NETAJI SUBHAS UNIVERSITY, JAMSHEDPUR

Estd. Under Jharkhand State Private University Act, 2018
Approved by AICTE, PCI, BCI, NCTE, INC & JNRC

EVALUATION SCHEME & SYLLABUS
FOR
MASTER OF TECHNOLOGY
IN
Mining Engineering
(M. TECH-MT)

On Choice Based Credit System (Effective from the Session: 2025-26)

Netaji Subhas University
Pokhari, Near Bhilai Pahadi, Jamshedpur, Jharkhand

COURSE STRUCTURE & SYLLABUS

FOR

MASTER OF TECHNOLOGY

IN

MINING ENGINEERING

(M.TECH)

Netaji Subhas University Pokhari, Near Bhilai Pahadi

Jamshedpur, Jharkhand

VISION

To strive for excellence in education, research, and entrepreneurship, with the ultimate goal of becoming a global hub for innovation. Committed to advancing scientific and technological services, we aim to contribute meaningfully to society.

MISSION

- To provide high-quality education that nurtures innovation, entrepreneurship, and ethical values, shaping future professionals equipped for a globally competitive landscape.
- To collaborate with stakeholders by sharing institutional expertise in education and knowledge, fostering mutual growth in technical learning.
- To cultivate an environment that encourages fresh ideas, groundbreaking research, and academic excellence, paving the way for future leaders, innovators, and entrepreneurs.
- To drive socio-economic progress by offering impactful scientific and technological solutions to society.

PROGRAMME EDUCATION OBJECTIVES (PEOs)

PEO1: Postgraduates will develop advanced theoretical and practical knowledge in thermal engineering to solve real-world and research-oriented problems.

PEO2: Postgraduates will engage in high-quality research, innovation, and development of new thermals engg. processes and technologies.

PEO3: Postgraduates will demonstrate professionalism, ethical responsibility, and leadership in academic, industrial, and research organizations.

PEO4: Postgraduates will pursue doctoral studies, postdoctoral research, or continuous professional development to stay updated with emerging trends.

PEO5: Postgraduates will apply their skills to contribute meaningfully to sustainable development and address societal and environmental challenges.

PROGRAMME OUTCOMES (POs)

PO1: An ability to independently carry out research/investigation and development work to solve practical problems.

PO2: An ability to write and present a substantial technical report/document.

PO3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

PO4: An ability to handle techno-scientific challenges of the society.

M.Tech. in Thermal Engineering – Semester-wise Course Distribution

SEMESTER I

S.No.	Subject Code	Subject Name	Periods per week			Credits	Marks		
			L	T	P		TE	IA	TM
1.	MTMI 101	Applied Rock Mechanics	4	1	-	4	70	30	100
2.	MTMI 102	Mine Planning and Design	4	1	-	4	70	30	100
3.	MTMI 103	Project Management	4	1	-	4	70	30	100
4.	MTMI 104	Operations Research	4	1	-	4	70	30	100
5.	MTMI 105	Environmental Control and Management	4	1	-	4	70	30	100
6.	MTMI 106	Rock Mechanics Lab	-	-	4	2	30	20	50
7.	MTMI 107	Mine Planning and Design Lab	-	-	4	2	30	20	50
		Total	20	5	8	24	420	180	600

SEMESTER II

S.No.	Subject Code	Subject Name	Periods per week			Credits	Marks		
			L	T	P		TE	IA	TM
1.	MTMI 201	Mine Safety Management	4	1	-	4	70	30	100
2.	MTMI 202	Mine Ventilation and Planning	4	1	-	4	70	30	100
3.	MTMI 203	Numerical Methods in Geotechnical Engineering	4	1	-	4	70	30	100
4.	MTMI 204	Research Methodology and IPR	4	1	-	4	70	30	100
5.	MTMI 205	Writing Skills for Scientific communication	4	1	-	4	70	30	100
6.	MTMI 206	Geotechnical Engineering Lab	-	-	4	2	30	20	50
7.	MTMI 207	Mine Ventilation and Planning Lab	-	-	4	2	30	20	50
		Total	20	5	8	24	420	180	600

SEMESTER III

S.No.	Subject Code	Subject Name	Credits
1.	MTMI 301	Seminar on Dissertation Evaluation	16
2.	MTMI 302	Dissertation – Interim Evaluation	4
		Total	20

SEMESTER IV

S.No.	Subject Code	Subject Name	Credits
1.	MTMI 401	Dissertation (Open Defense)	16
2.	MTMI 402	Dissertation (Evaluation)	4
		Total	20

