

B. Tech (Mining) VI SEMISTER

S. No	Course Code	Course Title	Scheme of Instruction			Lecture hr/week	Scheme of Examination		Credits
			L	T	P		CIE	SEE	
1	PC3201MN	Mine Ground Control	3	1	-	4	30	70	4
2	PC3202MN	Under Ground Mining Method (Metal)	3	1	-	4	30	70	4
3	PC3203MN	Surface Mining Method	3	1	-	4	30	70	4
4	PC3204MN	Mine Mechanization	3	-	-	3	30	70	3
5	PC3205MN	Fundamentals of Artificial Intelligence	3	-	-	3	30	70	3
6	PE- I*	Professional Elective –I	3	-	-	3	30	70	3
7	PC3209MN	Mining Mechanization Lab	-	-	3	3	25	50	1.5
8	PC3210MN	Mining Camp	-	-	-	-	75	-	1
Total			18	3	3	24	280	470	23.5

Professional Elective (PE-I)*

PE3206MN Mineral Exploration & Reserve Estimation
PE3207MN Mine Surface Environment Management
PE3208MN Rock Excavation Engineering

- The duration of Mining camp is between 7-10 days (under special conditions duration can be changed by HEAD, Mining)
- The Internship – II is to be conducted after completion of VI Semester for a duration of 30 days to be evaluated in VII Semester

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PC3201MN

MINE GROUND CONTROL

Teaching Scheme				Examination Scheme
L	T	P	C	Internal Marks: 30
3	1	0	4	External Marks : 70

UNIT I

Introduction:

Definition and concept of ground control in mines, Ground control practices in mines, constraints on ground control design, characteristics of coal measure strata, Pre mining stresses. Theories of mechanics of strata behavior, Modern concept of strata pressure redistribution. Manifestation of strata pressure, Convergence, load on prop, creep, heave, insitu stress measurement.

UNIT II

Roof Support:

Various methods of roof examination, conventional support — timber and steel supports, friction and hydraulic prop arches, rock and cable bolting, roof stitching, power supports ; support of shaft bottom, galleries, freshly exposed roof, shotcreting, systematic support rules.

UNIT III

Design of structures in rock:

Strength of pillars, factor of safety, barrier and shaft pillar design, Design of pillars, Design of underground opening, design of stopes, Stress Distribution around circular and different shaped openings.

UNIT IV

Subsidence:

Theories of subsidence, factor and affecting subsidence, prediction and measurement of subsidence, Damage and prevention of damage due to subsidence, modern methods of subsidence measurement

UNIT V

Rock burst and slope stability:

Rock burst – causes, occurrence, prediction, monitoring and control
Slope stability, slope parameters, different types of slope failures, factors affecting slope stability, various methods of failure and analysis, determination of factor of safety, different rock slope stabilization techniques.

Text / Reference books:

1. Obert and Duvall, "Rock Mechanics and design of structures in rock".
2. Peng , "Coal mining Ground control"
3. Jager and cook , "Fundamentals of rock mechanics "

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PC3202MN

UNDERGROUND MINING METHODS (METAL)

Teaching Scheme				Examination Scheme
L	T	P	C	Internal Marks: 30
3	1	0	4	External Marks : 70

UNIT I

Metal Deposits:

Scope and limitation of underground mines, opening up of underground deposits, choice of mode of entry, shaft and combination and their applicability, number of entries in relation to extent of deposit along strike and dip, ventilation requirements, physic – mechanical properties of ore and wall.

UNIT II

Raising Methods:

Layout of drift, crosscut, raise and winzes in ore body, Factors influencing choice of level interval, different types of raising methods, merits and demerits

UNIT III

Stopping Methods:

Factors governing the choice of methods. The different underground stoping methods: breast stoping, under hand and overhand, room and pillar, sublevel, square set, shrinkage, cut and fill methods and other stoping methods.

UNIT IV

Advanced Methods:

Recent advances in stoping practices, VCR mining, deep mining, stoping practices in rock burst prone mines, back-filling, recent developments in metal mining in India.

