NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA, SURATHKAL

First Year Bachelor of Technology
List of Courses Common to All Undergraduate Programmes
Foundation Courses (FC)
Basic Science Core (BSC)

MA110	Engineering Mathematics – I	(3-0-0)	3
MA111	Engineering Mathematics – II	(3-0-0)	3
PH110	Physics	(3-1-0)	4
PH111	Physics Laboratory	(0-0-2)	1
CY110	Chemistry	(3-0-0)	3
CY111	Chemistry Laboratory	(0-0-3)	2

Engineering Science Core (ESC)

WO110	Engineering Mechanics	(3-0-0)	3
ME111	Engineering Graphics	(1-0-3)	3

Humanities and Social Science Core (HSC)

SM110	Professional Communication	(3-0-0)	3

Mandatory Learning Courses (MLC)

CV110	Environmental Studies	(1-0-0)	1
SM111	Professional Ethics and Human Values	(1-0-0)	1
ME100	Introduction to Design Thinking	(2-0-0)	2

Other courses under Engineering Science Core (ESC)

Computer Programming courses under ESC (Set 1 or Set 2 as specified by the Department offering the B.Tech. Programme)

Set 1

(For Computer Science, AI, IT, E &C branches only)

CS110	C Programming	(3-0-0)	3
CS111	C Programming Lab	(0-0-3)	2

Set 2

(For E & E, Mechanical, Civil, Mining, Metallurgy, Chemical Engineering branches only)

CS100	Python Programming	(3-0-0)	3
CS101	Python Programming Lab	(0-0-3)	2

EC100	Elements of Electronics and Communication Engineering	(2-0-0)2

(For Artificial Intelligence,Mechanical, Civil, Mining, Metallurgy, Chemical Engineering branches only)

EE110	Elements of Electrical Engineering	(2-0-0)2

(For Mechanical, Civil, Mining, Metallurgy, Chemical Engineering branches only)

ME110	Elements of Mechanical Engineering	(2-0-0)2

(For Computer Science, IT, E &C, E & E, Civil, Mining, Metallurgy, Chemical Engineering branches only)

Programme Specific Core Courses

Chemical Engineering
CH150	Process Calculations	(2-2-0)4

Civil Engineering
CV100	Civil Engineering Materials and Construction	(3-1-0)4

Computer Science And Engineering
CS112	Discrete Mathematical Structures	(3-1-0) 4
MA208	Probability Theory and Applications	(3-0-0) 3

Electrical & Electronics Engineering
EE101	Analysis Of Electric Circuits	(3-1-0)4
EE143	Mathematics For Electrical Engineers	(3-1-0)4

Electronics And Communication Engineering
EC101	Joy of Electronics and Communication	(2-0-3)4
EC102	Circuits and Systems	(3-1-0)4

Information Technology
IT110	Digital System Design	(3-0-2)4
IT150	Object Oriented Programming	(3-0-2)4

Artificial Intelligence
IT111	Fundamental of Computer Systems	(4-0-0) 4
IT112	Computer Systems Lab	(0-0-2) 1
IT150	Python Programming	(3-0-0) 3
IT151	Python Programming Lab	(0-0-2) 1

Mechanical Engineering
ME112	Materials Science and Engineering	(3-0-0)3
ME113	Mechanics of Deformable Bodies	(3-0-0)3

Metallurgical And Materials Engineering
MT160	Introduction to Material Science & Technology	(3-1-0)4

Mining Engineering
MI101	Introduction to Mining Engineering	(3-0-0)3

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Sugested Plan of Study:

GROUP – I (S1-S6)

Semester →	I	II
	(Physics Cycle)	(Chemistry Cycle)
1	MA110	MA111
2	PH110	CY110
3	EE110	CS100/CS110
4	ME110	WO110
5	EC100	CS101/CS111
6	PH111	CY111
7	SM110	CV110
8	SM111	ME100
9	ME111	PSC
10	PSC	

GROUP – II (S7-S14)

Semester →	I	II
	(Chemistry Cycle)	(Physics Cycle)
1	MA110	MA111
2	CY110	PH110
3	CS100/CS110	EE110
4	WO110	ME110
5	CS101/CS111	EC100
6	CY111	PH111
7	CV110	SM110
8	ME100	SM111
9	PSC	ME111
10		PSC

Note: Refer previous page for the Specific Courses details in Physics and Chemistry cycle corresponding to different department curriculum.

NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA, SURATHKAL

Department of Mining Engineering
Bachelor of Technology in Mining Engineering

Basic Science Core Courses (BSC)

CY110	Chemistry	(3-0-0)3
CY111	Chemistry Laboratory	(0-0-3)2
MA110	Engineering Mathematics - I	(3-0-0)3
MA111	Engineering Mathematics - II	(3-0-0)3
PH110	Physics	(3-1-0)4
PH111	Physics Laboratory	(0-0-2)1

Engineering Science Core Courses (ESC)

CS100	Python Programming	(3-0-0)3
CS101	Python Programming Lab	(0-0-3)2
EC100	Elements of Electronics and Communication Engineering	(2-0-0)2
EE110	Elements of Electrical Engg	(2-0-0)2
ME110	Elements of Mechanical Engg	(2-0-0)2
ME111	Engineering Graphics	(1-0-3)3
ME200	Workshop	(0-0-2)1
ME211	Thermodynamic & Fluid Mechanics	(3-0-0)3
WO110	Engineering Mechanics	(3-0-0)3

Humanities and Social Science Core Courses (HSC)

SM110	Professional Communication	(3-0-0)3
SM300	Engineering Economics	(3-0-0)3
SM302	Principles of Management	(3-0-0)3

Programme Core Courses (PC)