Course Objectives – M.Tech Mining Engineering

- To provide students with in-depth theoretical and practical knowledge in advanced mining technologies, methods, and systems.
- To develop proficiency in the design, planning, and optimization of both surface and underground mining operations.
- To enhance understanding of rock mechanics, ground control, and geotechnical investigations for safe mining practices.
- To impart knowledge on advanced mineral processing, beneficiation techniques, and material handling systems.
- To build capability in environmental management, mine safety, and sustainable mining practices.
- To enable students to use modern software tools for mine planning, design, and data analysis.
- To promote research and innovation in emerging areas such as automation, remote sensing, and intelligent mining.
- To prepare students for technical leadership roles in industry, academia, and research organizations.
- To instill a strong sense of professional ethics, environmental stewardship, and social responsibility.
- To encourage critical thinking, problem-solving, and lifelong learning in the field of mining engineering.

Program Outcomes (POs) – M.Tech Mining Engineering

- **PO1:** Apply advanced knowledge of mining engineering to solve real-world problems.
- **PO2:** Use modern tools, software, and techniques for designing and analyzing mining systems.
- **PO3:** Conduct independent research and interpret data related to mining operations.
- **PO4:** Evaluate environmental and safety considerations in mining project planning.
- **PO5:** Demonstrate ethical responsibility and professional integrity in engineering practices.
- **PO6:** Communicate effectively in technical and non-technical contexts.

- **PO7:** Work effectively in multidisciplinary and multicultural teams.
- **PO8:** Engage in lifelong learning and adapt to technological advancements in mining.
- **PO9:** Understand the financial, legal, and policy dimensions of mining projects.
- **PO10:** Innovate and apply entrepreneurial approaches to tackle mining industry challenges.

MTMI 101

Applied Rock Mechanics

Subject Code	**MTMI101**	**IA Marks**	**30**
Number of Lecture Hours/Week	**04**	**Term End Exam Marks**	**70**
Total Number of Lectures per Hour	**40**	**CREDITS**	**04**

UNIT I - Stress Analysis: Stress analysis in 2D and 3D, equations of equilibrium, Mohr's Circles, plane stress and plane strain condition, stress distribution in simple structures, Flexure of beams and rectangular plates

UNIT – II- Properties of Rocks: Physico-mechanical properties of rocks including tri-axial strengths and in-situ strengths and their application in the design of different types of excavations, rock indices viz. drillability index, caving index, etc. Time dependent properties of rocks and their application in structural design, static and dynamic elastic constants of rocks, rock mass classification methods. Selection excavator based on rock properties.

UNIT III- In-Situ Stresses and Theories of Failure: In-situ stresses and instrumentation, drilling and blasting, measurement of stresses, strains, deformations, in-situ stress determination, strata monitoring in underground and opencast mines, mechanics a of drilling and blasting, blast vibration and its monitoring. Different theories of rock failure and their applications in design of mining structures.

UNIT IV - Design of Underground Openings, Subsidence, Rock Burst and Slope Stability: Design of single and multiple underground openings, pillars including shaft pillar, scaling factors, mining subsidence, rock burst, design of slopes and spoil banks, slope stability in rock & soil and its analysis, slope monitoring and stabilisation techniques. Design of pillars including barrier and shaft pillars.

UNIT V -Design of Mine Supports: Advances of mine supports, supports and bord and pillar and longwall workings, rock load assessment, design of different types of supports like conventional and non-conventional supports like shotcrete, fibre reinforced shotcrete, strata grouting, rock bolting, supports in tunnels and shafts

Text Books/Reference Books:

1. Obert, L. and Duvall, W.I., Rock Mechanics and Design of Structure in Rock John Wiley and Sons Inc., New York, 1967.
2. Vutukuri, V.S., and Lama, R.D., Handbook on Mechanical Properties of Rocks, Vol. I, II, III and IV, Transtech Publication, Berlin, 1974/78
3. Peng, S.S., Ground Control, Wiley Interscience, New York, 1987.
4. Brady, B.H.G. and Brown, S.T., Rock Mechanics, Wiley Interscience, 1985.
5. Hoek, E., and Brown, S.T., Underground Excavations in Rocks, Institute of Mining Metallurgy, London, 1980.

CO1: Analyze the mechanical behavior of rock and rock masses under various stress conditions.

CO2: Apply fundamental theories of elasticity and plasticity to solve rock mechanics problems.

CO3: Conduct and interpret laboratory and in-situ tests for determining rock properties.

