National Institute of Technology Karnataka, Surathkal

An Institute of National Importance



2026
UNDERGRADUATE CURRICULUM

Regulations, course structures and detailed syllabi for the eleven B.Tech. programmes of the Institute

NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA

SURATHKAL

(An Institute of National Importance under the Ministry of Education, Government of India)

U N D E R G R A D U A T E

C U R R I C U L U M

2 0 2 6

Bachelor of Technology (B.Tech.) Programmes

Academic Regulations • Course Structure • Detailed Syllabus

Surathkal, Mangaluru – 575 025, Karnataka, India

Department of Mining Engineering (MN)
Bachelor of Technology in Mining Engineering

Basic Science Courses (BSC)

MA105N	Probability and Statistics	(3-0-0)3
MA107N	Multivariable Calculus	(3-0-0)3
PH100N	Engineering Physics	(3-0-2)4
CY100N	Engineering Chemistry	(3-0-2)4
UC102N	Biology and Environment	(3-0-0)3
UC103N	Indian Knowledge System	(3-0-0)3

General Engineering Courses (GEC)

CS101N	Computer Programming (Python)	(0-0-6)3
UC100N	Data Science and AI	(2-0-2)3
UC101N	Introduction to Engineering	(2-0-2)3
DE100N	Design Thinking and Prototyping	(2-0-2)3

Life Skill Courses (LSC)

PL1XWN	Life skill - Activities - 1	(0-0-8)4
PL1YWN	Life skill - Activities - 2	(0-0-8)4
PL2XWN	Life skill - Activities - 3	(0-0-8)4
PL2YWN	Life skill - Activities - 4	(0-0-8)4
PL3XWN	Life skill - Activities - 5	(0-0-8)4

NCC Option under Life Skill Courses (LSC)

PL1X9N	NCC - Activities - 1	(0-0-8)4
PL1Y9N	NCC - Activities - 2	(0-0-8)4
PL2X9N	NCC - Activities - 3	(0-0-8)4
PL2Y9N	NCC - Activities - 4	(0-0-8)4
PL3X9N	NCC - Activities - 5	(0-0-8)4

Programme Core Courses (PCC)

CE207N	Mining Geology	(2-0-0)2
CE257N	Mining Geology Lab	(0-0-2)1
MN200N	Mine Surveying	(1-1-2)3
MN201N	Underground Coal Mining	(2-1-0)3
MN202N	Drilling and Blasting Engineering	(2-1-0)3
MN203N	Surface Mining Technology	(2-1-0)3
MN204N	Mining Machinery	(2-1-0)3
MN250N	Mine Environment and Ventilation Engineering.	(1-1-2)3
MN251N	Rock Mechanics	(1-1-2)3
MN252N	Underground Metal Mining	(2-1-0)3
MN253N	Mine Planning and Design	(1-1-2)3
MN254N	AI/ML/IoT Application in Mining	(1-1-2)3
MN255N	Mine Evaluation	(2-1-0)3
MN300N	Mine Systems Engineering	(2-1-0)3
MN301N	Mine Hazards, Rescue and Recovery	(2-1-0)3
MN302N	Mineral Processing Technology	(2-0-2)3
MN303N	Health and Safety Engineering	(1-1-2)3
MN304N	Mine Legislation and Management	(3-0-0)3

Dept/Institute Elective Courses (DEC)

MN350N	Applied Mine Surveying	(3-0-0)3
MN351N	Noise Pollution and Control	(3-0-0)3
MN352N	Production Drilling for Oil Wells	(3-0-0)3
MN353N	Strata Mechanics	(3-0-0)3
MN354N	Advanced Surface Mining Technology	(3-0-0)3
MN355N	Mechanization and Materials Handling	(3-0-0)3
MN400N	Rock Fragmentation Engineering	(2-1-0)3
MN401N	Data Analytics in Engineering	(2-0-2)3
MN402N	Reliability Engineering	(2-1-0)3
MN403N	Rock Excavation Engineering	(3-0-0)3
MN404N	Tunneling and Underground Space Engineering	(3-0-0)3
MN405N	Application of Geoinformatics in Mining	(3-0-0)3
MN406N	Rock Slope Engineering	(3-0-0)3
MN450N	Industrial Engineering and Management	(3-0-0)3
MN451N	Coal Beneficiation	(3-0-0)3
MN452N	Mine Power System	(3-0-0)3
MN453N	Geostatistics	(3-0-0)3
MN454N	Instrumentation, Communication, and Automation	(2-1-0)3
MN455N	Mine Contract Management and Clearances	(3-0-0)3

Internships/Major Project Courses (IPC)

MN398N	Internship I	(0-0-18)9
MN448N	Internship II	(0-0-18)9
MN498N	Internship III	(0-0-18)9
MN399N	Major Project I	(0-0-18)9
MN449N	Major Project II	(0-0-18)9
MN499N	Major Project III	(0-0-18)9

Honors Courses

Students seeking an Honors degree shall earn a minimum of 15 additional credits from Postgraduate courses offered by the respective Department, as decided by the DUGC.

Suggested Plan of Study for B.Tech. in Mining Engineering:

Sem	I	II	III	IV	V	VI	VII	VIII
1	PH100N	CY100N	CE207N	CE257N	MN300N	MN398N/ MN399N	MN448N/ MN449N	MN498N/ MN499N
2	MA107N	MA105N	MN200N	MN250N	MN301N	Elective	Elective	Elective
3	CS101N	UC100N	MN201N	MN251N	MN302N	Elective	Elective	Elective
4	UC101N	DE100N	MN202N	MN252N	MN303N	Elective		
5	UC102N	UC103N	MN203N	MN253N	MN304N			
6			MN204N	MN254N				
7				MN255N				
8	PL1XWN/ PL1X9N	PL1YWN/ PL1Y9N	PL2XWN/ PL2X9N	PL2YWN/ PL2Y9N	PL3XWN/ PL3X9N			

Requirements for B.Tech. in Mining Engineering:

Category of Courses	Minimum Credits to be Earned
Basic Science Courses (BSC)	20
General Engineering Courses (GEC)	12
Life Skill Courses (LSC)	20
Programme Core Courses (PCC)	51
Dept/Institute Elective Courses (DEC) Optional: MOOC Courses (0 – 8 credits)	21
Internships/Major Project Courses (IPC)	27
Total	151

Requirement for Honors:

Minimum No. of Courses to be Registered	Minimum Credits to be earned
5	15

Requirement for Minors:

Minimum No. of Courses to be Registered	Minimum Credits to be earned
5	15

MN200N MINE SURVEYING (1-1-2) 3

Principles of Mine Surveying, Plain Scale, Vernier Scale, Sources of Error in surveying, Problem Solving. Classification, Plane and Geodetic surveying; Measurement of Length by tape, Tape Corrections, Precise Linear Measurements. Compass Surveying: Prismatic Compass and Surveyor's Compass. Calculation of angles from bearings; Errors in compass surveying, Problem Solving. Leveling: Definitions; Methods of leveling; Booking field data. Errors in leveling; problems Solving. Contouring: Contour interval; Characteristics of contours; methods of contouring; interpolation of contours; uses of contour maps. Theodolites: Construction and operation; tests and adjustments; angle measurements; errors and mistakes; problems. Theodolite Traverse: Marking of stations; signals; linear measurement; angular measurement. Methods of traversing; balancing of traverse; misclosure. Computation of coordinates and plotting; checks and errors; adjustments; problems. Computation of Areas and Volumes; Dip, Fault and Borehole Problems.

Punmia, B. C. (2005). Surveying Vol. I & II; Kanerkar. Survcying. Vol - I ≪ Ghatak, S. (nd). Mine surveying and levelling (Vols. 1–3).

MN201N UNDERGROUND COAL MINING (2-1-0) 3

Status and scope of underground coal mining in India; importance and challenges. Classification of coal reserves: proved, indicated, inferred; estimation of commercial reserves and annual output. Opening of coal deposits; inclines, vertical shafts, and adits; comparison of opening methods. Shaft sinking methods and applications; advantages and limitations of different modes of opening. Basic coal mining methods; classification and factors influencing choice of mining method. Bord and pillar mining: concept, layout, panel development, and mechanized and semi-mechanized development techniques. Panel design: size of pillars, headings, and districts; panel development from main dip. Equipment used in development: chain conveyor, SDL, LHD, GAL, shuttle car, continuous miner. Room and pillar mining and operational considerations. Depillaring methods: caving and stowing techniques; extraction of pillars. And case studies of depillaring practices in Indian coal mines. Longwall mining: factors affecting longwall operations; face layouts and supports. Thick seam mining methods: sublevel caving, slice mining, shield method and roof support systems.

Deshmukh, D. J. (2009). Elements of Mining Technology, Vol. 1 (8th ed.); Singh, R. D. (2022). Principles and Practices of Modern Coal Mining (2nd ed.); Singh, T. N. (1992). Underground Mining of Coal. Hartman, H. L. (Ed.). (1992); Introductory Mining Engineering (2nd ed.). Wiley. Hartman, H. L., & Mutmansky, J. M. (Eds.). (2007); SME Mining Engineering Handbook (3rd ed.); Singh, J. G. (2000). Coal Mining. Lovely Prakashan.

MN202N DRILLING AND BLASTING ENGINEERING (2-1-0) 3

Applications of drilling in mining, classification of drilling methods, Mechanisms of rock drilling, Factors influencing percussive and rotary drilling. Different types of drill machines, Alignment and deviation of boreholes, Drilling for exploration, production drilling and drill patterns, Developments in explosives, including the classification and properties of explosives, Developments in initiating devices, Storage and handling of explosives, Exploders, circuit testers, safety aspects in blasting, Blast Design, Blasting layouts.

Das, S. K. (1993). Explosives and blasting practices in mines (1st ed.). Lovely Prakashan; Pradhan, G. K. (2020). Explosives & blasting technotes. Lovely Prakashan, Bhandari, S. (1997); Engineering rock blasting operations. A.A. Balkema

MN203N SURFACE MINING TECHNOLOGY (2-1-0) 3

Dimensions of open pits, Techniques for determining final pit limits, Production drilling and drill machines, Characteristics of explosives, Surface blast design and recent trends in blasting, Constructional and operational features of excavation and loading equipment's, Constructional and operational details of transporting equipment's, Layouts in open pit mines and Methods of opencast mining. Layout of waste dumps,

Conventional and continuous mining systems, Environmental management and reclamation planning, Techno-economic evaluation of surface mining projects, DGMS Regulations pertaining to surface mines, Case studies.

Das, S. K. (1984). Surface Mining Technology. Lovely Prakashan; Misra, G. B. (1994) Surface Mining. Dhanbad Publishers; Deshmukh, D. J. (1988), Elements of Mining Technology (Vols. 1–3). Central Techno Publishers; Hustrulid, W., & Kuchta, M. (2006), Open Pit Mine Planning and Design, Vol. 1: Fundamentals. Taylor & Francis. Martin, J. W. (1982), Surface Mining Equipment. Martin Consultants.

MN204N MINING MACHINERY (2-1-0) 3

Basic Principles of Transport: Transport of men, material, and minerals in underground mines, Techno-economic indices of transport systems, motive power used in mines, Pit-Top and Pit-Bottom layout, Wire Ropes: Construction; classification; applications, Wire Ropes. Inspection; capping and slicing of ropes, maintenance; calculation; testing; and relevant statutes, Rope Haulage: Types, principles of operation, suitability, Safety appliances, Rope Haulage: Signal systems for Rope Haulge, Rope Haulge Calculations, Winding: winding system components, Drum winding and Koepe winding; suspension gear for drum and Koepe winding, Winding: safety devices; mechanical and electrical braking system; safety features, Conveyor Transport: Purpose; types of conveyors; principle of operation, Conveyor Transport: description; applications and problem solving, Mine Pumps: Purpose; types of pumps; Drainage Pumping and Sumps Problem Solving.

