Engineering*. John Wiley & Sons. 570p. Jeremic M.L. (2020) Ground Mechanics in Hard Rock Mining. CRC Press. 538 pages.

Course Code	MN3151N	Course Name	Mine Ventilation Lab	Course Category	PC	L	T	P
						0	0	3

Pre-requisite Courses	Fluid Mechanics	Co-requisite Courses	NoneMine Ventilation Engineering	Progressive Courses	Mine Planning and Mineral Economics Mine Legoslation and Safety
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	ISRM Suggested Methods, BIS

Course Objectives	The objective of this laboratory course is to provide hands-on experience with instruments and techniques used in mine ventilation systems, and to familiarize students with measurement, analysis, and interpretation of ventilation parameters critical to underground mine safety and efficiency.

LIST OF EXPERIMENTS:

Sl. No.	Title of Experiment	Class Hours
1	Demonstration of mine ventilation models and equipment	3
2	Measurement of air velocity using vane anemometer	3
3	Measurement of air velocity using pitot tube	3
4	Measurement of air quantity and calculation of air flow in ducts/tunnels	3
5	Determination of mine airway resistance using manometers	3
6	Study of pressure losses in ventilation fittings (bends, junctions, regulators)	3
7	Calibration and use of inclined and U-tube manometers	3
8	Measurement of relative humidity using sling psychrometer and hygrometer	3
9	Study and operation of auxiliary and booster fans	3
10	Simulation of natural and mechanical ventilation systems	3
11	Measurement of gas concentrations using gas detectors (methanometer, CO detector, etc.)	3
12	Study of ventilation network using computer-aided software (e.g., Ventsim or VentGraph)	3
13	Design of simple ventilation circuits and analysis of airflow distribution	3
14	Field visit report/presentation on mine ventilation practices (if applicable)	3
TOTAL		**42**

Course Outcomes	Upon successful completion of this course, students will be able to: • Identify and operate key mine ventilation instruments. • Measure and analyze airflow, pressure, gas concentrations, and environmental conditions in mine-like setups. • Understand the principles behind ventilation network analysis and mine air control systems.

	• Interpret and evaluate the results of ventilation measurements for safe mine planning and operations.

Learning Resources	Banerjee S P (2003): *Mine Ventilation*. Lovely Prakashan, Dhanbad. 457p Ganguli R and Bandopadhyay S (2004): *Mine Ventilation*. Taylor & Francis. 536p. Hartman H L, Mutmansky J M, Ramani R V and Wang Y J (1997): *Mine Ventilation and Air Conditionin*g (3rd edition). John Wiley and Sons. 730p Kaku L C (2002): Numerical Problems on Mine Ventilation – Coal and Metal. 186p McPherson M J (2009): *Subsurface Ventilation and Environmental engineering* (2nd edition).Chapman and Hall, 824p Misra G B (2001*): Problems on Mine Ventilation*. Geeta Book Stores, Dhanbad. 213p

Course Code	MN3152	Course Name	MINING MACHINERY LAB	Course Category	PC/ PSE	L	T	P
						0	0	3

Pre-requisite Courses	Engineering Mechanics Fluid Mechanics Heat Power and Machine Elements	Co-requisite Courses	Mining Machinery	Progressive Courses	None
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	None

Course Objectives	This laboratory course aims to provide hands-on exposure to various mining machinery and equipment used in underground and surface mining. It is intended to familiarize students with the operational principles, components, and functions of essential machinery and their maintenance.

LIST OF EXPERIMENTS / PRACTICAL EXERCISES

Exp. No.	Title of Experiment / Practical Exercise	Hours
1	Study of components and working of different types of wire ropes and their splicing	3
2	Study of various types of rope haulage systems and safety devices	3
3	Demonstration and working of winding engines and brake systems	3
4	Study of suspension gear and cages used in mine shaft hoisting	3
5	Study and demonstration of headgear and its components	3
6	Study and working of coal cutting machines (shearers, ploughs, etc.)	3
7	Study and demonstration of drilling machines used in underground and surface mining	3
8	Study of explosives charging equipment and initiation systems (simulated setup)	3
9	Demonstration and working of face transport equipment – conveyors and shuttle cars	3
10	Study of different types of pumps used in mines – centrifugal, reciprocating, submersible	3
12	Study of ventilation fans and dust suppression systems	3
13	Study of flameproof and intrinsically safe electrical equipment used in underground mines	3
14	Study of maintenance requirements and troubleshooting of mining machinery	3
15	Visit to mining machinery section of a mine or training institute and report submission	3
TOTAL		**42**

Course Outcome	Upon completion of this course, students will be able to: • Identify and explain the function and construction of key mining machinery. • Explain the working mechanisms and safety features of equipment used in mining operations. • Carry out basic operations, performance checks, and maintenance of mining machines.

	• Develop practical insight into mechanical systems relevant to mining.

Learning Resources	De A. 2014. Latest Development of Heavy Earth Moving Machinery. Galgotia Publications Pvt. Ltd. 312 p. Khurmi R. S and Gupta. J.K. 2005.A Text Book of Machine Design. Eurasia Publishing House 1251 p Martin J. W., Martine T.J., Bennett T.P., and Martin K.M. 1982. Surface Mining Equipment. Martin Consultants, Golden, CO. 455 p. Nichols H., Day D. and Herbert N. 2010. Moving The Earth: The Workbook of Excavation Sixth Edition / Edition 6. McGraw-Hill Professional Publishing. 1232p. Peurifoy R.L., Schexnayder C.J. and Shapira A. 2010.Construction Planning, Equipment and Methods. McGraw-Hill Education.800 p. Woodcock C.R. and Mason J.S. 2012. Bulk Solids Handling: An Introduction to the Practice and Technology. Springer Science and Business Media. 522 p.

Course Code	MN3153N	Course Name	DESIGN OF MINE LAYOUT	Course Category	PC	L	T	P
						0	0	3

Pre-requisite Courses	Elementary Mining Engineering	Co-requisite Courses	Underground Coal Mining	Progressive Courses	Mine Planning and Design
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	CMR, MMR, BIS Standards

Course Objectives	The principal objectives of the Course are: • To equip students with practical skills to design surface and underground mine layouts. • To integrate knowledge of mining methods, geological conditions, and safety considerations in layout design. • To familiarize students with drafting tools, AutoCAD, and mine planning software for layout preparation. • To encourage critical thinking and problem-solving through case studies and project work.

LIST OF EXPERIMENTS

Sl. No.	Topic/ Practical Exercise	Class Hours
1	**Introduction** to mine layout types and drafting standards; review of AutoCAD	3
2	**Topographic and Geological Map Interpretation** for mine layout planning	3
3	**Surface Mine Layout - I**: Bench design and pit slope configuration	3
4	**Surface Mine Layout - II**: Haul road design, dumping site planning	3
5	**Surface Mine Layout - III**: Mine infrastructure (office, workshop, stockyard) layout	3
6	**Underground Mine Layout - I**: Shaft, incline, and adit design	3
7	**Underground Mine Layout - II**: Level, crosscut, and raise design	3
8	**Underground Mine Layout - III**: Stope design based on mining method (e.g., cut-and-fill, sublevel stoping)	3
9	**Ventilation System Layout** – primary and secondary ventilation, air flow paths	3
10	**Drainage and Pumping Layouts** in underground mines	3
11	**Emergency and Refuge Layouts** – safety exits, refuge chambers, firefighting systems	3
12	**Project Work Begins** – Students choose a mine (real or hypothetical) to design complete layout	3
13	**Project Work Continued** – Integration of survey data, mine method, safety, and	3

Sl. No.	Topic/ Practical Exercise	Class Hours
	environmental components	
14	**Final Submission and Presentation** of project-based mine layout designs	3
	TOTAL	**42**

Course Outcomes	On successful completion of this course, students will be able to: • Design surface mine layouts including pit design, haul roads, and waste dumps. • Prepare underground mine layouts including shaft, levels, crosscuts, stopes, and ventilation systems. • Use AutoCAD and mine planning software for creating 2D/3D mine layout drawings. • Interpret and apply survey data and geological maps in layout design. • Develop project-based layouts considering productivity, safety, and environmental constraints.