CO4: Design underground and surface excavations considering rock strength, stress redistribution, and failure criteria.

CO5: Evaluate slope stability and ground control measures in mining projects.

CO1	Analyze the mechanical behavior of rock and rock masses under various stress conditions	K1
CO2	Apply fundamental theories of elasticity and plasticity to solve rock mechanics problems	K2
CO3	Conduct and interpret laboratory and in-situ tests for determining rock properties.	K4
CO4	Design underground and surface excavations considering rock strength, stress redistribution, and failure criteria.	K3
CO5	Evaluate slope stability and ground control measures in mining projects.	K5

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	3		3						2	1		
CO2	2			1		1			3	3		
CO3	3									1		
CO4		2	3			1			1			
CO5						1						
CO Average	2.6 6	2	3			1			2	1.66		

MTMI 102
Mine Planning and Design

Subject Code	MTMI102	IA Marks	30
Number of Lecture Hours/Week	04	Term End Exam Marks	70
Total Number of Lectures per Hour	40	CREDITS ', .	04

UNIT – I- Introduction: Technical factors in mine planning, methodology of mine planning, short range & long range, mine modelling, mine simulation systems approach to mine planning based on mine subsystem and their elements, mine plan generation.

UNIT – II- Open Pit Mining: Selection of initial mine cuts, location of surface structures, division of mining area into blocks, mine design, bench drainage, geometry, haul roads, slope stability; open pit limits and optimisation, calendar plan, production planning, production scheduling, economic productivity indices.

UNIT – III- Underground Mining: Location of mine entries, mine and auxiliary,

optimisation of mine parameters, design of shaft pillars and protective pillars, planning of production capacity, layout of development drives / raises / winzes etc, length of faces, size of panels, etc, planning of support systems, ventilation, lay out of drainage system, planning production schedule and monitoring, selection of depillaring / stopping method, manpower management, economic/ productivity indices, techno economic analysis, mine reclamation design.

UNIT – IV- Equipment Planning: Latest technological developments in increase in both types and capacities of equipment used in mining operations. Planning and selection of equipment for different mining conditions. Equipment design for optimum drilling and blasting operations. Equipment information – performance, monitoring and expert systems. Innovative mining systems.

UNIT – V- Project Implementation and Monitoring : Pre-project activities – feasibility report, environment clearance, detailed project, report, sources of funds, import of technology, selection of contracts and contract administration, time management, cost control material management system, project quality assurance, social responsibility, government orders and guidelines. Environmental impact assessment and preparation of environmental management plan. Mine closure plan.

Text Books/Reference Books:

1. Jayanth Bhattacharya, Principles of Mine Planning-Allied Publishers, Delhi 2003.
2. Hustrulid, W. and Kuchta, M., (eds)., Fundamentals of Open pit Mine Planning and Design, Elsevier, 1995.
3. Ehrenburger, V and Fajkos, A., Mining Modelling, Elsevier, 1995.
4. Bawden, W.F., and Archibald., J.F., Innovative Mine Design for the 21st Century Elsevier,1993.
5. Passamehtoglu, A.G., Karpuz, C., Eskikaya, S. and Hizal, T., (Eds), Mine Planning and Equipment Selection, Elsevier, 1994.
6. Pazdziora, J., Design of Underground Hard Coal Mines, Elsevier, 1988.
7. Swilski, and Richards, Underground Hard Coal Mines, Elsevier, 1986.
8. Singh, B. and Pal Roy, P., Blasting in Underground excavations and mine.

CO1: Explain the principles and objectives of short-term and long-term mine planning.

CO2: Design the layout of surface and underground mines considering geological, economic, and technical factors.

CO3: Evaluate ore body modeling techniques and apply them in reserve estimation.

CO4: Optimize mine design using cut-off grade analysis and scheduling techniques.

CO5: Apply software tools for mine planning, design, and simulation

CO1	Explain the principles and objectives of short-term and long-term mine planning	K1
CO2	Design the layout of surface and underground mines considering geological, economic, and technical factors	K2
CO3	Evaluate ore body modeling techniques and apply them in reserve estimation.	K4
CO4	Optimize mine design using cut-off grade analysis and scheduling techniques	K3
CO5	Apply software tools for mine planning, design, and simulation	K5

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		3						2	1		
CO2	2			1		1			3	3		
CO3	3									1		
CO4		2	3			1			1			
CO5						1						
CO Average	2.66	2	3			1			2	1.66		

COURSE OBJECTIVES

- To understand the basic concepts of project management.
- Appraise the project using appropriate appraisal techniques.
- Design and implement project by considering risk and its evaluation.
- Learn the process of project planning and execution.