Principles of Mining Machinery and Systems, by Dr M.K Mallick and Dr R Hasim, Khwaab Publication, 2025; Ramlu, M. A. (n.d.). Mine hoisting. Oxford & IBH; Walker, S. C. (1988). Mine winding and transport. Elsevier; Kerlin, T. W. (n.d.) Mine Transport; Hartman, H. L., and Mutmansky, J. M. (Eds.). (2007). SME Mining Engineering Handbook (3rd ed.). Society for Mining, Metallurgy, and Exploration (SME); Ghatak, S. (2007). Mine Hoisting. Lovely Prakash.

MN250N MINE ENVIRONMENT AND VENTILATION ENGINEERING (1-1-2) 3

Composition of mine atmosphere; major and minor gases in underground mines, Mine gases: production, properties, physiological effects, and detection methods, Methane occurrence in coal seams; methane emission sources and methane layering, Mine fires, fumes and harmful gases; monitoring and control measures, Sources of heat in mines; effects of heat and humidity on workers, Psychrometry; measurement of humidity and thermal conditions in underground mines, Airflow through mine openings; resistance of mine airways and Atkinson’s equation, Equivalent orifice concept; splitting of air current and ventilation standards, Natural ventilation: causes, seasonal variation, and calculation of natural ventilation pressure (NVP), Mechanical ventilation; types of mine fans and theory of centrifugal and axial fans, Fan characteristics, operating curves, fan laws, and selection of suitable mine fans. Forcing and exhaust ventilation systems; auxiliary ventilation in headings and development workings, Ventilation planning and layouts for underground coal mines. Ventilation surveys, measurement techniques, and interpretation of ventilation data.

Hartman, H. L. (1982). Mine Ventilation and Air Conditioning. John Wiley & Sons; Mishra, G. B. (1986). Mine Environment and Ventilation. Oxford University Press; Vardhan, H. An Introduction to Underground Mine Environment and Ventilation. NPTEL; Vutukuri, V. S., & Lama, R. D. (1986). Environmental Engineering in Mines. Cambridge University Press.

MN251N ROCK MECHANICS (1-1-2) 3

Definition, Applications of Rock Mechanics. Evolution of ISRMRE, Physical properties of rocks, Mechanics properties of rocks, Elastic constants under static and dynamic loading, Prediction of rock properties, Introduction to RsData software, Analysis of stresses and strains, Mohr’s representation of stress & strains and strain relationships, Stress distribution around circular and different shaped openings, Theories of failure, Objectives and rock mass classifications, Prediction of Subsidence, Prevention of subsidence, subsidence survey.

Goodman, R. E. (1989). Introduction to rock mechanics (2nd ed.). Wiley; Obert, L. and Duvall, W. I. (1967). Rock mechanics and the design of structures in rock. Wiley; Peng, S. S. (1978). Coal mine ground control. Wiley; Deb, D. and Verma, A. K. (2025). Fundamentals and applications of rock mechanics (2nd ed.). PHI Learning Pvt. Ltd; Vutukuri, V. S. and Lama, R. D. (1974–1978). Handbook on mechanical properties of rocks (Vols. 1–4). Trans Tech Publications.

MN252N UNDERGROUND METAL MINING (2-1-0) 3

Introduction to underground metal mining; characteristics of metalliferous ore deposits, Development and opening of ore deposits; selection of main entries, Planning dimensions of underground metal mines; determination of level interval and mine life, Stope production services: drawpoints, ore passes, chutes, and loading arrangements, Classification of stoping methods: supported, unsupported, and caving techniques. Supported stoping methods and applications in metal mines. Unsupported stoping methods and operational considerations, Caving methods and introduction to block and sublevel caving, Backfilling operations; materials, techniques, and paste filling methods, Cavability index and Laubscher cavability classification system, Stope design using Mathews stability graph approach and stability zones, Selection of mining methods based on geo-mining conditions and deep mining challenges, Solution mining and in-situ leaching methods for mineral extraction, Techno-economics of metal mining projects; case studies of open-pit to underground conversion.

Hartman, H. L. (1987). Introductory Mining Engineering. John Wiley & Sons; Hustrulid, W. A. (1985). SME Handbook on Metalliferous Mining. SME; NIOSH–Snowden (2016). Geological and Mining Reports of Underground Metal Mining, Vol. 2, Selected research articles from journals and conference proceedings related to course topics.

MN253N MINE PLANNING AND DESIGN (1-1-2) 3

Exploration, resource, and reserve estimation, UNFC classification of mineral resources and ore reserves estimation, Different Mine Planning Stages: Micro and macro planning, Pre-feasibility and Feasibility Study: Function and preparation; DPR for metallic minerals and non-metallic minerals, Design for Mining the Mineral Deposits by Open-pit Mining: Determination of size of mine, life of mine, and production rates, Design for Mining the Mineral Deposits by Open-pit Mining: the ultimate open pit profile based on physical and economical parameters; optimum pit design, Design for Mining Mineral Deposits by Underground coal Mining: Determination of size of mine, life of mine, design of pillar and stope, and production rates, Mine Environment and Reclamation: Purpose, concepts, standards, plans, methods, Production planning and scheduling; categorization of mines, Introduction to mineral block auctioning; contracting, Mine-Develop-Operate (MDO) concept; land acquisition and liaisoning for mining project.

Bhattacharya, J. (n.d.). Principles of mine planning. Allied Publishers; Cummins, A. B. and Givens, I. A. (n.d.). SME handbook. Society of Mining Engineers of the American Institute of Mining, Metallurgical, and Petroleum Engineers; Hustrulid, W. A. (n.d.). Underground mining methods handbook. Society for Mining, Metallurgy, and Exploration; Hustrulid, W. A. and Kuchta, M. (n.d.). Open pit mine planning and design (Vol. 1). A. A. Balkema, Deshmukh, D. J. (n.d.). Elements of mining technology (Vol. 3). Central Techno Publications.