Learning Resources	AutoCAD official tutorials and documentation Bhattacharya J.(2003): Principles of Mine Planning, 2nd Edition. Allied Publishers Pvt Ltd., New Delhi. 508 pages Darling P (ed.) (2011): SME Mining Engineering Handbook, Third Edition. Two Volume Set. *Society for Mining*, Metallurgy, and Exploration Inc. Littleton, CO, USA.1984 pages Hartman H. L. and Mutmansky J. M. 2002. *Introductory Mining Engineering*. John Wiley & Sons. 570 pages. HustrulidW. A.,Kuchta M. and Martin R. K. (2013): Open Pit Mine Planning and Design, Two Volume Set & CD-ROM Pack, Third Edition. CRC Press. 1500 pages Indian Bureau of Mines – Technical Reports and Mining Plan Guidelines Mathur S. P. (1993): Mine Planning for Coal. M.G. Consultants, Bilaspur. 295 pages Peng S. S. 2006. *Longwall Mining*. Second edition. Published by Syd S. Peng. 636p. Singh J. G. 2000. *Underground Coal Mining Methods*. Braj-Kalpa Publishers. Varanasi, India. 538 pages.

Course Code	MN3171N	Course Name	TRAINING EVALUATION	Course Category	PC/ PSE	L	T	P
						0	0	0

Pre-requisite Courses	Mining Methods	Co-requisite Courses	Mine Ventilation Engineering	Progressive Courses	None
Course Offering Department		**MINING ENGINEERING**		Data Book/ Codes/ Standards	None

Course Objectives	The objectives of the Course are: • To evaluate the professional exposure gained by students during their industrial training or internship. • To develop students' ability to articulate technical knowledge, practical insights, and industry practices in the form of structured reports and presentations. • To assess students' understanding of real-world mining operations, workplace safety, organizational structure, and engineering applications.

Course Components:

1. **Industrial Training/Internship:**
   - Minimum duration: 4 to 6 weeks
   - Location: Mines, mining equipment companies, research organizations, or relevant industry
2. **Training Report Submission:**
   - Hard copy of a detailed training report
   - Report must include: company profile, training objectives, technical activities undertaken, field observations, process/machinery details, safety practices observed, conclusions, and references
   - Format: As prescribed by the department (cover page, acknowledgements, certificate from host organization, structured content, images/diagrams if needed)
3. **Oral Presentation / Viva Voce:**
   - Individual presentation before a departmental evaluation committee
   - Duration: 10–15 minutes followed by Q&A
   - Assessment of clarity, depth, and articulation of training experience

Course Deliverables:

- Duly signed and certified hard copy of the **training report**
- **Presentation slides** for evaluation
- **Participation in viva voce** conducted by a departmental committee

Additional Notes:

- Training reports must be submitted by the **third week** of the semester.
- Plagiarism in the report will lead to disqualification or re-submission.
- Students must ensure they maintain a **daily log or diary** during their internship for accurate report preparation

Course Outcomes	At the end of this sessional course, students will be able to: • Document and communicate their industrial training experience professionally.

	• Demonstrate understanding of mining operations and work culture. • Relate academic knowledge to industry practices. • Improve technical writing and oral presentation skills. • Develop critical thinking through observation and reporting.

Learning Resources	1. *Report* Writing *and Communication Skills* • Myneni, S.R. – *English for Engineers*, Pearson Education. 2. Technical Writing Guides • Departmental Training Report Guidelines and Templates • IEEE/ASME style guides (for referencing and formatting) 3. Oral Presentation and Viva Skills • Duarte, Nancy – *Slide: ology – The Art and Science of Creating Great Presentations*, O'Reilly. • Toastmasters International – Public speaking tips and structured speech delivery techniques. 4. Technical and Industry References

VI-SEMESTER COURSES SYLLABI

Course Code	MN3201N	Course Name	ROCK ENGINEERING	Course Category	PC/ PSE	L	T	P
						3	0	0

Pre-requisite Courses	Rock Mechanics Mining Geology	Co-requisite Courses	None	Progressive Courses	Mine Planning and Design
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	CMR, MMR, DGMS Circulars

Course Objectives	P**rimary objectives the course is to:** • Understand the mechanical behavior of rock masses. • Apply fundamental concepts of rock mechanics to the design and analysis of underground and surface structures. • Analyze and design stable slopes and underground openings in various rock conditions. • Evaluate the effects of discontinuities, stress, groundwater, and excavation methods on rock stability.

COURSE CONTENT

Module	Modules/ Topics	Class Hours	Learning Outcome
1	**DESIGN OF STRUCTURES IN ROCKS: —** Review of Rock Mechanics and Rock Engineering**, —** Rock Properties - Intact vs Rock Mass, – Laboratory and field testing methods, – Rock mass classification systems (RMR, Q-system, GSI), – In-situ Stress and Measurement Techniques, – Strength and Deformability of Rock Masses, – Empirical, Analytical, and Numerical Design Methods, – Excavation Design: Caverns, Shafts, Foundations, - Stress redistribution around openings, - Rock support systems (bolts, shotcrete, etc.), – Case studies of rock structure failures and successful designs	15	Ability to: differentiate between intact rock properties and rock mass properties and explain the significance of this distinction in engineering design; explain the role of in-situ stress in the design of underground and surface excavations; describe the principles behind various laboratory and field testing methods used to determine rock and rock mass properties; utilize common rock mass classification systems (e.g., RMR, Q-system, GSI) to characterize a rock mass for a given engineering project; interpret the results from these classification systems to make preliminary recommendations for rock support; apply empirical, analytical, and numerical design methods to propose safe and stable designs for underground structures such as caverns and shafts, as well as surface structures like foundations; select appropriate rock support systems (e.g., rock bolts, shotcrete, cable bolts) based on the rock mass conditions and the purpose of the excavation.
2	**SUBSURFACE ROCK ENGINEERING AND**	12	Ability to: understand and explain the principles of tunnelling in rock and compare excavation techniques such as drill & blast and tunnel boring

Module	Modules/ Topics	Class Hours	Learning Outcome
	TUNNELLING: — Principles of Tunnelling in Rock — Drill and blast vs TBM methods; Excavation-induced stress redistribution; Tunnel Design Approaches – Empirical (Q-system), Analytical, and FEM-based methods; Tunnel Support and Lining Design – NATM principles; Groundwater Effects and Drainage in Rock Tunnels; Instrumentation and Monitoring in Tunnelling; Stability Analysis and Control Measures		machines (tbm); analyze the effects of excavation-induced stress redistribution on tunnel stability; apply tunnel design approaches using empirical methods (e.g., q-system), analytical techniques, and numerical modeling (e.g., fem); design appropriate tunnel support systems and linings based on natm (new austrian tunnelling method) principles; assess the impact of groundwater on tunnel stability and propose suitable drainage and waterproofing measures; select and implement instrumentation and monitoring techniques to evaluate tunnel behavior and support performance during and after excavation; conduct stability analysis and recommend control measures for safe and efficient tunnelling in rock masses.
3	**ROCK SLOPE ENGINEERING:** — Introduction to Rock Slopes – Geological discontinuities and slope types; Modes of Rock Slope Failure – Planar, wedge, toppling, and circular failures; Stability Analysis Techniques – Limit equilibrium, stereographic projection; Rock Slope Reinforcement and Protection – Bolts, anchors, mesh, drainage; Remote sensing and monitoring of slope movement; Case Studies - Natural and man-made slope failures.	15	Ability to: Describe the types and characteristics of rock slopes and geological discontinuities influencing slope behavior; Identify and differentiate between various modes of rock slope failure, including planar, wedge, toppling, and circular failures; Apply appropriate stability analysis techniques such as limit equilibrium methods and stereographic projection to evaluate rock slope stability; Design and recommend slope reinforcement and protection measures, including the use of rock bolts, anchors, wire mesh, and drainage systems; Utilize remote sensing techniques and monitoring tools to assess and track slope movement and potential failure zones; Analyze real-world case studies of natural and man-made slope failures to understand causes, consequences, and mitigation strategies.
TOTAL		**42**	

Course Outcomes	After completing this course, the students will be able to: • Characterize rock mass and apply classification systems. • Design small to medium-sized surface and underground structures in rock. • Understand tunnel design and construction methods in various rock types. • Analyse the interaction between excavation and support systems. • Assess slope stability and design mitigation strategies. • Use stereonet and other graphical methods for failure analysis.