COURSE CONTENTS

Module 1

Introduction to Project Management: What is a project? Evolution of project management, the need of project management, where is project management appropriate? Characteristics of projects, Characteristics of project management, Projects in contemporary organizations, Project life cycle.

Module 2

Project Selection and Appraisal: Brainstorming and concept evolution, Project selection and evaluation, Selection criteria and models, Types of appraisals, SWOT analysis, Cash flow analysis, Payback period, and Net present value.

Module 3

Project Organization and Planning: Project manager, Cross-functional team, Dedicated project organization, Influence project organization, Matrix organization, Advantages and disadvantages of project organizations, Selection of project organization, Work Breakdown Structure (WBS), Integration of project organization and WBS, WBS and responsibility matrix.

Module 4

Project Scheduling and Resource Management: Gant chart, Milestone chart, Network techniques: PERT and CPM, AON and AOA representation, Three time estimates, Using probability distributions for time computation, Probability of project completion, Time scale version of network, Early start and late start schedules, Resource a location, Resource loading and leveling, Constrained resource scheduling, Multi-project scheduling and resource a location, Crashing a project.

Module 5

Computerized PM: Computerized PMIS, Choosing software for project management, using software for project management. Case Studies on Project Management : Modern cases in project management.

Reference Books

1. Project Management for Business and technology: Principles and Practice, John M.Nicholas, Pearson Prentice Ha l, New Delhi, 2005.
2. A Guide to the Project management Body of Knowledge (PMBOK Guide) 5 th Edition, PMI.
3. Project Management-Case Studies, Harold Kerzner, John Wiley & Sons, New Jersey, 2006.
4. Project and Production Management, A course by National Programme on Technology Enhanced Learning (NPTEL), Arun Kanda and S. G. Deshmukh, IIT

Delhi, 2005.

5. Projects: Preparation, Appraisal, Budgeting and Implementation, Prasanna Chandra, Tata McGrawHilPublishing Company Ltd., NewDelhi, 1980.

CO1	Explain the principles and objectives of short-term and long-term mine planning	K1
CO2	Design the layout of surface and underground mines considering geological, economic, and technical factors	K2
CO3	Evaluate ore body modeling techniques and apply them in reserve estimation.	K4
CO4	Optimize mine design using cut-off grade analysis and scheduling techniques	K3
CO5	Apply software tools for mine planning, design, and simulation	K5

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		3						2	1		
CO2	2			1		1			3	3		
CO3	3									1		
CO4		2	3			1			1			
CO5						1						
CO Average	2.66	2	3			1			2	1.66		

MTMI 104
Operations Research

Subject Code	**MTMI104**	**IA Marks**	**30**
Number of Lecture Hours/Week	**04**	**Term End Exam Marks**	**70**
Total Number of Lectures per Hour	**40**	**CREDITS**	**04**

UNIT – I Introduction to Operation Research

Basic concepts.

UNIT – II Linear Programming
Simplex methods, dual problem and post optimality analysis.

UNIT – III Dynamic Programming
Concept, recursive equation approach, computational procedure, forward and backward computations and problems of dimensionality.

UNIT – IV Network Analysis
Network representation, critical path calculations, probability and cost considerations in project scheduling, construction of time chart and resource leveling.

UNIT – V Inventory Models
Definition, deterministic and probabilistic models.

UNIT – VI Queuing Theory
Basic concepts, axiomatic derivation of the arrivals and departures, distribution for Poisson queues, Poisson queuing models, non-Poisson queuing models, queuing models with priorities for service.

UNIT – VII Non-linear Programming
Unconstrained external problems, constrained external problems, programming – separable, quadratic,stochastic and geometric

Text Books/Reference Books:

1. Introduction to Operations Research" by Frederick S. Hillier and Gerald J. Lieberman
2. Operations Research: Applications and Algorithms" by Wayne L. Winston
3. "Operations Research: An Introduction" by Hamdy A. Taha

Course Outcomes

CO1	Explain the principles and objectives of short-term and long-term mine planning	K1
CO2	Design the layout of surface and underground mines considering geological, economic, and technical factors	K2
CO3	Evaluate ore body modeling techniques and apply them in reserve estimation.	K4
CO4	Optimize mine design using cut-off grade analysis and scheduling techniques	K3
CO5	Apply software tools for mine planning, design, and simulation	K5

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		3						2	1		
CO2	2			1		1			3	3		
CO3	3									1		
CO4		2	3			1			1			
CO5						1						
CO Average	2.66	2	3			1			2	1.66		

MTMI 105
Environmental Control And Management

Subject Code	MTMI105	IA Marks	30
Number of Lecture Hours/Week	04	Term End Exam Marks	70
Total Number of Lectures per Hour	40	CREDITS	04

UNIT – I The theory and practice of creating safe, healthy and efficient working environment at an underground or surface mine.