UNIT V

Deep Mining:

Special problems of deep mines – rock pressure, heat, humidity, rock burst, noise and dust pollution, deep winding and transport, etc. ; solution mining, ore leaching, in situ leaching techniques

Text / Reference books:

1. Woodroof SC, " Methods of working coal and metal mines" Vol. III
2. Shevyakov, " Mining and mineral deposits"
3. DJ Deshmukh ," Elements of Mining Technology" Vol. -II
4. Peele, "Mining Engineers handbook". Vol. I & II
5. Popov, "Working of Mineral Deposits"

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PC3203MN

SURFACE MINING METHODS

Teaching Scheme				Examination Scheme
L	T	P	C	Internal Marks: 30
3	1	0	4	External Marks : 70

UNIT I

Introduction:

Status of surface mining, types of surface mines, applicability and limitations, concept of stripping ratio, stripping economics, concept of ultimate pit limits, design of haul roads, elements of surface mine planning – selection of site for box cut, selection of operating parameters like bench height, width, slope, etc.,

UNIT II

Layout and Design of Open Pit Mines:

Selection of site for box cut, Working pit slope and ultimate pit slope, common modes of slope failure, factors influencing stability of slopes, development of open cast mine layouts for various shapes of deposits. stripping methods using different machinery. layout problems.

UNIT III

Ground Preparation Techniques:

Preparation of the site – Ripping, Drilling and blasting; Types, operation selection, application and limitation of ground preparation equipments - Rippers, Dozers, Graders, Loader. Blast hole drills and rock breakers, placer mining, Economics of drilling and blasting. Its related calculation

UNIT IV

Excavation Techniques:

Selection criteria for equipments used in surface mines. Classification, application and limitations of different types of equipments used in surface mining projects; Cycle time and productivity calculation for excavating and loading equipments. Drag line - calculation of required bucket capacity for a given handling requirement, method and cycle of operations of drag lines, front end loaders, scrapers, bucket wheel and bucket chain excavators, surface miners. Determining the capacity and number of shovels and dumpers for planned production

UNIT V

Transportation Techniques:

Application of Different modes of transportation system – Trucks, Conveyors (shifting and High angle), Aerial rope ways, Rail transport and pipeline transport systems. Inpit crushers and conveying system. Formation of dumps with spreaders; Types of waste dump- internal and external; dump formation methods and corresponding equipment; Dump stability and stabilization measures

Text / Reference books:

1. SK Das, "Surface Mining Technology"
 2. Mishra GB, "Surface Mining".
 3. Hustruid W and Kuchta M," Open Pit Mine Planning & Design". Vol.-I
 4. Hustruid W, McCarter MK and Van Zyl D, "Slope Stability in Surface Mining"
 5. Deshmukh RT & Khare BP, " Sciences & Technology of Opencast Mining"
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PC3204MN

MINING MECHANIZATION

Teaching Scheme				Examination Scheme
L	T	P	C	Internal Marks: 30
3	0	0	3	External Marks : 70

UNIT I

Locomotive Haulage:

Types of locomotive; battery, diesel, electric, compressed air driven locomotives – construction, limitation, operational features, Hazard and their prevention, locomotive haulage calculation

UNIT II

Conveyors:

Different types, construction, details, application; operation maintenance, hazard and safety devices; AFC and their applications; belt and chain conveyors; calculations and recent developments
Aerial ropeways: types, construction details, tension arrangements; calculations

UNIT III

Face machinery:

Continuous Miner, Shearer, plough: their construction and operation; powered supports, stage loaders, lump barkers; safety devices, Modern concepts in underground mine mechanization.
Drills: Different types, construction, operation and maintenance

UNIT IV

Surface Mine Machinery:

Design and Constructional details of Front end loaders, Hydraulic excavators and Electric Rope shovel, Backhoe, Dragline, and Bucket Wheel Excavator. Bucket Chain Excavator and Surface Miners, Bull Dozers, Rock Breakers, Water Tankers.

UNIT V

Electrical & Hydraulic Equipments:

Electrical equipment and power distribution in underground and opencast mines; types of cables; industrial hydraulics, hydraulic and pneumatic power supply circuit in mine machinery; study of various elements of the circuit like valves, pumps, compressors, hydraulic motors, compressed air motors and all related equipment

Text / Reference books:

1. Karelin, "Mine Transport".
2. DJ Deshmukh, "Elements of Mining Technology" Vol. -III
3. Walker, "Mine winding and transport"
4. John Pipenger and Tyler Hicks, "Industrial Hydraulics"
5. Statham, "Coal Mining Practice"
6. Chang & Peng, "Longwall Mining"

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PC3205MN

FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

Teaching Scheme				Examination Scheme
L	T	P	C	Internal Marks: 30
3	0	0	3	External Marks : 70

UNIT – I

Introduction to Artificial Intelligence:

Overview of rich history, Historical Backdrop of 1950, The AI problems, Turing test, Underlying assumption, what is Intelligence, The level of the model, Criteria for success

Problems, Problem Spaces and Search:

Defining the problem as a state space search, Introduction to search strategies, Issues in the design of search programs, additional problems.