MN254N AI/ML/IOT APPLICATION IN MINING (1-1-2) 3

Overview of Artificial Intelligence (AI), Machine Learning (ML), and Internet of Things (IoT): Basic concepts and terminologies in AI and ML; B supervised, unsupervised, and reinforcement learning techniques; Overview of Artificial Intelligence (AI), Machine Learning (ML), and Internet of Things (IoT): introduction to neural networks and other prediction models, IoT Architecture and Components Relevant to Mining: Different types of sensors and communication systems like ZigBee, LoRa, IoT-Based Monitoring in Mining: Monitoring of environmental conditions, human body fatigue, equipment health, and ground movement using IoT sensors, IoT Data Acquisition and Real-Time Control: Data acquisition, transmission, processing, and real-time monitoring and control of mining operations through IoT systems, Role of AI, ML, and IoT in Smart Mining:

Significance, applications, and impact of AI, ML, and IoT technologies in enhancing safety, productivity, and operational efficiency in modern mining, Concept of AIoT in Mining: Fundamentals of Artificial Intelligence of Things (AIoT) and its relevance to smart and digital mining. AIoT for Intelligent Mining Systems: Designing intelligent systems for autonomous decision-making, process automation, and operational optimization in mining, Integration of AI/ML with IoT: Challenges, limitations, and solutions for integrating AI/ML models with IoT infrastructure in mining applications, Case Studies: Highlighting successful implementations in the mining industry; utilizing AI/ML/IoT for hazard detection and accident prevention; Case Studies on Smart Mine Monitoring: Underground environmental monitoring, worker health and safety monitoring using wearable IoT devices, and intelligent monitoring of mining operations, Case Studies on Intelligent Safety Systems: Slope stability monitoring, blast vibration monitoring, and AI/ML/IoT-enabled emergency response and disaster management systems, Mine Digitization: Concept, need, and scope of digital transformation in mining.

Russell, S. and Norvig, P. (2022). Artificial intelligence: A modern approach (4th ed.), Pearson Education; Müller, A. C. and Guido, S. (2016). Introduction to machine learning with Python. Shroff/O'Reilly; Bahga, A. and Madisetti, V. (2015). Internet of things: A hands-on approach. Orient Blackswan Private Limited; Chaulya, S. K. and Prasad, G. M. (2016). Sensing and Monitoring Technologies for Mines and Hazardous Areas. Elsevier; Deshmukh, D. J. (n.d.). Elements of mining technology (Vol. 3). Central Techno Publications.

MN255N MINE EVALUATION (2-1-0) 3

Introduction to mineral resources, resource classification, and National Mineral Policy, National mineral policies, sustainable development, and strategies for mining industry growth, Resource conservation principles and sustainable utilization of mineral resources, Mineral taxation, royalties, subsidies, and import-export regulations, Mineral trade, commodity markets, and derivatives in mineral trading, Mineral pricing mechanisms and factors influencing mineral prices, Sampling methods and techniques for mineral reserve estimation, Reserve estimation methods and economic block model concepts, Introduction to mine evaluation and stages of mining projects, Mining project evaluation using economic and financial analysis techniques. Economic evaluation techniques: NPV, IRR, Payback Period, Benefit-Cost Ratio, Determination of optimum mine size and production planning, Risk analysis and investment decision-making in mining projects.

Annels, A.E., Mineral Deposit Evaluation: A Practical Approach, Chapman Hall, 1991. Deshmukh; R.T., Mine and Mineral Economics, Emdee Publishers, 1986; Edwards, A. C., Mineral Resource and Ore Reserve Estimation, Australasian Institute of Mining and Metallurgy, 2001.

MN300N MINE SYSTEMS ENGINEERING (2-1-0) 3

Introduction to systems concept, analysis and systems engineering, Models in system analysis, Linear programming, graphical and simplex methods for solving linear programs, Sensitivity analysis in linear programming, Primal and dual linear programs, Integer programming algorithms, Network techniques for mining projects, CPM and PERT techniques and Transportation and assignment models, Dynamic programming, Deterministic and stochastic decision theory, Inventory control models and Queuing theory, Simulation techniques for equipment selection and production scheduling, Significance of management information systems in controlling and managing the mining activities.

Taha, H.A., Operations Research: An Introduction, 10th Edition, Pearson, 2017; Srinivasan, G., Operations Research: Principles and Applications, PHI Learning, 3rd Edition, 2017; Hillier, F.S. and Lieberman, G.J., Introduction to Operations Research, 11th Edition, McGraw Hill, 2020; Cummins, A.B., Mining Engineers Handbook, Vol. II, SME, AIME, New York, 1973.

MN301N MINE HAZARDS, RESCUE, AND RECOVERY (2-1-0) 3

Introduction to mine hazards; classification of mine disasters and safety principles, Mine fires: causes, classification, and characteristics of underground fires, Spontaneous combustion of coal; mechanism and stages of spontaneous heating. Factors influencing spontaneous combustion; detection and monitoring

techniques, Prevention and control of mine fires; fire stoppings and sealing of fire areas. Direct and indirect methods of dealing with mine fires; reopening sealed areas, Mine explosions: firedamp explosions, explosive limits, and causes, Coal dust explosions; prevention measures and Ellicot's explosibility graph, Intrinsically safe apparatus, flameproof enclosures, and ingress protection, Mine inundation: causes, prevention, and design of water dams, Approaching old workings; precautions and dewatering of waterlogged mines, Rescue and recovery: rescue equipment, apparatus classification, artificial respiration techniques, Emergency organization, locating trapped miners, recovery of injured persons, and first aid, Airborne respirable dust, dust diseases, sampling, suppression, and illumination standards in mines.

Ramlu, M. A. (1991). Mine Fires, Explosions, Rescue, Recovery & Inundations. Oxford & IBH Publishing; Rakesh & Lele, M. G. (1970). Inundation in Mines; Chaulya, S. K., & Prasad, G. M. (2016). Sensing and Monitoring Technologies for Mines and Hazardous Areas. Elsevier.

MN302N MINERAL PROCESSING TECHNOLOGY (2-0-2) 3

Importance of minerals in economy; role of beneficiation in metallurgical industries, Concept of liberation and importance in mineral processing, Theories of comminution and energy considerations, Crushing equipment, grinding mills, applications, and limitations, Comminution circuits and their design considerations, Sizing techniques and industrial screening methods. Performance of screens and interpretation of sizing data, Laws of settling and classification of particles in fluids, Types of classifiers and their selection and performance, Gravity concentration and dense media separation techniques. Magnetic, electrostatic separation, and flotation methods, Beneficiation of low-grade ores and coal preparation techniques, Solid-liquid separation: thickeners and filtration systems, Plant practices: flow sheets, metallurgical accounting, and process control.