UNIT – II Air pollution from surface mining and processing. Sources and classification of air pollutants – standards, monitoring and control. Transport and dispersion of air pollutants, Air quality modeling.

UNIT – III Water quality – physical, chemical, biological, criteria and standards. Monitoring, treatment and control of contaminated water.

UNIT – IV Noise and ground vibrations: sources, monitoring, prevention and control.

UNIT – V Tailings: characterization, technical issues, sampling and analysis, site selection and design of tailings impoundment.

UNIT – VI Environment planning systems and methodologies based on the principle of sustainable development including environmental impact assessment & management.

Text Books/Reference Books:

1. A.P. Sincero, and G. A Sincero ., *Environmental Engineering,*, Prentice Hall of India , 2002
2. Masters, G.M. and Ela, W.P.,, *Environmental Engineering and Science*, Prentice Hall of India , 2008
3. Metcalf and Eddy et al., *Wastewater Engineering: Treatment and Reuse*, McGraw Hill Education , 4th edition, 2017
4. Lawrence, D.P,, *Environmental Impact Assessment: Practical solutions to recurrent problems,*, John Wiley , 2003

CO1: Identify the major environmental impacts of mining and mineral processing activities.

CO2: Analyze air, water, and noise pollution parameters specific to mining operations.

CO3: Apply environmental laws, standards, and regulatory frameworks relevant to the mining industry.

CO4: Design appropriate control measures for dust, effluent, noise, and vibration in mines.

CO5: Develop environmental management plans (EMPs) for sustainable mining practices.

CO1	Explain the principles and objectives of short-term and long-term mine planning	K1
CO2	Design the layout of surface and underground mines considering geological, economic, and technical factors	K2
CO3	Evaluate ore body modeling techniques and apply them in reserve estimation.	K4
CO4	Optimize mine design using cut-off grade analysis and scheduling techniques	K3
CO5	Apply software tools for mine planning, design, and simulation	K5

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		3						2	1		
CO2	2			1		1			3	3		
CO3	3									1		
CO4		2	3			1			1			
CO5						1						
CO Average	2.66	2	3			1			2	1.66		

MTMI 106 (Rock Mechanics Lab)

Subject Code	**MTI106**	**IA Marks**	**30**
Number of Lab Hours/Week	**02**	**Term End Exam Marks**	**70**
Total Number of Lectures per Hour	**40**	**CREDITS** ', .	**02**

List of Experiments:

1. Sample collection and Specimen preparation.
2. Determination of moisture content, density, voids ratio and porosity of rocks.
3. Determination of compressive strength, modulus of elasticity and poisson's ratio of rocks.
4. Determination of tensile strength of rocks.
5. Determination of shear strength, angle of internal friction and cohesion of soil.
6. Determination of point load strength index of rocks.
7. Determination of protodyknov's strength index of rocks.
8. Determination of slake durability index of rocks.
9. Determination of cohesion and angle of internal friction of rocks using triaxial test.
10. Determination of hydraulic conductivity of sand.

MTMI 107 (MINE PLANNING AND DESIGN LAB)

Subject Code	MTMI107	IA Marks	30
Number of Lab Hours/Week	02	Term End Exam Marks	70
Total Number of Lectures per Hour	40	CREDITS	02

List of Experiments:

1. Estimation of reserves of coal and metaliferous deposits.
2. Design of the haul roadway of open pit mines.
3. Design of the surface mine.
4. Design of underground coal mine.
5. Design of mine ventilation system for board and pillar method.
6. Design of mine ventilation system for long wall panel.
7. Design of blast for open pit workings.
8. Design of blast for cast blasting technique.

MTMI 201- Mine Safety Management

Subject Code	MTMI201	IA Marks	30
Number of Lecture Hours/Week	04	Term End Exam Marks	70
Total Number of Lectures per Hour	40	CREDITS	04

UNIT I

Mine accidents and their analysis: Accident in mines;- different types, accident investigations; In-depth study of accidents due to various causes; and Human Behavioural Approach in mine safety, accident prevention and corrective action, accident proneness, creating and maintaining safety awareness, ZAP and MAP, job safety analysis, safety meeting and committee**.**

UNIT II

Health and mine safety: Definition of health and safety, management's role – function; evolution of management involvement, management's training, responsibility, cost of health and safety, role of labour organizations – Union impact and involvement, role of government – statutory controls and directions, spot and regular inspections, enforcement of standards, penalties for violations, collection and distribution of statistical data. Safety audit methods; Safety records management, Training of Miners. Recent trends of development of safety engineering approaches.