CV203	Mining Geology	(3-0-0)3
CV218	Mining Geology Laboratory	(0-0-3)2
MI101	Introduction to Mining Engineering	(3-0-0)3
MI201	Development of Mineral Deposits	(3-0-0)3
MI202	Mine Surveying	(3-1-0)4
MI203	Mine Surveying Lab	(0-0-3)2
	Mine Environment and Ventilation Engineering	(3-1-0)4
MI252	Mine Environment and Ventilation Engineering Lab	(0-0-3)2
MI253	Applied Mine Surveying Lab	(0-0-3)2
MI254	Mining Machinery	(3-1-0)4
MI255	Industrial Training in Mines–I	1
MI301	Surface Mining Technology	(3-1-0)4
MI302	Mine Hazards, Rescue and Recovery	(3-1-0)4
MI303	Underground Coal Mining Technology	(3-1-0)4
MI304	Industrial Training in Mines–II	1
MI351	Underground Metal Mining Technology	(3-1-0)4
MI352	Rock Mechanics	(3-1-0)4
MI353	Rock Mechanics Lab.	(0-0-3)2
MI354	Mine Systems Optimization	(3-1-0)4
MI355	Industrial and Professional Practice	1
MI356	Industrial Training in Mines–III	1
MI401	Mineral Processing Technology	(3-1-0)4
MI402	Mineral Processing Technology Lab.	(0-0-3)2
MI403	Rock Fragmentation Engineering	(3-1-0)4
MI404	Mine Design Laboratory	(0-0-3)2
MI405	Strata Mechanics	(3-0-0)3
MI451	Mine Legislation & Safety	(4-0-0)4
MI452	Ore Reserve Estimation and Mine Valuation	(3-0-0)3

Programme Specific Elective Courses (PSE)

MI210	Drilling & Blasting Engineering	(3-0-0)3
MI211	Seabed Mining	(3-0-0)3
MI260	Applied Mine Surveying	(3-0-0)3
MI261	Electrical Machinery in Mines	(3-0-0)3
MI310	Noise Pollution & Control Engg.	(3-0-0)3
MI311	Rock Reinforcement Engg.	(3-0-0)3
MI312	Mine Power Systems	(3-0-0)3
MI360	Mine Health and Safety Engg.	(3-0-0)3
MI361	Advanced Surface Mining Technology	(3-0-0)3
MI362	Production Drilling for Oil Wells	(3-0-0)3
MI363	Mechanization and Materials Handling	(3-0-0)3
MI410	Advanced U/G Coal Mining Technology	(3-0-0)3
MI411	Geostatistics	(3-0-0)3
MI412	Applications of IT in Mining Projects	(3-0-0)3
MI413	Cornerstone/capstone Project	4
MI460	Coal Washing and Handling	(3-0-0)3
MI461	Surface Mine Design	(3-0-0)3
MI462	Underground Coal Mine Design	(3-0-0)3
MI463	Underground Metal Mine Design	(3-0-0)3
MI464	Environmental Management and Sustainable Development	(3-0-0)3
MI471	Reliability Analysis of Engg. Systems	(3-0-0)3
MI472	Rock Excavation in Mines and Infrastructure Projects	(3-0-0)3
MI473	Stability of Rock Slopes	(3-0-0)3
MI474	Tunneling Engineering	(3-0-0)3
MI475	Numerical Modeling Techniques	(3-0-0)3
MI476	Industrial Engineering & Management	(3-0-0)3
MI477	Remote Sensing & Geoinformatics	(3-0-0)3
MI478	Safety Engineering	(3-0-0)3
MI479	Energy Resources Utilization and Climate Change	(3-0-0)3

Project (MP)

MI449	Mine Design Project-I	(0-0-3)2
MI499	Mine Design Project-II	(0-0-6)4

Mandatory Learning Courses (MLC)

CV110	Environmental Studies	(1-0-0)1
SM111	Professional Ethics and Human Values	(1-0-0)1
MI453	Mine Projects Exposure	1
MI490	Seminar	1
ME100	Introduction to Design Thinking	(2-0-0) 2
UC401	Liberal Arts courses/cocurricular/extra-curricular activities	10

Honor Courses (Hn)

MI901	Applied Rock Mechanics	(3-1-0)4
MI804	Underground Space Technology	(3-1-0)4
MI916	Risk and Safety Management in Mines	(3-1-0)4
MI705	Project Management	(3-1-0)4
MI855	Reclamation Rehabilitation and Risk	(3-1-0)4

Minor Courses (Mn)

MI480M	Mining Technology	(3-1-0)4
MI481M	Rock Excavation Engineering	(3-1-0)4
MI482M	Mine Safety Engineering	(3-1-0)4
MI483M	Mine Mechanisation	(3-1-0)4
MI484M	Environmental Managemnet	(3-1-0)4

Department specific course for Interdisciplinary Machine Learning Mnor

MI485	Project for Machine Learning Minor	(0-0-6) 4

NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA, SURATHKAL

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

Semester →	I	II	III	IV	V	VI	VII	VIII
1	MA110	CY110	CV203	ME200	SM302	SM300	MI401	MI451
2	PH110	CY111	CV218	ME211	MI301	MI351	MI402	MI452
3	PH111	MA111	MI201	MI251	MI302	MI352	MI403	Elective
4	EC100	CS100	MI202	MI252	MI303	MI353	MI404	Elective
5	EE110	CS101	MI203	MI253	MI304	MI354	MI405	MI499
6	ME110	WO110	Elective	MI254	Elective	MI355	Elective	MI453
7	ME111	MI101		MI255		MI356	MI449	MI490
8	SM110	CV110		Elective		Elective	UC401	
9	SM111	ME100						

Requirements for B.Tech. in Mining Engineering:

Category of Courses	Minimum Credits to be Earned
Foundation Courses Basic Science Core (BSC): 16 Engineering Science Core (ESC): 21 Humanities and Social Science Core (HSC): 9	46
Programme Core Courses (PC)	81
Electives Courses (Ele) Programme Specific Electives, MOOC Courses (0 – 8 credits)	21
Project (MP)	06
Mandatory Learning Courses (MLC)	16
Total	**170**

Requirement for Honors:

Minimum No. of Courses to be Registered	Minimum Credits to be earned
5	20

Requirement for Minors:

Minimum No. of Courses to be Registered	Minimum Credits to be earned
5	20

NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA, SURATHKAL

Minor Programmes

Minor in Chemical Engineeirng

CH150M	Process Calculations	(2-2-0)4
CH202M	Chemical Engineering Thermodynamics	(3-1-0)4
CH203M	Transport Phenomena	(2-2-0)4
CH252M	Chemical Reaction Engineering I	(2-1-0)3
CH302M	Process Dynamics and Control	(3-1-0)4

Minor in Civil Engineeirng

WO200M	Mechanics of Materials	(3-0-0)3
CV201M	Elements of Surveying	(3-0-0)3
CV252M	Soil Mechanics	(3-0-0)3
CV301M	Environmental Engineering	(3-0-0)3
CV254M	Highway and Traffic Engineering	(3-0-0)3
CV401M	Estimation, Costing and Specification	(3-0-0)3

Minor in Computer Science and Engineeirng
(Except for IT Students)