Learning Resources	Brady B.H.G. and Brown E.T. Rock Mechanics for Underground Mining Hudson J.A. and Harrison J.P. Engineering Rock Mechanics- An Introduction to Principles.

Hustrulid W. A., McCarter M. K., and Van Zyl D. J. A. Slope Stability in SurfaceMining. Society for Mining, Metallurgy, and Exploration, USA. 442 P.

Kliche C.A. 1999. Rock Slope Stability, Society for Mining, Metallurgy, and Exploration,USA. 253 p.

Palmstrom A. andStille H. 2015. Rock engineering, 2nd edition. ICE Publishing, 444 pages.

Pariseau W. G. 2011. Design Analysis in Rock Mechanics, Second Edition. CRC Press. 698 pages

Read J. and Stacey P. 2010. Guidelines for Open Pit Slope Design. CRC Press. 496 P.

Wood A. M. 2000. Tunnelling: Management by Design. CRC Press. 328 pages

Wyllie D.C. and Mah C.W 2005. Rock Slope Engineering, 4111 Edition, CRC Press. 456

Course Code	MN3202N	Course Name	ENVIRONMENTAL ENGINEERING FOR MINES	Course Category	PC/ PSE	L	T	P
						3	0	0

Pre-requisite Courses	Rock Mechanics Mining Geology	Co-requisite Courses	None	Progressive Courses	Mine Planning and Design
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	CMR, MMR, DGMS Circulars

Course Objectives	**Main objectives the course is:** • To impart knowledge of environmental issues associated with mining operations. • To understand the regulatory framework and environmental clearance process. • To introduce pollution control technologies and sustainable mining practices. • To promote environmental monitoring and management strategies in mines.

COURSE CONTENT

Sl. No.	Module Name and Topics	Class Hours	Learning Outcome
1	**Environment and Sustainable Development**: – Recent charges in development paradigm; Concepts of Sustainable development; Carrying capacity-based development planning	04	Ability to: Explain the recent changes in the development paradigm with emphasis on environmental considerations in mining and allied sectors; Define and interpret the concept of sustainable development and its relevance to the mining industry; Evaluate the principles of carrying capacity-based development planning and apply them to environmental planning and impact assessment in mining projects; Analyze the interrelationship between mining activities, environmental protection, and long-term sustainability goals.
2	**Environmental Impacts of Mining**: – Environment problems caused by mining - influencing factors	04	Ability to: Identify and describe the major environmental problems caused by different mining activities; Explain the influencing factors that determine the magnitude and nature of environmental impacts in mining projects; Analyze cause–effect relationships between mining operations and environmental degradation; Assess potential environmental risks associated with various stages of mining and propose preliminary mitigation approaches.
3	**Air Pollution**: – Air pollution in mining areas, nature of pollutants size, visibility and health effect; Emission factor and prediction type	06	Ability to: Identify and classify major air pollutants in mining areas, including their physical characteristics, visibility effects, and health implications; Explain and apply emission factor

	equation for estimation of dust load from point and nonpoint sources; Sampling and dispersion of air pollutants, atmospheric conditions, acid rain; Air pollution control measures in surface mines.		concepts and use prediction-type equations to estimate dust load from both point and non-point sources in mining environments; Describe techniques for sampling and dispersion analysis of air pollutants, and interpret the influence of atmospheric conditions on pollutant behavior; Discuss the causes and consequences of acid rain in relation to mining activities; Evaluate and recommend appropriate air pollution control measures suitable for surface mining operations.
4	**Noise and Blast Vibrations: –** Sources, propagation, monitoring and control; Blast vibrations including air blasts. Fly rocks from blasting	04	Ability to: Identify and explain the sources and propagation characteristics of noise and blast vibrations in mining environments; Differentiate between ground vibrations, air blasts, and fly rocks resulting from blasting operations; Apply appropriate methods for monitoring noise and blast-induced vibrations in surface and underground mines; Evaluate and recommend control measures to mitigate noise pollution and blast-induced hazards, ensuring environmental and operational safety.
5	**Water Pollution: –** Aquatic eco-system, classification of natural waters, toxicity of pollutants, pollutant groups; Causes of water pollution due to mining, - acid mine/rock drainage, heavy metal pollution, eutrophication, deoxygenation; Monitoring and control of water pollution, ground water monitoring, discharges of mine effluents	07	Ability to: Describe the structure and functioning of aquatic ecosystems and classify natural water bodies based on their characteristics; Explain the toxicity and environmental impact of various groups of water pollutants, particularly those associated with mining activities;; Analyze the causes and consequences of mining-induced water pollution, including acid mine/rock drainage, heavy metal contamination, eutrophication, and deoxygenation; Apply appropriate methods for monitoring surface and groundwater quality in and around mining areas; Recommend and evaluate control measures for preventing and managing water pollution from mine effluents and discharges.
6	**Mine Wastes and Disposal: –** Generation, Classification, Characteristics, Sulphide oxidation and control, Acid base accounting, O.B. dumps and amenity banks, tailings managements	05	Ability to: Describe the generation, classification, and characteristics of different types of mine wastes, including overburden and tailings; Explain the processes and environmental implications of sulphide oxidation in mine wastes and methods for its control; Apply acid-base accounting techniques to assess the acid-generating potential of mine waste materials; Evaluate design and environmental aspects of overburden dumps and amenity banks; and, Assess tailings management practices with respect to environmental safety, stability, and long-term sustainability.
7	**Land Reclamation: –** Land	05	Ability to: Explain the procedures and objectives of

	reclamation procedure, land use categories pre-mining investigations; Influence of type of deposit, topography and equipment; Top soil removal and storage, characteristics application of mulches; Stabilising agents and fertilizers; Technical and biological reclamation. Afforestation of mined areas, tailing Ponds O.B. dumps and amenity banks; Case examples of mined land reclamation		land reclamation in post-mining landscapes, including classification of land use categories; Conduct pre-mining investigations and assess the influence of deposit type, topography, and mining equipment on reclamation planning; Describe methods for topsoil removal, storage, and reuse, and evaluate the role of mulches, stabilizing agents, and fertilizers in land rehabilitation; Differentiate between technical and biological reclamation techniques and their application in different mine-related environments such as tailing ponds, OB dumps, and amenity banks; Design and propose afforestation plans suitable for reclaimed mined land; and, Analyze and draw lessons from case studies of successful mined land reclamation projects.
8	**Environmental Policies and Laws:** – Important national policies and relevant legislations pertaining to environment	03	Ability to: Identify and describe the key national environmental policies relevant to the mining sector; Interpret the objectives and provisions of major environmental legislations applicable to mining and allied industries; Evaluate the role and impact of environmental laws in regulating mining operations and promoting sustainable practices; Apply relevant legal and policy frameworks in the planning and management of environmentally responsible mining projects.
9	**Environmental Impact Assessment** and **Environmental Management planning**	04	Ability to: Explain the purpose, principles, and procedures of Environmental Impact Assessment (EIA) in the context of mining projects; Identify and assess potential environmental impacts of mining operations using standard EIA methodologies; Develop components of an Environmental Management Plan (EMP), including mitigation measures, monitoring strategies, and compliance mechanisms; Evaluate the effectiveness of EIA and EMP in promoting environmentally sustainable mining practices.
TOTAL		**42**	

Course Outcomes	At the end of the course, students will be able to: • Identify and analyze environmental impacts of mining operations. • Understand the legal and regulatory requirements related to mining and the environment. • Design basic pollution control systems for air, water, and land in mining areas. • Develop environmental management plans (EMP) and sustainable practices for mines.