UNIT III

Fault tree analysis: Introduction – methodology, symbols and Boolean techniques, qualitative analysis, computerized methods, statistical analysis, safety information, systems design. Appraisal of advance Techniques - fault tree analysis, Failure−Statistical methods of Risk analysis: Appraisal of advanced techniques Mode and Effect Analysis (FMEA); Failure Mode Effect and Critical Analysis (FMECA)

UNIT IV

Risk assessment and disaster management: Principles, risk and hazard control, risk and hazard evaluation and data collection for identified health risks, exposure assessment and risk characterization, probabilistic risk analysis, risk management, safety culture, human factors, reliability evaluation, safety audit. Identification of causes of mine disasters, preventive action.Concepts of Disaster, Types of Disaster and Dimensions of Natural and Anthropogenic Disasters (landslide, subsidence, fire and earthquake); Principles and Components of Disaster Management. Disaster Management and Mitigation, typical cases of mine disasters in India.

UNIT V

Miner's occupational diseases and enquiry committee: Miner's occupational health and diseases, preventive medical examinations, various types of injuries, compensable diseases, medical attention and removable of causative factors in the mines. Recommendations of inquiry committee carried out for safety and health issues in India.

Text / Reference books:

1. Brown DB. System analysis and design for safety. Prentice Hall. 1976.
2. Stranks J. Management systems for safety. Pitman publishing. 1994.
3. DeReamer R. Modern safety practices. John Wiley and Sons. 1959.
4. Wahab KA. New technology in health and safety. SMME. 1992.
5. Ericson CA. Fault tree analysis primer. Create Space Independent Publishing Platform. 2011.

CO1: Understand the principles, scope, and importance of safety management in mining operations.

CO2: Identify hazards and assess risks associated with surface and underground mining activities.

CO3: Interpret mining safety legislation, rules, and statutory requirements.

CO4: Develop safety management systems (SMS) and implement safety audit procedures.

CO5: Analyze accident case studies to determine root causes and suggest preventive measures.

CO1	Understand the principles, scope, and importance of safety management in mining operations.	K1
CO2	Identify hazards and assess risks associated with surface and underground mining activities	K2
CO3	Interpret mining safety legislation, rules, and statutory requirements estimation.	K4

CO4	Develop safety management systems (SMS) and implement safety audit procedures.	K3
CO5	Analyze accident case studies to determine root causes and suggest preventive measures	K5

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		3						2	1		
CO2	2			1		1			3	3		
CO3	3									1		
CO4		2	3			1			1			
CO5						1						
CO Average	2.66	2	3			1			2	1.66		

MTMI 202: Mine Ventilation And Planning

Subject Code	MTMI202	IA Marks	30
Number of Lecture Hours/Week	04	Term End Exam Marks	70
Total Number of Lectures per Hour	40	CREDITS ', .	04

UNIT-I

Mine Gases: Origin, occurrence, physical, chemical and physiological properties of mine gases, instruments used for spot detection of mine gases. Various damps, methane drainage techniques. Gas

chromatography.

UNIT-II

Mine Climate and Control: Sources of heat and humidity in mines and their effects, instruments used for measurement of temperature, humidity, pressure and velocity. Heat stress indices, Cooling power and method of improving cooling power

UNIT-III

Natural Ventilation and Laws of Air flow: Natural ventilation, Factors effecting NVP, Direction of air flow, Derivation of NVP, Motive column, Atkinson law governing airflow in mine openings

UNIT-IV

Mechanical Ventilation: Definition of Mechanical ventilation, Different types of fans and their characteristics, Operating point, Fan laws, installation. Ventilation appliances, economic size of roadways, determination of quantity and head requirements. Fan selection and evasee. **Ventilation networks:** simple and complex, solutions to simple ventilation network. Introduction to Hardy cross method for solving complex network. Introduction to ventilation softwares.

UNIT-V

Ventilation Planning: Standards of ventilation, ascensional ventilation, descensional ventilation, ventilation planning for different mining methods: Bord and pillar, Longwall mining method and cut and fill, sub level caving and shrinkage stoping method.