Gupta, A., & Yan, D. S. (2003). Principles of Mineral Processing. SME; Ramakrishna Rao, G. S. (2016). Mineral Processing Design and Operations. Elsevier; Weiss, N. L. (1985). Mineral Processing Handbook, Vols. 1–2; Wills, B. A. (1989). Mineral Processing Technology (4th ed.); Mineral Processing Techniques: Basics and Related Issues. Zorba Publishers.

MN303N HEALTH AND SAFETY ENGINEERING (1-1-2) 3

Illumination standards and visual fatigue in workplaces, Whole body vibration and musculoskeletal disorders in mining operations, Principles of accident analysis and accident causation theories, Accident investigation procedures and accident reporting methods, Safety performance indices: frequency rate, severity rate, and accident statistics, Risk management terminology and basic concepts of hazard and risk. Risk management objectives and risk management process, Risk estimation techniques and qualitative risk assessment methods, Risk control strategies and hierarchy of control measures, Safety management systems and preparation of safety management plans, Case studies on occupational safety and risk management in mining operations, Whole body vibration and musculoskeletal disorders in mining operations, Illumination standards and visual fatigue in workplaces. Principles of accident analysis and accident causation theories.

Ramlu, M. A. (1991). Mine Fires, Explosions, Rescue, Recovery & Inundations. Oxford & IBH Publishing; Rakesh & Lele, M. G. (1970). Inundation in Mines; Chaulya, S. K., & Prasad, G. M. (2016). Sensing and Monitoring Technologies for Mines and Hazardous Areas. Elsevier.

MN304N MINE LEGISLATION AND MANAGEMENT (3-0-0) 3

History and development of mine legislation in India; regulatory framework overview, Payment of Wages Act and Provident Fund Act: important statutory provisions, Mines Act 1952: objectives, definitions, and key provisions, Mines Rules 1955: provisions related to working conditions and employee welfare, Coal Mines Regulations 2017: safety, health, and operational requirements, Metalliferous Mines Regulations 1961: key provisions and applicability, Mines and Minerals (Regulation and Development) Act 1958: provisions and amendments, Mineral Conservation and Development Rules 2016: objectives and applicability, Mines Rescue Rules 1985 and Vocational Training Rules 1966. , Indian Electricity Rules 1956: provisions applicable to mining

operations, Accident causes, preventive measures, and accident analysis statistics. Safety management plans, safety audits, and accident enquiry reports, Important DGMS circulars: safety directives and compliance requirements. National Mineral Policy 2019: classification of minerals and policy implications.

Rakesh and Prasad, N. (1986). Legislation in Indian Mines: A Critical Appraisal. Ashalata Publications. Singh, C. P. (2004); Occupational Safety and Health in Industries and Mines. Tata McGill; Directorate General of Mines Safety. (n.d.). The Mines Act, Rules and Regulations. Commercial Law Publishers / Universal Law Publishing.

MN350N APPLIED MINE SURVEYING (3-0-0) 3

Basic principle of triangulation survey, Signals, towers and satellite station, Principles of tacheometry surveying, Various methods of tacheometric surveying, Principles of curve ranging and laying of curves in surface and underground, Aerial photogrammetry and field astronomy, Principles of correlation survey – Transferring coordinates and Correlation survey - Transferring RL, Total Station, GPS and DGPS, Solving problems, Drone surveying, Plans, Sections and IBM Rules & Regulations

Punmia, Surveying Vol - I, II & III; Kanetkar, Surveying, Vol – I, II & III; S. K. Duggal, Surveying, Viol. I & II; Ghatak, Mine surveying, Vol - I, II, III.

MN351N NOISE POLLUTION AND CONTROL (3-0-0) 3

Noise measurement techniques for individual noise sources, Noise measurement practices in industrial, Noise measurement practices in community environments, Basic principles of noise control engineering, Noise control in underground mining machinery and equipment, Noise control in heavy earth moving machinery and mineral processing plants, Hearing protective devices: types, working principles, and noise reduction capabilities, Noise impact prediction using mathematical Modelling techniques, Noise pollution assessment and management in industrial sectors, Noise abatement methods: sound absorption, acoustic barriers, vibration isolation, and damping, Noise-induced human vibration, health effects, and control measures, Noise control measures.

Harris, C. M. (1979). Handbook of Noise Control. McGraw-Hill; Pal, A. K., & Saxena, N. C. (1999). Noise Pollution in Coal Mining Complexes. ENVIS Centre of Mining Environment, ISM; Thumann, A., & Miller, R. K. (1976). Secrets of Noise Control. The Fairmont Press.

MN352N PRODUCTION DRILLING FOR OIL WELLS (3-0-0) 3

Introduction to oil wells and petroleum drilling operations, Drilling rigs and systems; rotary drilling fundamentals, Drill bits: tricone roller and PDC bits, Drill string components and pipe handling practices, Drilling fluids: functions and properties, Basic drilling hydraulics and circulation systems. Drilling problems: stuck pipe, lost circulation, twist-offs, Routine drilling operations and logging techniques, Well control principles and kick detection. Blowout prevention and shut-in procedures, Directional drilling basics and downhole tools, Well completion: casing design, cementing, integrity testing, Well stimulation methods: acidizing and hydraulic fracturing, Case studies in oil well drilling operations.

Conaway, C. F. The Petroleum Industry; Gerding, M. Fundamentals of Petroleum (3rd ed.).

MN353N STRATA MECHANICS (3-0-0) 3

Introduction to strata mechanics; scope and significance in mining, Differences between rock mechanics and strata mechanics; strata control objectives, Strata conditions before and after mining operations, Theories of strata behavior and ground movement, Stress redistribution in bord and pillar workings and longwall mining systems, Ground movement monitoring techniques and instrumentation, Instruments: extensometers, telltales, stress meters, LVDT, vibrating wire devices, In-situ stress measurement techniques: flat jack, over-coring, hydraulic fracturing, Pillar design, functions, failure mechanisms, and stability assessment, Subsidence:

mechanisms, prediction, and control methods, Rock bursts: causes, prediction, and mitigation techniques. Caving, cavability index, and applications in mining, Rock mass classification systems (RMR, Q, GSI) and support design.