Learning Resources	Bell F. G. and Donnelly L. J. 2006. *Mining and its Impact on the Environment*. Taylor & Francis. 547p. Canter L. W. 1996. *Environmental Impact Assessment*. McGraw-Hill. 660 p. Chaudhuri A. B.. 1992. *Mine Environment and Management*: *An Indian Scenario*. APH Publishing. 252 p. Down C. G. and Stocks J. 1977. *Environmental Impact of Mining*. Applied Science Publishers Ltd. 371 p. Eggert R. G. 2013.*Mining and the Environment*: *International Perspectives on Public Policy*. Routledge. 180 p. Lottermoser B. G. 2003. *Mine Wastes*: *Characterization, Treatment, and Environmental Impacts*. Springer.277 p. Marcus J. J. 1997. *Mining Environmental Handbook*: *Effects of Mining on the Environment and American Environmental Controls on Mining*. Imperial College Press. 785 p. Rajaram R. Dutta S. and Parameswaran K. 2005. *Sustainable Mining Practices: A Global Perspective*. Taylor & Francis. 376 p.

Course Code	MN3203N	Course Name	MINE PLANNING AND MINERAL ECONOMICS	Course Category	PC/ PSE	L	T	P
						3	0	0

Pre-requisite Courses	Elementary Mining Engineering, Rock Mechanics, Underground/Surface Mining Methods	Co-requisite Courses	Finance Economics and Management for Engineers	Progressive Courses	None
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	CMR, MMR, DGMS & IBM Circulars

Course Objectives	**Main objectives of the course are to enable the students to:** • Understand the stages of mine planning from exploration to closure. • Apply geostatistical techniques for ore reserve estimation. • Design and optimize mine layouts for both surface and underground operations. • Develop production schedules to maximize resource utilization and profitability. • Select appropriate mining equipment based on technical and economic criteria. • Estimate capital and operating costs for mining projects. • Conduct financial analyses to evaluate the economic viability of mining ventures. • Assess and manage risks associated with mining projects. • Appreciate the importance of sustainable development and environmental considerations in mine planning.

Sl. No	Module Name/ Topics	Class hours	Learning Outcome
1	**Introduction to Mine Planning:** — Overview of the mine planning process: from exploration to closure; — The role of the mine planner; — Types of mining projects and planning considerations; — Sustainability and social responsibility in mine planning.	4	Ability to: Describe the stages of the mine planning process, from exploration to mine closure; Explain the role and responsibilities of a mine planner in developing economically viable and technically sound mining projects; Differentiate between various types of mining projects and identify key planning considerations for each; and, Evaluate the importance of sustainability and social responsibility in modern mine planning practices.
2	**Mineral Economics Fundamentals: —** Time value of money; — Cost estimation: Capital costs, operating costs; — Revenue estimation: Metal prices, concentrate sales; — Cash flow analysis; — Profitability indicators: NPV, IRR, Payback Period	6	Ability to: Explain the concept of the time value of money and its significance in mineral project evaluation; Estimate capital and operating costs associated with mining projects using standard cost estimation techniques; Determine potential revenues based on metal prices and concentrate sales assumptions; Prepare cash flow statements for mining projects incorporating cost and revenue data; Apply key profitability indicators such as Net Present Value (NPV), Internal Rate of

Sl. No	Module Name/ Topics	Class hours	Learning Outcome
			Return (IRR), and Payback Period to assess the financial viability of mining ventures.
3	**Financial Analysis of Mining Projects:** — Discounted cash flow analysis; — Sensitivity analysis; — Break-even analysis; — Project financing and investment decisions; — Case studies of mining project evaluations	**6**	Ability to: Perform discounted cash flow (DCF) analysis to evaluate the financial feasibility of mining projects; Conduct sensitivity analysis to assess the impact of key variables (e.g., metal prices, costs, recovery) on project outcomes; Apply break-even analysis to determine the minimum production or pricing levels required for project viability; Explain various project financing options and investment decision-making approaches relevant to the mining industry; Analyze real-world case studies to evaluate financial strategies and decision-making processes in mining project development.
4	**Ore Reserve Estimation:** — Geological data collection and interpretation; — Sampling methods and quality control; — Geostatistical techniques – Variography, kriging, simulation; — Resource and reserve classification (JORC, NI 43-101); —Introduction to mine planning software for resource modelling	**6**	Ability to: Collect and interpret geological data relevant to mineral resource estimation; Apply appropriate sampling methods and implement quality control procedures to ensure data reliability; Use basic geostatistical techniques such as variography, kriging, and simulation for spatial estimation of mineral resources; Classify mineral resources and ore reserves in accordance with international reporting codes like JORC and UNFC; and, Demonstrate introductory-level proficiency in mine planning software for geological modeling and resource estimation.
5	**Surface Mine Planning:** — Pit design principles – Ultimate pit limits, pushbacks, ramp design; — Production scheduling for open pit mines; — Equipment selection for surface mining operations (trucks, shovels, etc.); — Waste management and stockpile design	**6**	Ability to: Apply pit design principles including determination of ultimate pit limits, pushback strategy, and ramp design for surface mines; Develop production schedules for open-pit mining operations based on resource availability and operational constraints; Select appropriate mining equipment (e.g., trucks, shovels) based on production requirements, material characteristics, and economic considerations; Design waste dumps and ore stockpiles with attention to environmental compliance and operational efficiency.
6	**Underground Mine Planning:** — Selection of underground mining methods based on orebody geometry; — Stope design and layout; — Development planning: Access, ventilation, infrastructure; — Production scheduling for underground mines; — Equipment selection for underground operations (LHDs, trucks, etc.)	**6**	Ability to: Select appropriate underground mining methods based on orebody geometry, depth, and geotechnical considerations; Design stope layouts considering safety, recovery, and economic factors; Plan mine development requirements, including access routes, ventilation systems, and supporting infrastructure; Prepare production schedules for underground mining operations; Select suitable underground mining equipment such as LHDs, trucks, and drills in alignment with method and production targets.
8	**Mine Closure and Reclamation:** — Environmental and social considerations in mine closure; —	**4**	Ability to: Explain the environmental and social considerations associated with mine closure and post-mining land use; Develop reclamation plans using

Sl. No	Module Name/ Topics	Class hours	Learning Outcome
	Reclamation planning and techniques; — Long-term monitoring and management; — Sustainable mine closure practices		appropriate techniques for land restoration and ecosystem rehabilitation; Design long-term monitoring and management strategies to ensure the stability and sustainability of closed mine sites; and, Evaluate sustainable mine closure practices in line with regulatory requirements and community expectations.
7	**Risk Assessment and Management in Mining: —** Types of risks in mining projects (technical, economic, political, environmental); — Risk assessment methodologies; — Risk mitigation strategies; — Decision-making under uncertainty.	**4**	Ability to: Identify and classify the various types of risks associated with mining projects, including technical, economic, political, and environmental risks; Apply risk assessment methodologies to evaluate the likelihood and impact of potential risks in mine planning and operations; Develop appropriate risk mitigation strategies to reduce or manage identified risks in mining projects; and, Make informed decisions under conditions of uncertainty, considering risk-benefit trade-offs and project objectives.
TOTAL		**42**	

Course Outcomes	At the end of the course, students will be able to demonstrate their learning through: • Problem-solving exercises related to ore reserve estimation and financial analysis. • Case study analysis of real-world mining projects. • Mine design projects, potentially utilizing mine planning software. • Presentations and discussions on economic and risk assessment topics. • Ability to critically evaluate the economic feasibility of mining projects.