CS202M	Data Structures and Algorithms	(3-1-0)4
CS251M	Database Systems	(3-1-0)4
CS252M	Operating Systems	(3-1-0)4
CS301M	Computer Networks	(3-1-0)4
CS305M	Software Engineering	(3-1-0)4

Minor in Electrical and Electronics Engineeirng
(Except for EC Students)

EE230M	Electric Circuits	(3-1-0) 4
EE261M	Basic Electric Machines	(3-1-0) 4
EE310M	Electric Power System	(3-1-0) 4
EE370M	Electrical and Electronics Measuring Instruments and Techniques	(3-1-0) 4
EE415M	Power Electronics in Power Control	(3-1-0) 4

Minor in Electronics and Communication Engineering
(Except for EE Students)

EC391M	Analog Electronic Circuits	(3-0-0) 3
EC392M	Digital Electronics	(3-0-0) 3
EC393M	Signals and Systems	(3-0-0) 3
EC394M	Communication Systems	(3-0-0) 3
EC395M	Data Communication and Networks	(3-0-0) 3

Minor in Information Technology
(Except for CS and AI Students)

IT210M	Data Structures and Algorithms	(3-0-2) 4
IT252M	Database Systems	(3-0-2) 4
IT254M	Web Technologies and Applications	(3-0-2) 4
IT301M	Parallel Computing	(3-0-2) 4
IT350M	Data Analytics	(3-0-2) 4

Minor in Artificial Intelligence
(Except for IT Students)

IT209M	Data Structures and Algorithms	(3-0-2) 4
IT255M	Artificial Intelligence	(3-0-2) 4
IT258M	Data Science	(3-0-2) 4
IT306M	Parallel and Distributed Problem Solving	(3-0-2) 4
IT307M	Machine Learning	(3-0-2) 4

Minor in Mechanical Engineeirng

ME501M	Manufacturing Engineering	(3-1-0) 4

ME502M	Thermal Engineering	(3-1-0) 4
ME503M	Mechanical Design	(3-1-0) 4
ME504M	Production Management	(3-1-0) 4
ME505M	Industrial Automation	(3-1-0) 4

Minor in Metallurgical and Materials Engineering

MT202M	Physical Metallurgy	(3-1-0)4
MT203M	Polymer Science and Technology	(3-0-0)3
MT252M	Phase Diagrams	(3-1-0)4
MT253M	Principles of Extractive Metallurgy	(3-1-0)4
MT351M	Ceramics and Refractories	(3-0-0)3

Minor in Mining Engineeirng

MI480M	Mining Technology	(3-1-0)4
MI481M	Rock Excavation Engineering	(3-1-0)4
MI482M	Mine Safety Engineering	(3-1-0)4
MI483M	Mine Mechanisation	(3-1-0)4
MI484M	Environmental Managemnet	(3-1-0)4

Minor in Chemistry

CY804M	Spectroscopy, Applications in Chemistry	(3-0-0) 3
CY703M	Organic Chemistry-I	(3-0-0) 3
CY704M	Physical Chemistry – I	(3-0-0) 3
CY751M	Inorganic Chemistry – II	(3-0-0) 3
CY754M	Spectroscopy	(3-0-0) 3

Minor in Mathematics

MA501M	Real Analysis	(3-0-0) 3
MA502M	Algebra	(3-0-0) 3
MA503M	Complex Analysis	(3-0-0) 3
MA504M	Partial Differential Equations	(3-0-0) 3
MA504M	Topology	(3-0-0) 3

Minor in Physics

PH701M	Mathematical Methods-1	(3-1-0)4
PH702M	Classical Mechanics	(3-1-0)4
PH703M	QuantumMechanics-1	(3-1-0)4
PH751M	Mathematical Methods-2	(3-1-0)4
PH752M	Quantum Mechanics-2	(3-1-0)4
PH754M	Electromagnetic Theory	(3-1-0)4

Minor in Management

SM200M	Financial Management	(3-0-0) 3
SM250M	Human Resource Management	(3-0-0) 3
SM305M	Business Analytics and Decision Making	(3-0-0) 3
SM350M	Entrepreneurship	(3-0-0) 3
SM405M	Marketing Management	(3-0-0) 3

Minor in Economics

SM205M	Microeconomics	(3-0-0) 3
SM255M	Macroeconomics	(3-0-0) 3
SM310M	Introduction to Industrial Economics and Organization	(3-0-0) 3
SM355M	Financial Economics	(3-0-0) 3
SM410M	Development Economics	(3-0-0) 3

Interdisciplinary Minor

Minor in Machine Learning
(Except for AI Students)

Common Courses

MA212M	Mathematics for Machine Learning	(4-0-0)	4
MA309M	Mathematical Foundations of Data Science	(3-1-0)	4
IT340M	Machine Learning	(3-0-2)	4
CS422M	Deep Learning	(3-1-0)	4

Parent Department Specific Courses

Chemical Engineering

CH459M	Machine Learning Applications in Chemical Engineering	(0-0-6)	4

Civil Engineering

CV448M	Machine Learning Applications in Civil Engineering	(0-0-6)	4

Computer Science and Engineering

CS367M	Foundations of CPS	(3-1-0)	4
CS426M	Reinforcement Learning	(3-1-0)	4
CS473M	Project for ML Minors	(0-0-6)	4

Electrical and Electronics Engineering

EE450M	Applications of Machine Learning Techniques to Problems in Electrical Engineering	(3-0-2)	4

Electronics and Communication Engineering

EC500M	Machine Learning for Electronics and Communication Engineering	(3-1-0)	4

Information technology

IT479M	Machine Learning Minor Project	(0-0-6)	4

Mechanical Engineering

ME496M	Application Project in Mechanical Engineering	(0-0-6)	4

Metallurgical and Materials Engineering

MT494M	Project for Machine Learning Minor	(0-0-6)	4

Mining Engineering

MI485M	Project for Machine Learning Minor	(0-0-6)	4

Reopening of sealed off areas. Mine explosions. Inundation. Approaching water logged areas and old workings. Water dams and design. Rescue & recovery equipment's for use in mines. Rescue organization. Examples of major mine disasters in India & abroad.

Ramlu, M.A. Mine Fires, Explosions, Rescue, Recovery & Inundations; Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 1991.

Rakesh &Lele, M.G. Inundation in Mines; Mrs. Asha Lata, Varanasi, 1970.

MI303 UNDERGROUND COAL MINING TECHNOLOGY   (3-1-0)4

Status and scope of underground coal mining. Classification of coal reserves. Opening up of deposit. Horizon mining. Basic coal mining methods. Bord and pillar mining: development & depillaring with semi-mechanised and mechanized board and pillar mining. Longwall mining. Thick-seam mining: Classification of thick seam mining methods, inclined slicing with caving; sub-level caving. Hydraulic Mining. Underground gassification of coal.