Deb, D., & Verma, A. K. (2025). Fundamentals and Applications of Rock Mechanics (2nd ed.). PHI Learning; Galvin, J. M. (2016). Ground Engineering for Underground Coal Mining. Springer; Hartman, H. L. (Ed.). SME Mining Engineering Handbook; Jeremic, M. L. (1985). Strata Mechanics in Coal Mining; Peng, S. S. (1978). Coal Mine Ground Control. Wiley.

MN354N ADVANCED SURFACE MINING TECHNOLOGY (3-0-0) 3

Detailed classification of surface mining equipment's and their constructional features, Operational features of HEMM, Unit operations in surface mine projects, Selection of machinery for various operations, Loading equipment's - Cyclic type and Continuous type, Transporting equipment's – Cyclic type and Continuous type, Auxiliary/Miscellaneous equipment's, Applicability, equipment selection criteria and inputs, Computations for the capacity and number of machines vis-à-vis mine production, DGMS regulations pertaining to safety of HEMM, Advanced surface mining methods, Maintenance of HEMM, Automation and application of IoT in HEMM.

Martin & Martin, 1982, Surface Mining Equipment, Martin Consultants, U.S.A; Amithish Dey, Latest Developments of Heavy Earth Moving Machinery, Dhanbad Book Stores; Hartman H. L. Introductory Mining Engineering, John Wiley & Sons.

MN355N MECHANIZATION AND MATERIALS HANDLING (3-0-0) 3

Introduction to mechanization and materials handling in mining, Locomotive haulage systems and rolling stock, Haulage calculations and performance analysis, Belt conveyors: components and working principles. Conveyor capacity, tension, and power calculations, Safety devices and cable belt conveyors, Intermediate storage and in-pit crushing systems, High-angle conveyors and loading systems, Slurry transport and pipeline systems, Face machinery and productivity of loading machines, Material handling systems in opencast mining. Aerial ropeways: design, construction, and calculations, Plant layout: hydraulic, pneumatic stowing and paste filling, Automation, maintenance, and safety in materials handling systems.

Deshmukh, D. J. (1994). Elements of Mining Technology, Vol. 3; Morley, L. A. (1990). Mine Power Systems; Ramlu, M. A. (1996). Mine Hoisting; Reese, C. (2000). Material Handling Systems; Tatiya, R. R. (2005). Surface and Underground Excavation; Walker, S. C. (1988). Mine Winding and Transport.

MN400N ROCK FRAGMENTATION ENGINEERING (2-1-0) 3

Bulk Explosive Systems, Blast Designs, Substitutes for Explosives, Mechanisms of Rock Fragmentation Due to Blasting: Theories and importance, Prediction and assessment of fragmentation, Environmental Effects of Rock Blasting, Controlled blasting techniques, Under water blasting, Case studies of mining and infra projects, Various Legal Aspects Related to Rock Blasting, Economic evaluation of blasting projects, Overview of Different Software Used in Blast Design and Assessment.

Bhandari, S. (1997). Engineering rock blasting. A. A. Balkema; Konya, C. G. (1989). Blast design. CRC Press; Persson, P. A. (1986). Rock fragmentation. International Development Corporation.

MN401N DATA ANALYTICS IN ENGINEERING (2-0-2) 3

Introduction to data analytics in engineering and mining applications, Data-driven decision-making and data types in mining, Statistical techniques for geological and geotechnical data analysis, Regression and classification techniques in engineering analytics, Data analytics in mine safety and risk assessment, Predictive analytics for injury and accident data, Sensor-based data analytics for fatigue and worker health monitoring, Hazard prediction using machine learning models, Case studies on accident prevention using

AI/ML. Predictive Modelling of rock characterization using deep learning, Seismic data analysis in underground mining, Data visualization and interpretation techniques, Applications of analytics in operational optimization. Integrated case studies and project-based applications.

Maiti, J. (2020). Multivariate Statistical Modelling in Engineering and Management. CRC Press; Soofastaei, A. (2020). Data Analytics Applied to the Mining Industry. CRC Press.

MN402N RELIABILITY ENGINEERING (2-1-0) 3

Introduction to reliability, quality, and system performance, Reliability in system life cycle and engineering applications, Failure concepts, failure modes, and causes of failure, Maintainability and availability concepts, Reliability improvement techniques. Reliability block diagrams: series and parallel systems, Combined systems and redundancy concepts, FMECA and failure analysis techniques, FRACAS and reliability data management, Fault tree analysis (FTA) and system failure analysis, Markov models and system state analysis, Availability, downtime, and performance measures, Reliability-centered maintenance and applications. Reliability management, culture, and software applications.

Ebeling, C. E. (2017). Reliability and Maintainability Engineering. Tata McGraw Hill; Kapur, K. C., & Pecht, M. (2014). Reliability Engineering. Wiley.

MN403N ROCK EXCAVATION ENGINEERING (3-0-0) 3

Introduction to rock excavation in mining and infrastructure projects, Excavation methods: drilling and blasting, mechanical excavation, Excavation equipment and material handling systems, Selection criteria for excavation equipment, Excavation planning and project management principles, Excavation in sensitive and urban areas. Differences between mining and infrastructure excavation projects, Environmental impact assessment in excavation projects, Environmental management and mitigation measures, Economic evaluation of excavation projects, Case studies: mining, quarry excavation, tunneling and underground projects, Case studies: hydel, pipeline, and canal excavation projects, Case studies: large caverns and infrastructure excavation projects.

Balci, C. et al. (2013). Mechanical Excavation in Mining and Civil Industries. CRC Press; Bhandari, S. (1997). Engineering Rock Blasting; Ghose, A. K., & Singh, R. N. (2006). Engineered Rock Structures.