Learning Resources	Bhattacharya J.(2003): *Principles of Mine Planning*, 2nd Edition. Allied Publishers Pvt Ltd., New Delhi. 508 pages Darling P (ed.) (2011): *SME Mining Engineering Handbook*, Third Edition. Two Volume Set. Society for Mining, Metallurgy, and Exploration Inc. Littleton, CO, USA.1984 pages HustrulidW. A.,Kuchta M. and Martin R. K. (2013): *Open Pit Mine Planning and Design*, Two Volume Set & CD-ROM Pack, Third Edition. CRC Press. 1500 pages Martin W. E. 1994. *Environmental Economics and the Mining Industry*, Volume 4 of studies in risk and uncertainty. Kluwer Academic Publishers, 1994. 130 pages Mathur S. P. (1993): *Mine Planning for Coal*. M.G. Consultants, Bilaspur. 295 pages Ray S C , and Sinha I N. (2016): *Mine and Mineral Economics*. PHI Learning Private Limited. 264 pages Runge I. C. 1998. *Mining Economics and Strategy*.Society for Mining, Metallurgy, and ExplorationInc. Littleton, CO, USA. 316 pages. Stermole J. M. and Stermole F. J. 2012.*Economic Evaluations and Investment Decision Methods*. 13th Edition. Investment Evaluations Corporation, Golden, Colorado. Torries T. F. 1998. *Evaluating Mineral Projects: Applications and Misconceptions*. Society for Mining, Metallurgy, and Exploration Inc. Littleton, CO, USA. 172 pages.

Course Code	MN3251N	Course Name	Rock Design Practical	Course Category	PC/ PSE	L	T	P
						0	0	3

Pre-requisite Courses	Rock Mechanics	Co-requisite Courses	Rock Engineering	Progressive Courses	None
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	None

Course Objectives	The objectives of the Course are: • To provide hands-on experience in the advanced testing of rocks under various engineering conditions. • To familiarize students with the characterization and design aspects related to rock mass and rock structures. • To develop an understanding of in situ stress measurement, rock mass classification, and support system evaluation.

LIST OF EXPERIMENTS:

Sl. No.	Experiment Title	Contact Hours
1	Determination of In Situ Stresses using Over-coring/Flat Jack/Photo-elastic Methods (Demonstration or Simulation)	3
2	Determination of Modulus Ratio and Poisson's Ratio of Rocks (using uniaxial and triaxial test data)	3
3	Slake Durability Test – Durability assessment of weak rocks	3
4	Brazilian Test – Tensile strength of rock samples	3
5	Point Load Strength Index Test – Index testing and conversion to UCS	3
6	Triaxial Compression Test on Rock Specimens (Demonstration or Lab Setup)	3
7	Swelling Pressure Test on Expansive Rock/Soil	3
8	Rock Mass Classification using RMR and Q-system	3
9	Determination of Joint Roughness Coefficient (JRC) and Joint Wall Compressive Strength (JCS)	3
10	Estimation of Rock Bolt Load Bearing Capacity using Pull-Out Test	3
11	Load-Deformation Behaviour of Rock Joints – Direct Shear Test	3
12	Laboratory Demonstration of Ground Penetrating Radar or Borehole Logging Techniques (if available)	3
13	Model Study on Roof Fall and Support Interaction (with scaled physical models or simulation software)	3
14	Design of Support System for Underground Excavations (Lab-based case study)	3

Sl. No.	Experiment Title	Contact Hours
TOTAL		**42**

Course Outcomes	At the end of the course, the student will be able to: • Conduct advanced laboratory experiments to evaluate the strength and deformability of rock materials and rock masses. • Assess and classify rock masses for engineering purposes using empirical systems. • Interpret results for practical applications in underground and surface excavation design. • Understand instrumentation techniques used in rock engineering practice.

Learning Resources	ASTM/IS Codes for Rock Testing Brady B. H. G. 2012. Rock Mechanics for Underground Mining. Springer Science & Business Media. 528 p Department Lab Manual (provided during the course) Hudson, J.A. and Harrison, J.P. 2000. Engineering Rock Mechanics - An Introduction to the Principles. Elsevier. 456 p ISRM Suggested Methods for Rock Characterization Read J. and Stacey P. 2009. Guidelines for Open Pit Slope Design. CSIRO Publishing, Collingwood, Victoria, Australia. 512p

Course Code	MN3252N	Course Name	ENVIRONMENTAL ENGINEERING FOR MINES LAB	Course Category	PC/ PSE	L	T	P
						0	0	3

Pre-requisite Courses	Energy Environment and Climate Change Fluid Mechanics	Co-requisite Courses	Environmental Engineering for Mines	Progressive Courses	None
Course Offering Department		**MINING ENGINEERING**		Data Book/ Codes/ Standards	None

Course Objectives	The objectives of the Course are: to: • Provide practical knowledge and technical skills in monitoring environmental parameters in mining regions. • Train students in sampling, laboratory analysis, and interpretation of air, water, soil, and noise pollution data. • Introduce environmental control and mitigation techniques applicable to mining activities. • Promote awareness of regulatory standards and sustainable environmental practices in the mining industry.

LIST OF EXPERIMENTS

Sl. No.	Module Name/ Topics	Contact Hours
1	Sampling and analysis of Suspended Particulate Matter (SPM), PM10, and PM2.5 using High Volume Sampler	3
2	Estimation of gaseous pollutants: SO_2 and NOx using gas sampling and analysis kits	3
3	Measurement of respirable dust levels using personal dust samplers.	3
4	Measurement of ambient and occupational noise levels using a Sound Level Meter.	3
5	Noise mapping of a mining site and analysis against CPCB standards.	3
6	Sampling of mine water, surface water, and groundwater.	3
7	Physical and chemical parameter analysis: pH, turbidity, TDS, hardness, chloride, sulphate.	3
8	Biological parameters: Determination of Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), and Chemical Oxygen Demand (COD).	3
9	Heavy metal detection in mine water: Fe, Mn, As (using spectrophotometry or test kits).	3
10	Determination of pH, moisture content, and organic matter in mine soil samples.	3
11	Analysis of heavy metal contamination in soil.	3
12	Leachability test (TCLP) for overburden and tailings.	3
13	Laboratory simulation of Acid Mine Drainage (AMD) generation and neutralization.	3
14	Demonstration of simple filtration and adsorption techniques for water treatment.	3
TOTAL		**42**

Course Outcomes	At the end of this practical course, students will be able to: • Carry out air, water, soil, and noise quality assessments in and around mining areas. • Use and calibrate modern environmental monitoring equipment effectively. • Analyze environmental samples and interpret data in compliance with regulatory standards. • Demonstrate understanding of environmental impact and pollution control measures in mining. • Prepare technical reports and documentation related to environmental monitoring and management.

Learning Resources	Lottermoser *B. G. 2003*. *Mine Wastes: Characterization, Treatment, and Environmental Impacts. Springer.277 p*. Mahajan, S.P. 1985. *Pollution Control in Process Industries*, Tata McGraw-Hill. 273p. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G. – *Environmental Engineering*, McGraw-Hill. 736p Relevant CPCB, SPCB, and MoEFCC Guidelines for air, water, and noise quality standards. Laboratory manuals and user guides for environmental monitoring instruments.

Course Code	MN3253N	Course Name	MINE PLANNING LAB	Course Category	PC/ PSE	L	T	P
						0	0	3

Pre-requisite Courses	Mining Methods Mine Ventilation	Co-requisite Courses	Finance Economics and Management for Engineers	Progressive Courses	None
Course Offering Department		**MINING ENGINEERING**		Data Book/ Codes/ Standards	None

Course Objectives	The objectives of the Course are: to: • Develop practical skills in mine planning, design, and scheduling. • Familiarize students with tools and software used in mine planning. • Integrate geological, geotechnical, and economic data for developing mine plans. • Reinforce theoretical knowledge through laboratory-based applications.