Singh, R.D. Principles and Practices of Modern Coal Mining, 1997.ISBN 81-224-0974-1

Singh, T.N. Underground Mining of Coal, Oxford & IBH, 1992.

MI304 INDUSTRIAL TRAINING IN MINES - II   (0-0-0)1

Industrial Training – II should be taken up at the end of IV semester, preferably in underground coal mines. Relevant information pertaining to the development and extraction of coal by underground mining methods, details of different equipments working in the mines and their operational information, layouts and other techno- economic data, information regarding safety aspects, man-power, production and productivity, management practices and environmental protection measures should be included.

MI310 NOISE POLLUTION AND CONTROL ENGINEERING   (3-0-0)3

Basics of sound. Frequency analysis. Equipment's used for noise measurement. Various standards in India & abroad on noise exposure. Effects of noise exposure. Community noise. Industrial noise control & hearing testing. Environmental noise measurement. Noise measurement & control of HEMM, Coal handling & preparation plants, Jackhammer drills. Noise control measures for DG sets. Human vibration:measurement, control and standards. Health effect of vibration-Handarm and Whole-body vibration. Parameters influencing human response to vibration.

Harris, C.M : Handbook of Noise Control, McGraw- Hill Book Company, 1979.

Albert Thumann & Richard K. Miller : Secrets of Noise Control, The Fairmont Press, Georgia, 1976.

ISO 2631-1: Mechanical vibration and shock-Evaluation of human exposure to whole-body vibration-second edition 1997-05-01.

MI311 ROCK REINFORCEMENT ENGINEERING   (3-0-0)3

Roof bolting. Cable bolting. Shotcreting. Cavability of rocks – effect on supports design. Longwall supports. Lining of tunnels and shafts. Yieldable arches and ring sets. Reinforcement of pillars. Stabilization of slopes. Roof convergence. Stope closure. Back filling, Mechanical behavior and monitoring of various supports. Capital investment for supports, cost control process.

Biron, C and Ariglu, E., Design of Supports in Mines, John Wiley & Sons, 1983.

Britton, S.G., Construction Engineering in Underground Coal Mines, SME, 1983.

MI312 MINE POWER SYSTEMS   (3-0-0)3

Electric power in mining, three-phase circuit analysis, mine power system components, distribution of electrical power in surface and underground mines, grounding systems, ground wire monitoring, distribution cable construction and selection, power flow calculations, power factor correction, design of substations, switchhouses and power centers, method of symmetrical components, mine power system fault analysis, transients and overvoltages, protective equipment and relaying, 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.

MI351 UNDERGROUND METAL MINING TECHNOLOGY   (3-1-0)4

Development and opening up of underground deposits. Choice and suitability of entries. Draw points and ore passes. Different methods of stoping. Problems encountered in deep mines and measures to tackle them. Introduction to solution mining and in-situ leaching. Case studies from Indian Mines.

Hartman, H.L. Introductory Mining Engineering. John Wiley & Sons, 1987.

Hustrulid, W.A., SME Handbook on Metalliferous Mining, 1985.

Niosh Snowden, Geological and Mining Reports of Underground Metal Mining: VolumeII, Wide Publishing, India,

2016.
Ratan Raj Tatiya , Surface and Underground Excavations, 2nd Edition : Methods, Techniques and Equipment, Taylor & Francis Ltd *, London, United Kingdom, 2013.*

MI352 ROCK MECHANICS   (3-1-0)4
Physical properties, Physico-mechanical properties of rocks, Elastic constants under static and dynamic loading. Determination of in-situ strength properties of rocks and Nondestructive testing, Analysis of stresses and strains. Mohr's representation of stress and strain. Stress – strain relations. Behaviour of rocks under stress. Engineering classification of rock mass, Rock fracture mechanics. Stress distribution around different mine openings.
Obert, L. & Duvall, W.I.- Rock Mechanics and design of structures in rock; John Wiley & Sons, New York, 1967.
Wittke, W., Rock Mechanics, Springer-Verlag, Berlin, 1990.

MI353 ROCK MECHANICS LAB   (0-0-3)2
A total of 10 to 12 experiments shall be carried out pertaining to the subject.

MI354 MINE SYSTEMS OPTIMIZATION   (3-1-0)4
Introduction to systems concept, analysis and systems engineering; models in system analysis; linear programming; integer programming; network techniques for mining projects; CPM and PERT techniques; dynamic programming; transportation and assignment models; decision theory; inventory control; queuing theory; simulation techniques for equipment selection and production scheduling; significance of management information systems in controlling and managing the mining activities.
Sharma, J.K., Mathematical Models in Operations Research, Tata Mcgraw-Hill, New Delhi, 1989.
Cummins, A.B., Mining Engineers Handbook, Vol. II, SME, AIME, New York, 1973.
Taha, H.A., Operations Research: An Introduction, 8th Edition, Pearson, 2006.

MI355 INDUSTRIAL AND PROFESSIONAL PRACTICE   (0-0-0)1
Mine camp to be held at the end of V semester. Relevant information pertaining to the development and extraction by mining methods, details of different equipments working in the mines and their operational information, layouts and other techno-economic data, information regarding safety aspects, man-power, production and productivity, management practices and environmental protection measures should be included in the report.

MI356 INDUSTRIAL TRAINING IN MINES - III   1
A detailed report of the industrial training undergone at the end of VI semester, preferably in underground metal mines, should be submitted. The report should consist of all details about opening up of the deposit, development and stoping techniques, specifications and operational details of equipment working in the mine, ventilation scheme, power distribution, safety aspects, management practices and environment protection measures and the relevant lay outs. Current techno-economic indices should be a part of the report.