UNIT – II

AI Framework:

Framework to work with data in an Ai project, step by step approach to putting together an AI project from beginning to deployment

Heuristic Search Techniques:

Generate-and-Test, Hill climbing; simple & steepest; simulated Annealing, Best-first-search

UNIT – III

Knowledge Representation:

Knowledge representations and mappings, Approaches to knowledge representation, Issues in knowledge representation

Predicate Logic:

Representing simple facts in logic, Representing Instance and Isa relationships, Computable functions and Predicates, Resolution, Natural Deduction.

UNIT – IV

Representing Knowledge Using Rules:

Procedural versus Declarative knowledge, Logic programming, Forward versus Backward Reasoning

Symbolic Reasoning under Uncertainty:

Introduction to Non-monotonic Reasoning, Logics for Non-monotonic Reasoning, Implementation issues

UNIT-V

Natural Language Processing:

Introduction, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing, Statistical Natural Language Processing, Spell Checking.

Future of AI:

Autonomous driving, Weaponization of AI, technological unemployment, drug discovery and regulation

Text / Reference books:

1. Elaine rich, Kevin knight and Shivashankar B Nair “Artificial Intelligence”, Third Edition, McGraw-Hill, ISBN No: 978-0-07-008770-5, 2015
 2. Deepak Khemani, “A First Course in Artificial Intelligence”, First Edition, McGraw Hill Education, ISBN No: 978-1259029981, 2013
 3. Patterson, “Introduction to Artificial Intelligence” First Edition, 2000, Pearson Education India, ISBN No: 978-8120307773, 2015.
 4. Russell, “Artificial Intelligence” Third Edition, Pearson Education India, ISBN No: 978-9332543515, 2015.
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B Tech (Mining) VI- Semester

PC3206MN

MINERAL EXPLORATION & RESERVE ESTIMATION

Teaching Scheme				Examination Scheme
L	T	P	C	Internal Marks: 30
3	0	0	3	External Marks : 70

UNIT - I

Introduction:

Definition, objectives and criteria for mineral exploration, guides for ore search: Physiographic, stratigraphic, lithographical, structural mineralogical, geochemical, geobotanical and hydro geological

UNIT - II

Reserve Estimation:

Types of drilling, drill core sample logging, data compilation, preparation of litholog of the bore hole – isocore and isopatch maps preparation of geological cross sections, interpretation of the coalmining and exploration deposit reserve estimation.

UNIT - III

Exploration:

Introduction to important mineral resources in India and worldwide, surface and aerial prospecting, reconnaissance, application of exploration methods
Preliminary and detailed exploration by boring, exploratory mining by shafts, drifts, cross-cuts, collection and compilation of data for computer processing

UNIT - IV

Geological Exploration:

Geochemistry, geochemical exploration; distribution of elements in igneous rocks and minerals, primary haloes and primary dispersion; chemical weathering, mobility in secondary environment, displaced anomalies, pathfinders and their application

UNIT - V

Geo Physical Exploration:

Basic concepts of geophysical exploration, Methods of geophysical exploration: Gravity, Seismic, electrical.

Remote Sensing, Application of remote sensing in mineral exploration, visual image & satellite data interpretation,

Text / Reference books

1. M S Krishnaswamy, "Mineral Deposits"
2. Arogyaswamy, "A Text book of Mining Geology"
3. William I Smith, "Remote sensing application in mineral exploration"

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PC3207MN

MINE SURFACE ENVIRONMENT MANAGEMENT

Teaching Scheme				Examination Scheme
L	T	P	C	Internal Marks: 30
3	0	0	3	External Marks : 70

UNIT – I

Introduction:

Environmental Pollutants due to surface Mining – Air, Water, Noise; impact of men on the extent of environmental problem; Nature and extent of environmental problems due to mining.