LIST OF EXPERIMENTS/ EXERCISES

Sl. No	Topic	Contact Hours
1	**Geological and Survey Data Interpretation:** Preparation and interpretation of geological cross-sections and plans, Estimation of ore reserves using various methods (e.g., cross-section, block model, polygonal) & Drawing and interpretation of borehole data and longitudinal sections.	9
2	**Surface Mine Planning:** Design of open-pit layouts with different pit geometries; Calculation of stripping ratio and pit optimization (manual and software-aided) & Preparation of open-pit production scheduling.	9
3	**Underground Mine Planning:** Development of mine layout for various underground methods (e.g., room and pillar, longwall), Design of shaft, incline, and crosscut development layouts & Scheduling of development and stoping operations.	9
4	**Mine Planning Software (Demonstration and Hands-on):** Introduction to basic functions of mine planning software (e.g., Surpac, Datamine, Minex, or equivalent), Block model creation and reserve estimation using software & Pit design and scheduling using software (basic level demonstration/hands-on).	9
5	**Economic Evaluation and Scheduling:** Cut-off grade calculation and break-even analysis & Preparation of project cash flow and NPV/IRR estimation (basic economic modelling in Excel or software).	6
TOTAL		**42**

Course Outcome	At the end of this practical course, students will be able to: • Interpret geological and geotechnical data for mine planning. • Prepare and evaluate open-pit and underground mine layouts. • Perform basic design of mine development and production scheduling. • Use mine planning software and tools for layout, scheduling, and optimization.

	• Demonstrate understanding of reserve estimation, cutoff grade calculation, and mine economics.

Learning Resources	Bhattacharya J.(2003): *Principles of Mine Planning*, 2nd Edition. Allied Publishers Pvt Ltd., New Delhi. 508 pages Darling P (ed.) (2011): *SME Mining Engineering Handbook*, Third Edition. Two Volume Set. Society for Mining, Metallurgy, and Exploration Inc. Littleton, CO, USA.1984 pages HustrulidW. A.,Kuchta M. and Martin R. K. (2013): *Open Pit Mine Planning and Design*, Two Volume Set & CD-ROM Pack, Third Edition. CRC Press. 1500 pages Martin W. E. 1994. *Environmental Economics and the Mining Industry*, Volume 4 of studies in risk and uncertainty. Kluwer Academic Publishers, 1994. 130 pages Mathur S. P. (1993): *Mine Planning for Coal*. M.G. Consultants, Bilaspur. 295 pages Ray S C , and Sinha I N. (2016): *Mine and Mineral Economics*. PHI Learning Private Limited. 264 pages Runge I. C. 1998. *Mining Economics and Strategy*.Society for Mining, Metallurgy, and ExplorationInc. Littleton, CO, USA. 316 pages. Stermole J. M. and Stermole F. J. 2012.*Economic Evaluations and Investment Decision Methods*. 13th Edition. Investment Evaluations Corporation, Golden, Colorado. Torries T. F. 1998. *Evaluating Mineral Projects: Applications and Misconceptions*. Society for Mining, Metallurgy, and Exploration Inc. Littleton, CO, USA. 172 pages.

VII-SEMESTER COURSES SYLLABI

Course Code	MN4101N	Course Name	COAL AND MINERAL BENEFICIATION	Course Category	PC/ PSE	L	T	P
						3	0	0

Pre-requisite Courses	Chemistry, Physics, Fluid Mechanics, Mine Economics	Co-requisite Courses	None	Progressive Courses	None
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	BIS methods

Course Objectives	**Main objectives of the course are to enable the students to:** • Understand the basic principles of mineral liberation and separation. • Identify and characterize different types of ores and coals relevant to beneficiation processes. • Explain the mechanisms and applications of various comminution equipment. • Design and evaluate sizing operations using screens and classifiers. • Describe the principles and applications of gravity separation, froth flotation, magnetic, and electrostatic separation techniques. • Analyze dewatering processes and equipment. • Appreciate the importance of process flowsheets and mass balance calculations in plant design. • Recognize the environmental impacts and sustainable practices in mineral beneficiation. • Understand the specific challenges and processes involved in coal preparation.

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Sl. No.	Module Name and topics	No. of Classes	Learning Outcome
1	**Comminution: —** Principles of comminution, Comminution theory, work index	02	Ability to: Explain the principles and objectives of comminution in coal and mineral beneficiation processes; Apply comminution theories to analyze size reduction performance; and, Calculate the work index and estimate energy requirements for different comminution operations.
2	**Crushers: —** Basic crushing plant flowsheet, open/closed circuit crushing, Types of crusher, Primary crushers, Secondary crushers	04	Ability to: Describe the basic crushing plant flowsheet and differentiate between open and closed circuit crushing systems; Classify various types of crushers used in mineral processing, including their design and operational principles; Differentiate between primary and secondary crushers based on function, feed size, and reduction ratio; and, Select suitable crushing equipment for specific applications in coal and mineral

			beneficiation.
3	**Grinding mills: —** Motion of charge in a tumbling mill, tumbling mills, grinding circuits	03	Ability to: Explain the motion of charge in tumbling mills and its effect on grinding efficiency and energy consumption; escribe the types and working principles of tumbling mills used in coal and mineral beneficiation; Differentiate between various grinding circuits (e.g., open and closed circuits) and assess their suitability for specific beneficiation objectives.
4	**Particle size analysis and Industrial screening: —** Sieve analysis, mesh size, Performance of screens, Industrial screen types	03	Ability to: Perform particle size analysis using sieve methods and interpret results in terms of size distribution and mesh size; Evaluate the performance of screening equipment based on efficiency, capacity, and cut size; and, Identify and describe different types of industrial screens and their applications in coal and mineral beneficiation processes.
5	**Classification: —** Principles of classification, Hindered and free settling, types of classifiers – Hydraulic, mechanical, hydrocyclone, factors affecting cyclone performance	04	Ability to: Explain the principles of classification in mineral processing, including the concepts of free and hindered settling; Differentiate between types of classifiers, such as hydraulic, mechanical, and hydrocyclones, based on their working principles and applications; Analyze the factors affecting the performance of hydrocyclones and other classifiers; and, Select appropriate classification equipment for specific coal and mineral beneficiation scenarios.
6	**Gravity concentration: —** Principles of gravity concentration, gravity separators, Jigs, shaking tables	06	Ability to: Explain the principles of gravity concentration and its role in coal and mineral beneficiation; escribe the working principles and applications of common gravity separators such as jigs and shaking tables; and, Compare the performance and suitability of different gravity concentration methods for various types of ores and coal.
7	**Dense medium separation (DMS): —** The dense medium, centrifugal separators, DMS circuits, Typical dense medium separations, efficiency of separation, partition curves	04	Ability to: Explain the principles of dense medium separation (DMS) and the role of dense media in mineral beneficiation; Describe the working of centrifugal separators and typical DMS circuits used in industry; Analyze typical dense medium separation processes and evaluate their applicability to different coal and ore types; Assess the efficiency of DMS operations using partition curves and related performance indicators.
8	**Froth flotation: —** Principles of flotation, classification of minerals, collectors, frothers, Regulators, importance of pH, pulp potential, role of bubble generation and froth performance, modern aspects	03	Ability to: Explain the fundamental principles of froth flotation and the physico-chemical basis of mineral separation; Classify minerals based on flotation behavior and identify appropriate reagents including collectors, frothers, and regulators; Analyze the influence of process parameters such as pH, pulp potential, bubble generation, and froth performance on

			flotation efficiency; and, Discuss modern developments and technological advancements in flotation techniques used in coal and mineral beneficiation.
9	**Magnetic and electrical separation: —** Magnetic fundamental related to mineral, Magnetic precipitator	04	Ability to: Explain the magnetic and electrical properties of minerals relevant to their separation; Describe the working principles and applications of magnetic and electrostatic separators used in coal and mineral beneficiation; and, Evaluate the performance and suitability of magnetic precipitators for specific mineral processing scenarios.
10	**Dewatering: —** Thickening, drying, filtration	03	Ability to: Explain the principles and objectives of dewatering in coal and mineral beneficiation processes; Describe various dewatering techniques, including thickening, filtration, and drying, along with their working mechanisms; and, Select appropriate dewatering methods based on material characteristics and process requirements.
11	**Coal preparation plant (CPP) : —** Float and sink analysis, basic layout, main and auxiliary equipment.	03	Ability to: Explain the purpose and principles of float and sink analysis and its application in coal washing; Describe the basic layout and process flow of a typical coal preparation plant (CPP); and, Identify and explain the functions of main and auxiliary equipment used in coal preparation operations.
12	**Iron ore beneficiation plant: —** Primary and secondary ore beneficiation circuits.	03	Ability to: Describe the process flow and objectives of primary and secondary beneficiation circuits in an iron ore beneficiation plant; Differentiate between the unit operations involved in primary and secondary ore processing; and, Analyze the role of each stage in improving the grade and quality of iron ore for further processing or utilization.
TOTAL		**42**	

Course Outcomes	After completion of this course students will be able demonstrate their learning through: • Solving problems related to comminution, sizing, and separation efficiencies. • Analyzing and interpreting mineralogical data for beneficiation design. • Developing basic flowsheets for simple beneficiation circuits. • Participating in discussions on the selection of appropriate beneficiation methods for different ore types. • Understanding the role of beneficiation in the overall mining value chain.