MI360 MINE HEALTH AND SAFETY ENGINEERING   (3-0-0)3
Mine accidents, Accident analysis and prevention, Accident report, Risk assessment & preparation of safety management Plan. Safety audits. Occupational hazards in mines, Hazard analysis. Hazard control by engineering approach, Hazard control by system approach. Economics of safety and cost-effectiveness. Occupational health and safety, Occupational diseases, Problems of safety and health in contractual work, Behavior based safety, Ergonomics and its application in mining.
Ridley, J & Channing, J.; Safety at Work; Butterworth-Heinemaan, Oxford, 2001.
L.C. Kaku: A Study of Mine management, Legislation & General Safety
S. Ghatak: A Study of Mine management, Legislation & General Safety
C.P. Singh: Occupational safety and health in Industries and mines

MI361 ADVANCED SURFACE MINING TECHNOLOGY   (3-0-0)3
Analysis of elements of surface mining operations. Classification of surface mining equipment systems vis-à-vis unit operations. Equipment selection criteria and procedures, application and selection. Types, basic operations, maintenance and capacity utilization, applicability and selection considerations. Computations for the capacity and number of machines vis-à-vis mine production. Dump planning. Minimization of adverse impacts and maximization of use of mineral resources. Cost Estimation. Conversion of old underground workings into surface mines.
Amithosh Dey, Latest Development of Heavy Earth Moving Machinery, Annapurna Publishers, Dhanbad, 1995. Martin, J. W., Martin T. J., Bennett, T. P. &Martin,K. M. Surface Mining Equipment, Martin Consultants Inc., USA, 1982.

MI362 PRODUCTION DRILLING FOR OIL WELLS   (3-0-0)3

Geography of petroleum and natural gas. Characterization of crude and natural gas deposits. Well logging. Interpretation and use of information in petroleum and natural gas engineering. Drilling technology for mining of crude and gas. Well completion and stimulation.

Chugh, C.P., Drilling Technology Handbook, Oxford & IBH Pub. Co, 1988.
Hartman, H.L., Introductory Mining Engineering; Wiley Interscience, New York, 1987.
S.Mcalecse, Operational Aspects of Oil and Gas Well Testing: Volume1, Elsevier Science &Technology, Elsevier Science Ltd, Oxford, United Kingdom,2000.

MI363 MECHANIZATION AND MATERIALS HANDLING   (3-0-0)3

Locomotive haulage, rolling stocks, conveyors, belt conveyor calculations, safety devices for conveyors, face machinery, calculation of productivity of loading machines, material handling systems, elements of material handling systems in large opencast projects, high-angle conveyors, pipeline transportation, aerial ropeways, aerial ropeway calculations, equipment for hydraulic and pneumatic stowing, roof bolting machines, variable and thyristor drives, remote control, monitoring and automation of mining processes.

Ramlu, M.A., Mine Hoisting, Oxford & IBH, New Delhi, 1996.
Walker, S.C., Mine Winding and Transport, Elsevier, Amsterdam, 1988.
Deshmukh, D.J., Elements of Mining Technology Vol. III; Vidyasewa Prakashan, Nagpur, 1994.
Reese, C., Material Handling Systems: Designing for Safety and Health, CRC Press, 2000.

MI401 MINERAL PROCESSING TECHNOLOGY   (3-1-0)4

Scope and objective of mineral processing. Ore handling and storage. Ore sorting, Sampling techniques and devices. Liberation and comminution, Laboratory and industrial sizing. Concentration methods. Magnetic and high tension separation. Forth flotation. Classifiers. Coal quality. Coal preparation for coarse and fine coal. Washability curves and washability number. Dewatering devices. Drying and tailings disposal.

Wills, B.A., Mineral Processing Technology ; Pergamon Press – 4th Edition , 1989.
Weiss, N.L. , Mineral processing Handbook – Vol. I & II, S.M.E., 1985.
Maurice C. Fuerstenau , Edited by Kenneth N. Han , Principles of Mineral Processing, Society for Mining, Metallurgy, and Exploration , United States, 2003.
Ashok Gupta , Denis S. Yan ., Mineral Processing Design and Operations : An Introduction, Elsevier Science & Technology, Oxford, United Kingdom, 2016.
G S Ramakrishna Rao , Mineral Processing Techniques Basics and Related Issues, Zorba Publishers , India, 2014.

MI402 MINERAL PROCESSING TECHNOLOGY LAB   (0-0-3)2

A total of 10 to 12 experiments shall be carried out pertaining to the subject.

MI403 ROCK FRAGMENTATION ENGINEERING   (3-1-0)4

Bulk explosive systems. Substitutes for explosives. Mechanisms of rock fragmentation due to blasting. Fragmentation prediction and assessment. Blast design. Theory of shaped charges. Recent advances in blasting techniques in both underground and surface mines. Blasting in construction projects. Special techniques of blasting. Underwater blasting. Environmental effects and their control. Controlled blasting techniques. Economic evaluation of blasting operations.

Konya, C.G. Blast design, CRC Press, London, 1989.
Persson, Rock fragmentation. International development Corporation, Sweden, 1986.
Sastry, V.R., Advances in Drilling & Blasting, Allied Publishers, 1993.

MI404 MINE DESIGN LABORATORY   (0-0-3)2

A total of 10 to 12 experiments shall be carried out pertaining to the subject.

MI405 STRATA MECHANICS   (3-0-0)3

Definition and concepts of ground control in mines; State of stress in underground openings- premining and induced stresses, influence of water, time, temperature on stress behaviour. Design of structure in rock, Design of pillars, Cavability characteristics &cavability index, design of supports. Subsidence- Concept, prediction and determination, measurement techniques, subsidence damage and its prevention. Rock bursts and bumps – mechanisms, prediction and estimation of damage.

Obert L. and Duvall W.I. – Rock Mechanics and The Design of Structures In Rocks; John Wiley & Sons, New York, 1967.
Peng, S.S. Coal Mine Ground Control ; John Wiley & Sons, New York, 1978.
Biron C. and Arioglue E- Design of Supports in Mines; John Wiley & Sons, New York, 1983.

MI410 ADVANCED U/G COAL MINING TECHNOLOGY   (3-0-0)3
Planning considerations for inclines and shafts, considerations for their location and construction. Location of shaft using sieve analysis; Design of shaft pillar. Bord & pillar mining- design of pillar, design of panel, barrier pillar. Planning inputs for development and depillaring by continuous miners. Longwall face support and machinery, Extraction of pillars in thick and steep seams with caving and stowing. Planning inputs for longwall panel. Selection design and development of most suitable mining method based on Physico - mechanical properties. Production planning. Production cost estimation. Punch entries. High wall mining. Caving characteristics of roof rocks. Shield Mining.
Singh, R.D. Principles and Practices of Modern Coal Mining, 1997, ISBN 81-224-0974-1
Singh, T.N., Thick seam Mining, Oxford & IBH, 1992.
Vorbjev & Deshmukh, Advanced Coal Mining, Tata McGill, 1988.
Mathur, S.P., Advanced Coal Mining, M.S. Enterprises Bilaspur, 1999.