MN404N TUNNELING AND UNDERGROUND SPACE ENGINEERING (3-0-0) 3

Introduction to tunneling and underground space engineering, Historical developments and scope of tunneling, Types of underground excavations and influencing parameters, Geological investigations and rock mass classification, Stress distribution around tunnels and design considerations, tunneling methods: soft ground and hard rock tunneling. Shallow and deep tunneling techniques, Drilling pattern and blast design in tunnels, tunneling by road headers and impact hammers, Tunnel boring machines: principles, selection, and performance, NATM and modern tunneling approaches, Tunnel supports and ground treatment techniques. Tunnel services: ventilation, drainage, illumination, communication, Excavation of large caverns and tunneling hazards.

Bickel, J. O. et al. (1997). Tunnel Engineering Handbook; Clark, G. B. (1987). Principles of Rock Fragmentation; Hudson, J. A. Rock Engineering Systems; Johansen & Mathiesen (2000). Modern Trends in Tunnelling.

MN405N APPLICATION OF GEOINFORMATICS IN MINING (3-0-0) 3

Basics of geographic information systems and spatial data concepts, Remote sensing principles, sensors, platforms, and satellite imagery, Fundamentals of GPS/GNSS and positioning techniques, Applications of GIS in mineral exploration and resource mapping, Use of remote sensing in mine planning and surface mapping. Haul road alignment and mine infrastructure planning using GIS, Overburden dump monitoring and slope stability analysis using geospatial data, Subsidence monitoring and deformation analysis using remote sensing

techniques, Land use and land cover change detection in mining areas, Mine water drainage analysis and watershed mapping using GIS. Mine reclamation and land rehabilitation planning using geospatial techniques, Environmental impact assessment using geoinformatics tools, Basics of geographic information systems and spatial data concepts, Remote sensing principles, sensors, platforms, and satellite imagery.

Bhatta, B. (2016). Remote Sensing and GIS (2nd ed.). Oxford Publishing House; El-Rabbany, A. (2002). Introduction to GPS: The Global Positioning System. Artech House; Lillesand, T., & Kiefer, R. W. (2015). Remote Sensing and Image Interpretation (7th ed.). John Wiley & Sons.

MN406N ROCK SLOPE ENGINEERING (3-0-0) 3

Introduction to slope stability in surface mines. Mechanisms of slope failures: planar, circular, wedge, and toppling failures, Description, derivation, and calculation of different slope failure mechanisms, Field investigations and data collection methods: geological mapping, discontinuity surveys, and sampling techniques, Geotechnical investigations and characterization of rock and soil masses for slope stability assessment, Laboratory testing methods: density, moisture content, strength properties, and permeability tests, Design of mine slopes using limit equilibrium analysis methods, Numerical Modelling techniques for slope stability analysis and interpretation of results, Slope stabilization methods: mechanical, drainage, reinforcement, retaining structures, and their applications, Slope failure monitoring techniques: total station monitoring and extensometers, Advanced monitoring systems: crack meters, borehole extensometers, and slope stability radar, Case studies of slope failures and stabilization practices in surface mines, Relevant mining statutes, regulations, and best practices related to slope stability and monitoring in surface mines.

Brawner, C. O. (1982). Stability in surface mining. Society for Mining, Metallurgy, and Exploration; Deb, D. and Verma, A. K. (2025). Fundamentals and applications of rock mechanics (2nd ed.). PHI Learning Pvt. Ltd.; Giani, F. (1992). Rock slope stability analysis; Hoek, E. and Bray, J. W. (1984). Rock slope engineering. John Wiley & Sons.

MN450N INDUSTRIAL ENGINEERING AND MANAGEMENT (3-0-0) 3

Concepts of management and organization; functions of management, Organizational structures and departmentation, Motivation theories and workplace behavior, Leadership styles and effectiveness, Group dynamics and conflict management, Introduction to work study and productivity improvement, Time study techniques and work measurement. Job evaluation methods and wage determination, Project management fundamentals and life cycle. Network techniques: CPM and PERT, Human resource management principles, Total quality management concepts and tools, Job satisfaction and organizational behavior, Case studies in industrial engineering and management.

Khanna, O. P., & Rai, D. (2005). Industrial Engineering and Management; Barnes, R. M. Motion and Time Study; Besterfield, D. H. Total Quality Management; Chase et al. (2003). Operations Management; Koontz & Weihrich. Principles of Management.

MN451N COAL BENEFICIATION (3-0-0) 3

Introduction to coal beneficiation and its importance, Coal quality parameters and classification of coal, Washability characteristics and sink-float analysis. Washability index and degree of washability, Coal washeries and preparation plant operations, Jigs and heavy media cyclone applications, Coal cleaning techniques for coarse coal, Fine coal beneficiation and flotation techniques, Beneficiation of non-coking coal and dry beneficiation methods, Automation and quality control in coal preparation plants, Environmental management in coal beneficiation, Coal handling plant layout and operation. Coal transportation systems and material handling, Case studies in coal beneficiation and plant performance.

Muthui, R. K. et al. (2014). Coal Handling and Equipment Selection; Prochaska, E. Coal Washing; Weiss, N. L. (1985). Mineral Processing Handbook, Vol. 2

MN452N MINE POWER SYSTEM (3-0-0) 3

Electric power in mining; Three-phase circuit analysis, Mine power system components, basic mine power distribution arrangements, Distribution of electrical power in surface and underground mines, Grounding systems, ground wire monitoring; Distribution cable construction and selection, stresses in cables, cable codes, Power flow calculations, power factor correction, Design of substations, switch houses and power centers, Substation grounding and protection, Method of symmetrical components and mine power system fault analysis, Transients and overvoltages in mine power systems, Mine power system protection equipment and relaying, Relaying schemes for overload, phase-to-phase and ground fault protection, Legislative and safety aspects.

Morley, L.A., Mine Power Systems, US Bureau of Mines Information Circular 9258, 1990; Stevenson, W.D., Elements of Power System Analysis, 4th Edition, McGraw Hill, 1982; Kothari, D.P. and Nagrath, I.J., Modern Power System Analysis, 4th Edition, McGraw Hill, 2011.