Learning Resources	Arnold B. J. Klima M. S. Bethell P. J. 2007. Designing the Coal Preparation Plant of the Future. *Society for Mining*, Metallurgy, and Exploration Inc. Littleton, CO, USA. 216 pages Drelich J. 2012. Water in Mineral Processing. *Society for Mining*, Metallurgy, and Exploration Inc. Littleton, CO, USA. 416p

	Fuerstenau M. C. and Han K. N. (2003): Principles of Mineral Processing. *Society for Mining*, Metallurgy, and Exploration Inc. Littleton, CO, USA. 573 pages Gaudin A. M. 1967. Principles of Mineral Dressing McGraw-Hill book Company, Inc. 554 pages. Gupta A. and Yan D (2006): Mineral Processing Design and Operation: An Introduction. Elsevier. 718 pages Hancock B. A., Pon M. R. L. 1999. Mineral Processing: Environment, Health and Safety. The Minerals, Metals & Materials Society (TMS). 448 pages Kawatra S.W. and Natarajan K.A. (eds) 2001. Mineral Biotechnology: Microbial Aspects of Mineral Beneficiation, Metal Extraction, and Environmental Control. *Society for Mining*, Metallurgy, and Exploration Inc. Littleton, CO, USA. 272 pages.

Course Code	MN4102N	Course Name	MINE LEGISLATION AND SAFETY	Course Category	PC/ PSE	L	T	P
						3	0	0

Pre-requisite Courses	Underground/ Surface Mining Methods Mine Environment	Co-requisite Courses	None	Progressive Courses	None
Course Offering Department		**Mining Engineering**		Data Book/ Codes/ Standards	BIS methods

Course Objectives	Principal objectives of the course are to enable the students to: • Understand the historical development and rationale behind mining legislation in India. • Identify and interpret the key provisions of major Indian mining statutes (e.g., Mines Act, Mines Rules, Coal Mines Regulations, Metalliferous Mines Regulations). • Explain the role and responsibilities of statutory officials (managers, agents, owners, DGMS) in ensuring mine safety. • Apply principles of risk assessment and management to identify, evaluate, and control hazards in mining environments. • Describe common types of mining accidents and their root causes, and outline procedures for accident investigation. • Understand the health and welfare provisions stipulated by mining laws. • Explain the legal requirements related to specific mining hazards such as explosives, machinery, ventilation, and ground control. • Appreciate the importance of a proactive safety culture and effective safety management systems in preventing accidents.

COURSE CONTENT:

Sl. No.	Module Name/ Topics	Contact Hours	Learning Outcome
1	INTRODUCTION TO MINING LEGISLATION IN INDIA: — Historical development of mining legislation; — Objectives and need for legal control in mining; — Overview of the Indian Constitution provisions related to mines and minerals; — Roles of statutory authorities: DGMS, IBM, Ministry of Mines.	**5**	Understand the structure, hierarchy, and scope of various statutory instruments governing mining operations in India, including Acts, Rules, Regulations, and DGMS Circulars.
2	THE MINES ACT, 1952:: — Definitions and applicability; — Provisions related to working hours, employment of women and children; — Health, safety, and welfare provisions; — Powers of inspectors, penalties, and obligations of mine owners	**8**	Identify common types of accidents in mines and analyze human, technical, and environmental factors contributing to their occurrence.
3	COAL AND METALLIFEROUS MINES REGULATIONS: — Important provisions of CMR 2017 and MMR 1961; — Appointment and duties of	**10**	Describe accident prevention strategies and explain the roles and responsibilities of statutory bodies

	statutory personnel; — Mine workings, haulage, winding, and transportation regulations; — Ventilation, lighting, and use of explosives in mines; — Recent amendments and proposed revisions.		such as DGMS, Ministry of Labour, and other safety enforcement agencies.
4	OCCUPATIONAL HEALTH AND WORKING CONDITIONS: — Provisions under the Occupational Safety, Health and Working Conditions Code, 2020; — Medical examination, fitness for work, and occupational diseases; — Dust, noise, vibration, and thermal stress – exposure limits and control.	**6**	Explain the importance of safety in mining operations, and describe mechanisms like safety campaigns and the Safety Performance Rating System (SPRS) to promote a safety culture.
5	MINE ACCIDENTS AND SAFETY MANAGEMENT: — Classification and causes of mine accidents; — Accident investigation and reporting procedures; — Risk assessment, hazard identification (HIRA, HAZOP) ; — Safety Management System (SMS) and Safety Audit	**8**	Interpret key provisions of the Mines Act, 1952 related to health, safety, working hours, employment conditions, and responsibilities of employers and workers.
6	MINE RESCUE, EMERGENCY RESPONSE, AND ENVIRONMENTAL SAFETY: — Rescue stations, teams, and equipment; — Disaster management plan and emergency preparedness; — Environmental obligations under mining laws; — Sustainable and responsible mining practices	**5**	Explain important provisions of the CMR relevant to safe coal mining practices, including rules on machinery, mine ventilation, support, and explosive handling.
TOTAL		**42**	

Course Outcomes	After successfully completing the course, students will be able to demonstrate their learning through: • Analyzing specific provisions of mining acts and regulations in response to given scenarios. • Conducting mock risk assessments for typical mining operations. • Developing basic accident investigation reports based on provided case studies. • Discussing the roles and responsibilities of various stakeholders in maintaining mine safety. • Critically evaluating safety practices against regulatory requirements and best industry standards.

Learning Resources	Books on mine safety management by authors focusing on Indian or international mining safety (e.g., R.N. Gupta, V.K. Singh, or relevant international texts). Dey N. C. - Golden Book on Mine Legislation DGMS Circulars, Notifications, and Standing Orders (available on DGMS website). International mining safety guidelines (e.g., from ILO, IOM, leading mining companies). Relevant publications from Ministry of Labour and Employment, Ministry of Mines, and Ministry of Coal (Government of India).

	The Coal Mines Regulations, 2017 (as amended from time to time): Directorate General of Mines Safety (DGMS) Publication. The Metalliferous Mines Regulations, 1961 (as amended from time to time): Directorate General of Mines Safety (DGMS) Publication. The Mine Vocational Training Rules, 1966 (as amended from time to time): Government of India Publication. The Mines Act, 1952 (as amended from time to time): Government of India Publication. The Mines Rules, 1955 (as amended from time to time): Government of India Publication.

Course Code	MN4171N	Course Name	TRAINING/ INTERNSHIP EVALUATION	Course Category	PC/ PSE	L	T	P
						0	0	0

Pre-requisite Courses	Mining Methods	Co-requisite Courses	Mine Ventilation Engineering	Progressive Courses	None
Course Offering Department		**MINING ENGINEERING**		Data Book/ Codes/ Standards	None

Course Objectives	The objectives of the Course are: • To evaluate the professional exposure gained by students during their industrial training or internship. • To develop students' ability to articulate technical knowledge, practical insights, and industry practices in the form of structured reports and presentations. • To assess students' understanding of real-world mining operations, workplace safety, organizational structure, and engineering applications.