MI411 GEOSTATISTICS   (3-0-0)3
Sampling Methods – Theory and Concepts. Classical Statistical methods: Univariate and Bivariate; Exploratory data analysis. Probability distributions: application in ore reserve estimation. Concepts of Geostatistics; Semi-variogram: Kriging: Geostatistical conditional simulation. Practical applications of Geostatistics in geotechnical investigation.
S.M Gandhi and B.C Sarkar Essentials of mineral exploration and evaluation, Elsevier publications 2016
Chilès, J.-P., and P. Delfiner (1999), Geostatistics - Modeling Spatial Uncertainty, John Wiley & Sons, Inc., New York, USA.
Lantuéjoul, C. (2002), Geostatistical simulation: Models and algorithms, 232 pp., Springer, Berlin.
Kitanidis, P.K. (1997) Introduction to Geostatistics: Applications in Hydrogeology, Cambridge University Press.

MI412 APPLICATION OF IT IN MINING PROJECTS   (3-0-0)3
Development of algorithms and flow charts related to mining projects. Overview of mine planning software's. IT applications in:pit limits determination, reliability of equipment&preventive maintenance, blast design, ventilation planning, safety data base management system and mine safety automation,Computer aided production planning and scheduling in mines. Selected topics to be cover on IT applications in mining.
Ram, R. V. et. al. ITs in Mineral Industry, Oxford & IBH, 1994
Husterilid, Open Pit Mine Planning and Design, Bulkema, 1995.
SURPAC Software manual: www. gemcomsurpac.com Isograph
Reliability Workbench Version 13.0 User Guide
GIAN Course on IT application and data analysis in mining and other core industries.

MI413 CORNER STONE/CAPSTONE PROJECTS   4
   For details refer to clause 3.2 (f) under Regulations specific to Undergraduate Programmes.

MI449 MINE DESIGN PROJECT- I   (0-0-3)2
A small project of relevance to mining will be taken up by the student

MI451 MINE LEGISLATION & SAFETY   (4-0-0)4
Important statuary provisions related to Payment of Wages Act, History and development of mine Legislation in India (In brief) and NCWA, provident Fund Act, Mines Act- 1952, Mines Rules- 1955, Coal Mines Regulations-2017, Metalliferrous Mines Regulations-1961, Mines and Minerals (Regulation and Development) Act 1958, Mineral Conservation and Development Rules 2016. Mines Rescue Rules-1985. Vocational Training Rules-1966, Indian Electricity Rules-1956. Accident- causes and preventive measures for various accidents in mines; Accident analysis statistics; Accident cost, Accident enquiry report, safety management and audit.
Rakesh and Prasad, Legislation in Indian Mines – A critical appraisal, Ashalata Pub., Varanasi, 1986.
Singh, C.P. Occupational Safety and Health in Industries and Mines, Tata McGill, 2004.

MI452 ORE RESERVE ESTIMATION AND MINE VALUATION   (3-0-0)3
National mineral resources; national mineral policy and strategies for development of mining industry; resource conservation; technology import, taxation, royalty and subsidies; mineral trade; concept of derivatives in mineral trade; pricing mechanism of minerals; sampling; estimation of reserves; economic block model concept; valuation of mines and mineral properties, life of a mining project; project evaluation; determination of optimum size of mine; risk analysis in mineral investment decisions.
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.

MI453 MINE PROJECTS EXPOSURE   **1**
Comprehensive report about the short visits made to different mines and other industries will be submitted at the end of VIII Semester

MI490 SEMINAR   **1**
A topic of relevance to the mining industry to be chosen and the seminar be delivered with audio – visual aids. A write up of the same should also be submitted.

MI499 MINE DESIGN PROJECT- II   **(0-0-6)4**
A major project of relevance to mining will be taken up by the student

MI460 COAL WASHING AND HANDLING   **(3-0-0)3**
Coking and non-coking coal. Coal washeries, sink and float tests on coal, washability index, optimum degree of washability and washability number, application of jigs, heavy media cyclone, Coal cleaning techniques for fine coal and coarse coal, coal flotation, beneficiation of non-coking coal, automation and quality control in preparation plants. Environmental management in coal preparation. Coal gasification, liquefaction and new products from coal. homogenization and blending systems.
Weiss, N.L., Mineral Processing Handbook- Volume-II, Published by SME, 1985.
Muthui Richard K, Rop Bernard K, Kabugu M, Coal Handling and Equipment Selection, LAP Lambert Academic Publishing, United States, 2014.

MI461 SURFACE MINE DESIGN   **(3-0-0)3**
Preliminary investigations. Stages of planning. Feasibility Report. Planning inputs. MMDR and MCDR. Project scheduling and monitoring. Estimation of mine life. Determination of ultimate pit limits. Interrelation and planning of unit operations. Equipment selection. Transport and dumping subsystems. Design of haul roads. Extraction methods for beach sand deposits. Mining of developed coal seams. Selective mining. Estimation of productivity & profitability. Quality control. Introduction to mine design softwares.
Rzhevsky, V.V. Opencast Mining Unit Operations, Mir Publisher, 1983.
Rshensky V.V. Opencast Mining Technology and Integrated Mechanisations, Mir Publishers, 1985.
W.Hustrulid and M.Kuchta, Open Pit Mine Planning & Design, Vol. 1 & 2, Taylor & Francis, 2006.

MI462 UNDERGROUND COAL MINE DESIGN   **(3-0-0)3**
Objectives and Stages of Planning. Feasibility report. Detail project report (DPR); Determination of mine design parameters. Planning input for selection of mining method. Estimation of mine life. Design and production planning. Introduction to mine design software. Production cost analysis.Selection criteria for face and underground transport equipment. Planning and design layouts for ventilation, drainage and power supply. Ventilation management. Productivity and quality control; planning of deep underground coal mines; Automation in underground coal mines.
Peng, S.S. Longwall Mining , Department of Mining Engineering, West Virginia University, 2006
Mathr, S.P. Coal Mining, M.S. Enterprises Bilaspur, 1999.