Text / Reference books:

1. Mishra GB. Mine environment and ventilation. Oxford University Press. 1992.
2. Hartman HL. Mine ventilation and air conditioning. Wiley Interscience publication.1993.
3. Hall CJ. Mine ventilation engineering. Society of mining engineers, New engineers, New York, 2nd Edition. 1992.
4. Vutukuri VS. Mine environment engineering, Trans tech publishers. 1986.
5. McPherson MJ. Subsurface ventilation and environmental engineering. Chapman and hall publication, London. 1993.

Course Outcomes

CO1: Explain the principles of mine ventilation and the importance of maintaining air quality in underground mines.

CO2: Calculate air quantity requirements based on mine size, layout, and working conditions.

CO3: Design ventilation networks using various methods such as natural and mechanical ventilation.

CO4: Analyze mine ventilation circuits using mathematical models and network analysis techniques.

CO5: Select and design appropriate ventilation equipment including fans, ducts, regulators, and air-cooling systems.

CO1	Explain the principles of mine ventilation and the importance of maintaining air quality in underground mines.	K1
CO2	Calculate air quantity requirements based on mine size, layout, and working conditions.	K2
CO3	Design ventilation networks using various methods such as natural and mechanical ventilation.	K4
CO4	Analyze mine ventilation circuits using mathematical models and network analysis techniques	K3
CO5	Select and design appropriate ventilation equipment including fans, ducts, regulators, and air-cooling systems	K5

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		3						2	1		
CO2	2			1		1			3	3		
CO3	3									1		
CO4		2	3			1			1			
CO5						1						
CO Average	2.66	2	3			1			2	1.66		

MTMI 203

Numerical Methods In Geotechnical Engineering

Subject Code	MTMI203	IA Marks	30

Number of Lecture Hours/Week	04	Term End Exam Marks	70
Total Number of Lectures per Hour	40	CREDITS ', .	04

UNIT: 1

Introduction: Categories of Problems in Geo□ technical Engineering, Finite Difference Method, Boundary Corrections for Grids. Accuracy, Convergence and Stability. Idealization of soil behaviour; Linear, Bilinear and multi□ linear, Hyperbolic, Spline function, Ramberg – Osgood‟s Model, Polynomials, Higher order elastic models, perfect plasticity, frictional. Elastic models of soil behaviour – The winkler – Filenenko□ boroditch – Pasternak – Ressiener models.

UNIT: II

Seepage: Finite Difference Solution to Laplace equation for Homogeneous and Layered Soils.

UNIT:III

Consolidation: Finite Difference Solution for One Dimensional, Two and three dimensional consolidations. Multi layered systems. Consolidation of Ground for Construction Load and Static Load.

Unit: IV

Shallow Foundations: Beams on Elastic foundations, solution by Finite Difference and – Finite Element Method (Direct Approach) Limit analysis, Lower Bound and Upperbound theories Method of Finite difference solution of Raft foundations.

UNIT: V

Pile Foundation: Pile Stresses – Static loading – Finite Element Method Solution (Direct approach) of the pile static pile capacity, wave equation, Lateral piles by Finite Element Method (Direct Approach) and Finite Difference method.

Text / Reference books:

1. Numerical methods in Geotechnical Engineering by C.S. Desai and J.T. Christian McGraw Hill publications.
2. Analytical and computer methods in foundation engineering, JE Bowles, McGraw Hill publications.
3. Foundation analysis and design, JE Bowles, McGraw Hill publications

4. Foundation analysis by RF Scott, Printice Hall
5. Hytenyi, Beams on Elastic Foundations – university of Michigan Press.
6. Elastic Analysis of Soil – Foundation Interaction, APS Selvadurai – Elsevier
7. Pile Foundation Analalysis& Design by Poulos and Davis.

Course Outcomes

CO1: Understand the fundamentals of numerical methods and their application in solving geotechnical problems.

CO2: Apply finite difference and finite element methods to analyze stress, deformation, and failure in soils and rocks.

CO3: Solve boundary value problems related to slope stability, foundation settlement, and underground openings.

CO4: Develop and validate geotechnical models using appropriate discretization techniques.

CO5: Use numerical tools and software (like FLAC, PLAXIS, or ANSYS) for geotechnical simulation and analysis.