MN453N GEOSTATISTICS (3-0-0) 3

Introduction to Statistical Theory and Geostatistics Concepts: Principles, Introduction to Statistical Theory and Geostatistics Concepts: applications, advantages/disadvantages, limitations, Sampling: Sample preparation and data collection, Sampling: types, methods, procedures, Assaying: Assay methods and data collection; types, methods, procedures, Resources Estimation Techniques: Concepts of nugget, sill, range; regionalized variables; geometric methods, Resources Estimation Techniques: geometric methods; Variance: Concepts, computations, Modelling; Variogram: Functions, mathematical models, computations, Modelling, Resources Estimation Techniques: Semi-variogram: Functions, mathematical models, computations, Modelling; Kriging: Concepts, types, practices, Geostatistical Conditional Simulation Methods: Resource estimation, Geostatistical Conditional Simulation Methods: methods, methodology, Case Studies of Geostatistics Applications in mining, Case Studies of Geostatistics Applications in Different Areas.

Chilès, J.-P. and Delfiner, P. (1999). Geostatistics: Modelling spatial uncertainty. John Wiley & Sons; Gandhi, S. M. and Sarkar, B. C. (2016). Essentials of mineral exploration and evaluation. Elsevier; Kitanidis, P. K.(1997). Introduction to geostatistics: Applications in hydrogeology. Cambridge University Press; Lantuéjoul, C. (2002). Geostatistical simulation: Models and algorithms. Springer; Deshmukh, D. J. (n.d.). Elements of mining technology (Vol. 3). Central Techno Publications.

MN454N INSTRUMENTATION, COMMUNICATION, AND AUTOMATION (2-1-0) 3

Introduction to digital mine and smart mining concepts, LiDAR survey and 3D virtual mine Modelling, Real-time sensor data visualization and asset tracking systems, Miner tracking and hazard warning systems. Mine transport surveillance in opencast mines, GPS-RFID tracking, weighbridge automation, and access control systems, Wireless communication, V2X communication, and CCTV analytics, Slope monitoring, radar systems, and centralized surveillance. Underground monitoring: gases, dust, DPM, and safety systems, Strata monitoring, fire detection, and environmental monitoring systems, Underground communication: leaky feeder, Wi-Fi, and optical fiber systems, Trapped miner communication and integrated communication systems, Automation: pump, fan, conveyor, and traffic management systems, OITDS, collision avoidance systems, and centralized mine automation.

Bandyopadhyay, L. K. et al. (2014). Wireless Communication in Underground Mines. Springer; Chaulya, S. K., & Prasad, G. M. (2016). Sensing and Monitoring Technologies for Mines. Elsevier.

MN455N MINE CONTRACT MANAGEMENT AND CLEARANCES (3-0-0) 3

Introduction to mine contract management and MDO model in mining industry, Definitions and interpretation of key contractual terms and legal provisions, Scope of mining project; mining rights and compliance requirements, Appointment of Mine Developer and Operator; substitution and contractual obligations,

Responsibilities of MDO: development, operation, safety, environment, and reporting, Responsibilities of grantor: access, approvals, and payment obligations, Payment terms: structure, schedule, and financial considerations in contracts, Project timelines and milestones; monitoring and performance evaluation, Force majeure clauses: events, risks, and contractual implications, Termination clauses and procedures in mining contracts. Dispute resolution mechanisms and legal frameworks, Statutory clearances: prospecting license, mining lease, forest and environmental clearance, Pollution control consents under Air Act, Water Act; electrical and fire safety approvals. Land acquisition, rehabilitation and resettlement; compliance and case studies.

Model Mine Developer and Operator (MDO) Agreements (Government of India); Relevant provisions of Mining Laws, Environmental Laws, and DGMS Guidelines; Industry reports and case studies on mining contracts and clearances

CE207N MINING GEOLOGY (2-0-0) 2

General Geology: Interior of the Earth and Plate tectonics; Mineralogy and Petrology; Structural Geology: Dip and Strike, study of folds, faults, Joints, unconformities; Economic Geology: Magmatic, Hydrothermal, Sedimentary, Metamorphic deposits, oxidation and supergene enrichment, study of Gold, Iron, copper, lead, Zinc, Chromite, manganese, bauxite, mica, asbestos deposits. Exploration Geology: Stage of mineral exploration, Geological, Geophysical, geochemical and remote sensing methods of exploration. Applied Geology; Sampling, guides for locating ore deposits, geological mapping, Hydrogeology

Arogya Swamy, Courses in Mining Geology, Oxford & IBH, 1988
Haakon Fossen, Structural geology. Cambridge University Press, 2016.
Parbin Singh, Engineering and General Geology, Katson Pub., Delhi, Sixth edition 2001
Umeshwar Prasad, Economic Geology: Economic Mineral Deposits. CBS Pub., 2006.

CE257N MINING GEOLOGY LAB (0-0-2) 1

Identification of rock-forming minerals - Identification of ore-forming minerals - Identification of rocks (Igneous – Sedimentary – Metamorphic) – Interpretation of Geological Maps and cross sections - Interpretation and Analysis of Dip, Strike, Thickness and borehole problems in mining

Bose, N., & Mukherjee, S. (2017). Map interpretation for structural geologists (Vol. 1), Elsevier.
Rutley, F. (2012). Rutley's elements of mineralogy. Springer Science & Business Media.

MN398N/ MN448N/ MN498N INTERNSHIP – I/ II/ III (0-0-18) 9

Internship is an integral component of the B.Tech. curriculum intended to provide students with practical exposure and an opportunity to apply their academic knowledge in real-world engineering, research, and professional environments. Students may undertake internships in industry, R&D organizations, academic/research institutions, or other organizations approved by the Institute. Internships outside NITK shall require prior approval of the concerned Department. Of the three Internship/Major Project slots available during the sixth to eighth semesters, a student may undertake the Internship/Major Project outside NITK for a maximum of two semesters. The internship shall be carried out under the guidance of a faculty member of the Institute and an industry/research mentor and shall be evaluated based on the work undertaken, report, presentation, and other criteria prescribed by the DUGC of the respective Department.

MN399N MAJOR PROJECT - I (0-0-18) 9

The students jointly or individually will be assigned an experimental or a theoretical problem, to be carried out under the supervision of a guide. The project has to be completed in the VI, VII & VIII semester. The students should complete the preliminary literature survey and a part of the work in the VII semester. Their work will be reviewed and evaluated.