MI463 UNDERGROUND METAL MINE DESIGN   **(3-0-0)3**
Planning and scheduling of insets, shaft bottoms, winding and transportation systems. Surface lay outs including mill and concentrator plants. Determination of number and dimensions of stopes. Planning and scheduling of a cycle of operations. Concept of ore blending. Overall planning and scheduling of activities in metal mining and processing. Case studies of planning of mining operations.
Agoshkov M., et. Al., Mining of Ores and Non- Metallic Minerals, Mir Publishers, Moscow, 1983.
Hartman, H.L. Introductory Mining Engineering, John Willey & Sons, 2007.
Niosh Snowden, Geological and Mining Reports of Underground Metal Mining: VolumeII, Wide Publishing, India, 2016.
Ratan Raj Tatiya , Surface and Underground Excavations, 2nd Edition : Methods, Techniques and Equipment, Taylor
&   Francis Ltd *, London, United Kingdom, 2013.*

MI464 ENVIRONMENTAL MANAGEMENT AND SUSTAINABLE DEVELOPMENT   **(3-0-0)3**
Environmental problems due to mines and quarries. Land degradation. Pollution due to mining in terms of air and water. Acid Mine Drainage, Socio- economic impacts. Control measures. Pollution due to noise and vibrations. Effluents discharge. Reclamation of mined out and subsided areas. Mine closure. Environmental legislation and policies. Environmental Management Plan. Environmental Impact Assessment. Risk Analysis. Disaster management

plan. Preparation of EMP for various mineral industries. Cost of environmental management. Environmental audit.

Dhar, B.B., Environmental Management of Mining Operations, Ashish Publication House, New Delhi, 1991.

Chadwick et al., Environmental Impacts of Coal Mmining and Utilization, Pergamon Press,1992.

MI471 RELIABILITY ANALYSIS OF ENGG. SYSTEMS (3-0-0)3

Reliability definition. Failure data analysis of mining equipment's. System of reliability. Reliability improvement. Maintenance of mining machinery, MIS for maintenance function. Maintenance planning and scheduling. Statistical analysis and data distributions of failure data. Availability and maintainability. Reliability and availability of repairable and non-repairable system. Systems with preventive and corrective maintenance. Reliability evaluation. Reliability prediction and modelling. Application of reliability in engineering systems and case studies. Applications of reliability software's in engineering.

Patrick D. T. O' Connor. "Practical Reliability Engineering". Wiley India Pvt. Ltd., 4th Edition, 2012.

L. S. Srinath. "Reliablity Engineering". East –West Press, 4th Edition, 2005.

John Davidson (Ed). The Reliability of Mechanical Systems. I Mech E. London 1994.

John P. Bentley. An Introduction to reliability & Quality Engineering. Longman Scientific & Technical, England, 1993.

MI472 ROCK EXCAVATION IN MINES & INFRASTRUCTURE PROJECTS (3-0-0)3

Rock excavation by different methods in mining and infrastructure projects. Excavation and material handling equipment. Selection of equipment. Excavation in sensitive areas. Project Planning and Management. Practical examples in mining projects, ports, tunneling projects, pipeline excavations, canal excavation projects, hydel projects, Caveens/ large excavations etc. Environmental planning, environmental impact assessment and Management. Project economics.

Stack, B., Mining and Tunneling Machine, 1978.

Martin, J. W., Martin T. J., Bennett, T. P. &Martin,K. M. Surface Mining Equipment, Martin Consultants Inc., USA, 1982.

MI473 STABILITY OF ROCK SLOPES (3-0-0)3

Mechanisms of slope failures. Field investigations and data collection. Design of slopes - physical, empirical, probabilistic methods, analytical (limit equilibrium analysis) and numerical (continuum models, discontinuum and crack propagation models) modeling. Stabilization and reinforcement of slopes. Slope failure monitoring-modern techniques (SSR).Softwares for slope stability analysis. Case studies.

Hoek, E. and Bray, J.W; Rock Slope Engineering; John Wiley & Sons; New York; 1984

Brawner, C.O; Stability in surface mining, SME of USA; New York, 1982. Giani, F; Rock

Slope Stability Analysis; Balkema; Rotterdam; 1992.

MI474 TUNNELLING ENGINEERING (3-0-0)3

Design principles of underground openings, single and multiple openings with different orientation. Dimensions, shape, structural behavior and sequence of excavations intunnels.Rock conditions and initial state of stresses. Computer aided tunnel design. Tunnel driving techniques. Tunnel supports, automation of supports, Shield tunneling system with road headers. Field instrumentation, Tunnel stability analysis, Case studies.

Bieniawski, Z.T., Rock Mechanics and Design in Mining and Tunnelling, Rotterdam : A.A. Balkema, 1984.

Pokorovski, Driving Horizontal Workings and Tunnel, Mir Publishers, 1980

MI475 NUMERICAL MODELLING TECHNIQUES (3-0-0)3

Development and use of numerical modeling in rock excavations. Finite element (2D and 3D). Boundary element (2D and 3D). Displacement and continuity. Basic equations for mathematical modeling of rock mass. Static and dynamic behavior of rock mass. Elastic-linear and non-linear, elastoplastic and time dependent models. Case studies.

Kidybinski A. & Kwasniewski M. (Eds); Modelling of Mine Structures, A.A. Balkema, Rotterdam, 1988.

Kidybinski A. &Dubinski J. (Eds); Strata Control in Deep Mines, A.A. Balkema, Rotterdam, 1990.

MI476 INDUSTRIAL ENGINEERING & MANAGEMENT (3-0-0)3

Concepts of Management and Organisation, Functions of Management, Organisational Structures, Basic concepts related to Organisation Departmentation, Motivation, Leadership, Group dynamics, Conflict management, Work study, Time study, Job Evaluation, Project management, Network techniques, Human Resource Management.

Khanna, O.P., Rai, D. Industrial Engineering and Management, 2005.

Stoner, Freeman, Gilbert, Management, 6th Ed, Pearson Education, New Delhi, 2005.

Ralph M Barnes, Motion and Time Studies, John Wiley and Sons, 2004.

Chase, Jacobs, Aquilano, Operations Management, TMH 10th Edition, 2003.

MI477 REMOTE SENSING AND GEOINFORMATICS (3-0-0)3

Concept of GPS. Application of remote sensing to mining projects. Satellite signals. GPS instruments. Sensors and platforms. Image Processing and interpretation. Data processing. Concepts of GIS. Components, data acquisition, topology and spatial relationships, data storage verification and editing, network systems, data manipulation and analysis. Spatial and mathematical operations in GIS. Various GIS packages and their salient features.

Basudev Bhatta, Remote sensing and GIS, II Edition, Oxford Publishing House, 2016.
George Jeoseph, Fundamentals of Remote Sensing, II Edition, Universal Press, 2017.
Lillisand, Keifer and Chipman, Remote Sensing and Image Interpretation, VI Edition, Wiley Publishers.
Hassan A. Karimi, Handbook of Research in Geoinformatics, Information Science Reference, 2017.