UNIT – II

Air Pollution:

Sources and Classification of pollutants including dust and their effect on human health, Sources, hazards, sampling and analysis, standards, instrumentation and measurement of pollutants including dust. Control and preventive measures for air pollution including dust

UNIT – III

Water & Noise Pollution:

Environmental Pollution due to Water - Sources and Classification of pollutants and their effect on human health, hazards, sampling and analysis, Water pollution standards. Noise standards – Measurement – Noise Impact Index assessment, Control and preventive measures for water, noise pollution due to vibrations, their monitoring, prevention and control

UNIT – IV

Land effects & EIA:

Reclamation Planning, land use analysis, monitoring and maintenance, reclamation equipment and techniques, acid and alkaline drainage, control measures
Framework for EIA, EIA methodologies and their applicability; Uncertainties in EIA

UNIT - V

Environmental legislation:

Environmental laws, the Environmental (Protective) Act, 2004, The Water Act (1974), The Air act (1981), The Forest Act 1927, The forest conservation act 1980, Power and responsibilities of regulatory agencies and occupation consent to establish and operate wild life protection act and rules, Environmental clearance procedure for a mining Project.

Frame work of EMP, Legislative requirements of EMP; Preparation and appraisal of EMP report.

Text / Reference books:

1. Hartman HL. Mine ventilation and air conditioning. Wiley, Newyork. 1999.
 2. Mishra GB. Mine environment and ventilation. Oxford University Press. 1992.
 3. Mackenthun KM. Basic concepts in environmental management. Lewis publications, London. 1998.
 4. Shyam D and Armin R. Environmental law and policy in India. Oxford University Press, New Delhi. 2001.
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PC3208MN

ROCK EXCAVATION ENGINEERING

Teaching Scheme				Examination Scheme
L	T	P	C	Internal Marks: 30
3	0	0	3	External Marks : 70

UNIT - I

Introduction:

Concepts, historical developments in rock excavation, systems, factors affecting the rock fragmentation, mechanism of rock breakage and fracture; their application to rock fragmentation methods for rock fragmentation – explosive action, cutting, ripping and impacts. Scope and importance of rock excavation engineering in mining and construction industries; physico-mechanical and geotechnical properties of rocks vis-à-vis excavation method; selection of excavation method; Rock breaking processes: Primary, Secondary and Tertiary, Energy consumption computations.

UNIT – II

Rock mechanics:

Rock properties related to machining process; application of compressive, tensile and multiaxial strengths, index tests and abrasivity, anisotropy, elasticity, porosity, laminations, bedding and jointing in rock fragmentation process.

UNIT - III

Rock cutting technology:

Mechanism of drilling – rotary, percussive, rotary, rotary percussive, mechanics of rock machining, theory of single tool rock cutting, crack initiation and propagation, breakage pattern, rock excavation by cutting action – picks, discs, roller cutters water jet cutting, methods of evaluation of drillability and cuttability of rocks. Advances in drilling equipment, pneumatic versus hydraulic, design and operating parameters of surface and underground drilling; evaluation of drill performance; mechanism of bit wear; bit selection; economics of drilling

UNIT - IV

Rock cutting tools:

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

Theories of rock tool interaction for surface excavation machinery rippers, dozers, scrapers, BWE, continuous surface miners, auger drills; theories of ploughs, shearers,–rock tool interaction for underground excavation machinery road headers, continuous miners and tunnel boring machines; selection criteria for high pressure water jet assisted–cutting tools; advanced rock cutting techniques cutting.

UNIT - V

Rock excavating machines:

Excavating machines, principles, operation, applicability and technical indices of road headers, TBM'S coalface machines and bucket wheel excavators. Recent Developments in rock excavation machinery

Text / Reference books

1. Cummings AB and Given IV. SME mining engg. vol. I and II, America. 1992.
 2. Hartman HL. Introductory mining engineering. John Wiley and Sons, New York. 1987.
 3. Chugh CP. Diamond drilling. Oxford-IBH. 1984.
 4. Clark GB. Principles of rock fragmentation. John Wiley and Sons, New York. 1987.
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B Tech (Mining) VI- Semester

PC3209MN

MINING MECHANIZATION LABORATORY

Teaching Scheme				Examination Scheme
L	T	P	C	Internal Marks: 25
0	0	3	1.5	External Marks : 50

1. Different types of ropes, rope capping and rope splicing
2. Different types of rope haulage
3. Haulage clips
4. Haulage tracks and rolling stocks
5. Head gear frame, suspension gear for cage/skip, guider ropes, safety hooks
6. Winding drums, safety device and braking system
7. Various types of pumps
8. Conveyor constructional details
9. Various types of locomotives
10. Drills construction
11. Power distribution in underground and OC mines.