CO1	Explain the principles of mine ventilation and the importance of maintaining air quality in underground mines.	K1
CO2	Calculate air quantity requirements based on mine size, layout, and working conditions.	K2
CO3	Design ventilation networks using various methods such as natural and mechanical ventilation.	K4
CO4	Analyze mine ventilation circuits using mathematical models and network analysis techniques	K3
CO5	Select and design appropriate ventilation equipment including fans, ducts, regulators, and air-cooling systems	K5

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		3						2	1		
CO2	2			1		1			3	3		
CO3	3									1		
CO4		2	3			1			1			
CO5						1						

CO Average	2.66	2	3			1			2	1.66		

MTMI 204

Research Methodology And IPR

Subject Code	**MTMI204**	**IA Marks**	**30**
Number of Lecture Hours/Week	**04**	**Term End Exam Marks**	**70**
Total Number of Lectures per Hour	**40**	**CREDITS**	**04**

UNIT 1:

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

UNIT 2:

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT 3:

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT 4:

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications

UNIT 5:

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Text / Reference books:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall, "Industrial Design", McGraw Hill, 1992.
6. Niebel, "Product Design", McGraw Hill, 1974.
7. Asimov, "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Course Outcomes

CO1: Understand the fundamentals of research methodology and its significance in engineering research.

CO2: Formulate research problems, hypotheses, and objectives based on literature review and gap analysis.

CO3: Design appropriate research methods including experimental, analytical, and simulation-based approaches.

CO4: Apply statistical tools for data collection, analysis, interpretation, and validation of research findings.

CO5: Prepare technical reports, research papers, and thesis documents in a structured and ethical manner.

CO1	Understand the fundamentals of research methodology and its significance in engineering research	K1
CO2	Formulate research problems, hypotheses, and objectives based on literature review and gap analysis	K2
CO3	Design appropriate research methods including experimental, analytical, and simulation-based approaches..	K4
CO4	Apply statistical tools for data collection, analysis, interpretation, and validation of research findings	K3

CO5	Prepare technical reports, research papers, and thesis documents in a structured and ethical manner	K5

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		3						2	1		
CO2	2			1		1			3	3		
CO3	3									1		
CO4		2	3			1			1			
CO5						1						
CO Average	2.66	2	3			1			2	1.66		

MTMI 205- Writing Skills For Scientific Communication

Subject Code	**MTMI205**	**IA Marks**	**30**
Number of Lecture Hours/Week	**04**	**Term End Exam Marks**	**70**
Total Number of Lectures per Hour	**40**	**CREDITS** ', .	**04**

Unit-1:

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness**,** Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising.

Unit-2: Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Unit-3:

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Unit-4:

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.

Unit-5:

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Text Books/Reference Books:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

Course Outcomes

CO1: Understand the principles and structure of effective scientific and technical writing.

CO2: Develop clarity, coherence, and conciseness in writing scientific documents such as theses, research papers, and project reports.

CO3: Apply appropriate grammar, punctuation, and style suitable for academic and professional communication.

CO4: Critically review and edit scientific texts for language, structure, and content accuracy.

CO5: Use standard formats and referencing styles (APA, IEEE, etc.) in technical writing

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CO5	Use standard formats and referencing styles (APA, IEEE, etc.) in technical writing	K5

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		3						2	1		
CO2	2			1		1			3	3		
CO3	3									1		
CO4		2	3			1			1			
CO5						1						
CO Average	2.66	2	3			1			2	1.66		

MTMI 206- Geotechnical Engineering Lab

Subject Code	**MTMI206**	**IA Marks**	**30**
Number of Lab Hours/Week	**02**	**Term End Exam Marks**	**50**
Total Number of Lectures per Hour	**40**	**CREDITS** ', .	**02**

List of Experiments:

1. Determination of moisture content and specific gravity of soil
2. Grain size distribution analysis and hydrometer analysis
3. Atterberg limits (liquid limit, plastic limit, shrinkage limit)
4. Field identification tests
5. Vibration test for relative density of sand

6. Standard and modified proctor compaction tests
7. Falling head permeability test and constant head permeability test
8. CBR

MTMI 207- Mine Ventilation And Planning Lab

Subject Code	MTMI207	IA Marks	30
Number of Lab Hours/Week	02	Term End Exam Marks	50
Total Number of Lectures per Hour	40	CREDITS	02

List of Experiments:

1. Determination of air quantity.
2. Determination of air cooling power.
3. Detection of mine gases and construction of mine fans.
4. Performance of evasee.
5. Performance of fans in series and parallel.
6. Determination of weisbach coefficient.
7. Study and analysis of ventilation network.
8. Study of Fire extinguishers, rescue and reviving apparatus.
9. Study of various types of stopings and re-opening a sealed off area.
10. Konimeter, gravimetric dust sampler and personal dust sample.