MI478 SAFETY ENGINEERING (3-0-0)3

Basic concept of risk; Difference between hazards and risks; Risk components and types, Risk management objectives, Risk management process; Hazards Identification and Risk Assessment (HIRA).Type of injury. Causes of injury, statistical analysis of injury data. Accident and preventive measures for various accidents in mines; Accident analysis and accident statistics; Economic evaluation of accident, Accident investigation report. Safety management and audit.Ergonomics and its application in safety engineering. Behavior base safety.

Ridley, J & Channing, J.; Safety at Work; Butterworth-Heinemaan, Oxford, 2001.
L.C. Kaku: A Study of Mine management, Legislation & General Safety.
S. Ghatak: A Study of Mine management, Legislation & General Safety.
C.P. Singh: Occupational safety and health in Industries and mines
Seppo Väyrynen · Kari HäkkinenToivo Niskanen: Integrated occupational safety and health management by springer publications. SBN 978-3-319-13179-5 ISBN 978-3-319-13180-1 (eBook) DOI 10.1007/978-3-319-13180-1

MI479 ENERGY RESOURCES UTILIZATION AND CLIMATE CHANGE (3-0-0)3

Trends in Energy Supply & Quality of Life; Energy Demand & Supply Options; Energy Resources - their distribution & Utilisation ; Non-Conventional Hydrocarbons; Concepts of Energy & Exergy flows; Sustainability and Climate Change; Environmental Economics. Carbon Emissions; Potential Impacts; Climate Change Prediction Models - Basics; Global Climate Change negotiations – Problems and Issues; Carbon sequestration – Capture & Storage.

David Coley, Energy & Climate Change — Creating Sustainable Future, John Wiley & Sons Ltd, 2008
Chris Goodall, Ten Technologies to Fix Energy and Climate, Second edition Profile Books, 2009 Anilla
Cherian, Energy and Global Climate Change: Bridging the Sustainable
Development Divide, John Wiley & Sons, 2015

Courses for Minor in Mining Engineering

MI480M MINING TECHNOLOGY (3-1-0) 4

Introduction to mining projects. Roll of mining industry in development of nation. Mine development. Basics of underground coal mining technologies. Basics of underground metal mining technologies. Basics of surface mining technologies. Application of mechanical, civil, electrical, electronics and IT in mining projects.

Tatiya R.R., Surface and underground excavation: methods, techniques and equipment, A. A. Balkema publishers, 2005.
Walker S.C. Mine Winding and Transport. Elsevier, Amsterdam 1988.
Gross, C. A., Electric Machines, 1st Edition, CRC Press, 2006. Isograph
Reliability Workbench Version 13.0 User Guide
GIAN Course on IT application and data analysis in mining and other core industries.

MI481M ROCK EXCAVATION ENGINEERING (3-1-0)4

Rock excavation in mining and infrastructure projects. Methodologies. Mines. CNG Pipeline projects. Hydel projects, Tunnels. U/G Caverns. Ports. Material handling equipment. Selection of equipment. Excavation in sensitive areas. Project Planning and Management. Environmental impact assessment and Management. Project economics.

Stack, B., Mining and Tunneling Machine, 1978.
Martin, J. W., Martin T. J., Bennett, T. P. &Martin,K. M. Surface Mining Equipment, Martin Consultants Inc., USA, 1982.

MI482M MINE SAFETY ENGINEERING (3-1-0)4

Accident- causes and preventive measures for various accidents in mines; Accident analysis statistics. Accident cost. Accident report, Risk assessment & preparation of safety management Plan. Safety audits. Occupational hazards in mines, Hazard analysis. Hazard control by engineering approach, Hazard control by system approach. Economics of

safety and cost-effectiveness. Occupational health and safety, Occupational diseases, Problems of safety and health in contractual work, Behavior based safety, Ergonomics and its application in mining.

Ridley, J & Channing, J.; Safety at Work; Butterworth-Heinemaan, Oxford, 2001.

L.C. Kaku: A Study of Mine management, Legislation & General Safety

S. Ghatak: A Study of Mine management, Legislation & General Safety

C.P. Singh: Occupational safety and health in Industries and mines

Rakesh and Prasad, Legislation in Indian Mines – A critical appraisal, Ashalata Pub., Varanasi, 1986.

Singh, C.P. Occupational Safety and Health in Industries and Mines, Tata McGill, 2004.

MI483M MINE MECHANISATION (3-1-0)4

Equipment for excavation, transportation, processing. Selection of equipment. Tendering and processing. Maintenance. Inventory. Automation. New developments. Productivity of machines. Economics.

Amithosh Dey, Latest Development of Heavy Earth Moving Machinery, Annapurna Publishers, Dhanbad, 1995.

Reese, C., Material Handling Systems: Designing for Safety and Health, CRC Press, 2000.

Martin, J. W., Martin T. J., Bennett, T. P. &Martin,K. M. Surface Mining Equipment, Martin Consultants Inc., USA, 1982.

MI484M ENVIRONMENTAL MANAGEMNET (3-1-0)4

Environmental issues. Pollution due to mining in terms of land degradation, air and water, noise and vibrations. Socio-economic impacts. Waste management. Reclamation and rehabilitation. Environmental Impact Assessment. Risk Analysis. Disaster management. Environmental audit. Environmental economics.

Dhar, B.B., Environmental Management of Mining Operations, Ashish Publication House, New Delhi, 1991.

Chadwick et al., Environmental Impacts of Coal Mining and Utilization, Pergamon Press,1992.

Courses for Honors in Mining Engineering (Refer PG and PhD curriculum for details)

MI705	Project Management	(3-1-0)4
MI804	Underground Space Technology	(3-1-0)4
MI855	Reclamation Rehabilitation and Risk Management	(3-1-0)4
MI901	Applied Rock Mechanics	(3-1-0)4
MI916	Risk and Safety Management in Mines	(3-1-0)4

UC401 LIBERAL ARTS COURSES/CO-CURRICULAR/EXTRACURRICULAR ACTIVITIES 10

CATEGORY A : Maximum 3 credits, CATEGORY B : Maximum 3 credits, CATEGORY C : Minimum 4 Credits and Maximum 7 credits.

10 Credits have to be earned from 1st Semester to 7th Semester by choosing Category (A + B + C) OR Category (A + C) or Category (B + C) courses combination . Registration for 10 Credits has to be done in 7th Semester.

For details of CATEGORY A, CATEGORY B and CATEGORY C refer to clause 3.2 (f) under Regulations specific to Undergraduate Programmes.