Course Components:

1. **Industrial Training/Internship:**
   - Minimum duration: 4 to 6 weeks
   - Location: Mines, mining equipment companies, research organizations, or relevant industry
2. **Training Report Submission:**
   - Hard copy of a detailed training report
   - Report must include: company profile, training objectives, technical activities undertaken, field observations, process/machinery details, safety practices observed, conclusions, and references
   - Format: As prescribed by the department (cover page, acknowledgements, certificate from host organization, structured content, images/diagrams if needed)
3. **Oral Presentation / Viva Voce:**
   - Individual presentation before a departmental evaluation committee
   - Duration: 10–15 minutes followed by Q&A
   - Assessment of clarity, depth, and articulation of training experience

Course Deliverables:

- Duly signed and certified hard copy of the **training report**
- **Presentation slides** for evaluation
- **Participation in viva voce** conducted by a departmental committee

Additional Notes:

- Training reports must be submitted by the **third week** of the semester.

- Plagiarism in the report will lead to disqualification or re-submission.
- Students must ensure they maintain a **daily log or diary** during their internship for accurate report preparation

Course Outcomes	At the end of this sessional course, students will be able to: • Document and communicate their industrial training experience professionally. • Demonstrate understanding of mining operations and work culture. • Relate academic knowledge to industry practices. • Improve technical writing and oral presentation skills. • Develop critical thinking through observation and reporting.

Learning Resources	1. *Report* Writing *and Communication Skills* • Myneni, S.R. – *English for Engineers*, Pearson Education. 2. Technical Writing Guides • Departmental Training Report Guidelines and Templates • IEEE/ASME style guides (for referencing and formatting) 3. Oral Presentation and Viva Skills • Duarte, Nancy – *Slide:ology – The Art and Science of Creating Great Presentations*, O'Reilly. • Toastmasters International – Public speaking tips and structured speech delivery techniques. 4. Technical and Industry References

Course Code	MN4151N	Course Name	COAL AND MINERAL BENEFICIATION LAB	Course Category	PC/ PSE	L	T	P
						0	0	3

Pre-requisite Courses	Engineering Chemistry Mining Machinery	Co-requisite Courses	Coal and Mineral Beneficiation	Progressive Courses	None
Course Offering Department		**MINING ENGINEERING**		Data Book/ Codes/ Standards	BIS Codes

Course Objectives	The objectives of the Course are: to: • Provide practical exposure to the processes involved in the beneficiation of coal and minerals. • Enable students to understand the working principles of various laboratory-scale beneficiation equipment. • Develop the ability to evaluate process efficiency and optimize beneficiation operations. • Correlate theoretical knowledge with experimental data for real-world mineral processing applications.

LIST OF EXPERIMENTS

Sl No.	Experiment Title	Contact Hours
1	**Sampling and Sample Preparation** – Techniques for coal and mineral samples	3
2	**Particle Size Analysis (Sieve and Sedimentation Methods)**	3
3	**Jaw Crusher Experiment** – Determination of reduction ratio and crushing efficiency	3
4	**Roll Crusher Experiment** – Size reduction and capacity estimation	3
5	**Screening Analysis** – Use of vibrating and fixed screens, calculation of efficiency	3
6	**Gravity Separation (Jigging)** – Beneficiation of coal or mineral ore by jigging	3
7	**Spiral Concentrator Operation** – Performance and recovery analysis	3
8	**Heavy Media Separation (Sink-Float Test)** – For coal or mineral samples	3
9	**Froth Flotation** – Separation of sulphide ores or coal by froth flotation technique	3
10	**Magnetic Separation** – Recovery of magnetic materials from ore mixtures	3
11	**Thickening and Filtration** – Settling studies and determination of thickener performance	3
12	**Moisture and Ash Content Determination in Coal**	3
13	**Proximate Analysis of Coal** – Determination of volatile matter, fixed carbon, etc.	3
14	**Beneficiation Flow Sheet Development** – Integration of lab results into process flow diagram	3

Sl No.	Experiment Title	Contact Hours
TOTAL		**42**

Course Outcomes	At the end of this practical course, students will be able to: • Identify and operate key coal and mineral beneficiation equipment. • Perform crushing, screening, and sizing operations and analyze size distribution. • Apply physical separation techniques for coal and mineral concentration. • Calculate process efficiency and evaluate product quality. • Demonstrate understanding of beneficiation flowsheets and plant operations.

Learning Resources	Gupta A. and Yan D. S. (2016) *Mineral Processing Design and Operations: An Introduction*, Elsevier. 882p. Konar B. B. (1997) *Coal Preparation*. Allied Publishers (P) Limited. 221p Subba Rao D.V. (2019). *Minerals and Coal Process Calculations*. CRC Press. 356p. Wills B. A. (2013). *Mineral Processing Technology: An Introduction to the Practical Aspects of Ore Treatment and Mineral Recovery*. Elsevier. 646p

VIII-SEMESTER COURSES SYLLABI

Course Code	MN 4291	Course Name	One Semester Internship / Project	Course Category	PC	L	T	P
						0	0	0

Pre-requisite Courses	None	Co-requisite Courses	None	Progressive Courses	None
Course Offering Department		**Mining Engineering**		Data Book / Codes/Standards	None

Course Objectives	This course marks the culmination of the One Semester Internship / Project. Students will finalize their research, complete data analysis, and compile their findings into a comprehensive thesis document following academic and industry standards.
Course Outcomes	Upon successful completion of this course, students will be able to: • Synthesize and interpret research findings effectively. • Draft a well-structured thesis document meeting academic standards. • Demonstrate the significance and originality of their research contributions. • Prepare the report and appear for the examination.

Course Code	MN 4292	Course Name	Grand viva	Course Category	PC	L	T	P
						0	0	0

Pre-requisite Courses	None	Co-requisite Courses	None	Progressive Courses	None
Course Offering Department		**Mining Engineering**		Data Book / Codes/Standards	None

Course Objectives	This course involves the final presentation and One Semester Internship / Project report. Students will present their completed work in a formal seminar and defend their findings before a panel of experts. The viva-voce will assess their depth of understanding and contribution to the field.
Course Outcome	Upon successful completion of this course, students will be able to: • Deliver a comprehensive thesis presentation highlighting key findings. • Defend their research work effectively before an expert panel. • Address critical questions and justify their conclusions. • Demonstrate mastery in their area of research and contribute to knowledge advancement.

Learning Resources	1. Alana J. E. and Slater T.2014. Writing your Doctoral Dissertation or Thesis Faster: A Proven Map to Success. SAGE Publications Ltd. 296 pages 2. Creswell J. W. and Poth C N. 2016. Qualitative Inquiry and Research Design: Choosing Among Five Approaches. 4th Edition. SAGE Publications. 488 pages. 3. Dunleavy P. 2003. Authoring a PhD: How to Plan, Draft, Write and Finish a Doctoral Thesis or Dissertation. Palgrave Macmillan 4. Fisher, C. and Buglear, J. 2004. Researching and writing a dissertation for students. Prentice Hall 5. Hyatt Land Roberts C.M. 2023. The Dissertation Journey: A Practical and Comprehensive Guide to Planning, Writing, and Defending Your Dissertation Fourth Edition. Corwin. 6. 264 pages. 7. Issac R. 2022. Thesis: Beginning to END: Idea to open viva–voce exam. Notion Press, Chennai. 128 pages 8. Krathwohl D. and Smith N. L. 2005. How To Prepare A Dissertation Proposal: Suggestions for Students in Education and the Social and Behavioral Sciences. Syracuse University Press. 289 pages. 9. Negi S. 2022. A Practica l Guide to Modern Research: Thesis and Dissertations - Planning, Writing and Viva-voce. Laxmi Publications. 467 Pages.