B.E. MINIING ENGINEERING

III SEMESTER

Sl. No	Subject Code	Title	Teaching Department	Teaching Hours /Week			Examination				Credits
				Lecture	Tutorial	Practical	Duration (Hours)	SEE Marks	CIE Marks	Total Marks	
1	17MAT31	Engineering Mathematics – III	Maths	04			03	60	40	100	04
2	17MN32	Mining Electrical Engineering	EEE	04			03	60	40	100	04
3	17MN33	Mining Geology-I	MN/Geology	04			03	60	40	100	04
4	17MN34	Mechanics of Materials	MN/ME/CV	04			03	60	40	100	04
5	17MN35	Elements of mining Engineering	MN	04			03	60	40	100	04
6	17MN36	Computer Aided Machine Drawing	ME	02		04	03	60	40	100	03
7	17MNL37	Mining Geology Laboratory-I	Geology/MN	01		02	03	60	40	100	02
8	17MNL38	Mining Electrical Engineering Laboratory	EEE	01		02	03	60	40	100	02
9	17KL/CPH39/49	Kannada/Constitution of India, Professional Ethics and Human Rights	Humanities	01			01	30	20	50	01
TOTAL				**24**		**08**		**510**	**340**	**850**	**28**

Engineering Mathematics – III [As per Choice Based Credit System (CBCS) scheme] SEMESTER – III (Mining Engineering)			
Course Code	**17MAT31**	**CIE Marks**	**40**
Number of Lecture Hours/week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Marks**	**03**
Credit = 04			

TO BE TAKEN FOR MATHEMATICS BOARD

MINING ELECTRICAL ENGINEERING

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III (Mining Engineering)

Course Code	**17MN32**	**CIE Marks**	**40**
Number of Lecture Hours/week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Marks**	**03**

Credit = 04

Course objectives:

This course will enable students to:

To learn the importance of Electrical Engineering and its applications in Mining and allied industries.

Modules	**Teaching Hours**
MODULE-1: Introduction	
Introduction: Scope and importance of Electrical Engineering in Mining, qualification, roles and responsibilities of electrical inspectors, Indian Electricity Rules applicable to Mining. **Introduction to Electrical Drives and its Application in Mining:** Electrical Drives, advantages, parts, choice of electrical drives, status of AC and DC drives, precautions in coal mines, methods of neutral grounding, types of electric drives for control of winders, shearers and conveyors, electric drives for mine hoists.	**10 Hours**
MODULE-2: DC Machines	
DC Machines: Types and characteristics of DC motors, voltage and torque equation of DC motors, regulation, and speed control of shunt motors – armature, flux and voltage control, problems on shunt motors. Electric braking of shunt motors – dynamic, plugging and regenerative, characteristics of DC shunt generator.	**10 Hours**
MODULE-3: AC Machines	
AC Machines: Types and working principle of 3 phase induction motors, working principle of synchronous motor, problems on synchronous motors, speed control of induction motors, plugging of an induction motor, working principle of an alternator.	**10 Hours**
MODULE-4: Protective Devices & Power Distribution in Mines	
Protective Devices: Fuses - types, air break switches, air circuit breakers, oil circuit breakers, principle of underground signaling in mines, types of motor enclosures in mines **Power Distribution in Mines:** Single line diagram of power distribution on surface and in underground mines, Cables – various types for surface and underground mines, Flameproof apparatus, Intrinsically safe apparatus, Standard voltage levels for mining as per IER 1956.	**10 Hours**
MODULE-5: Mine Illumination	
Mine Illumination: Definition, laws of illumination, types of lighting sources, comparison of conventional and solid state lighting, general lighting in underground and surface mines, standards of mine lighting, LED lighting – working, types used in underground and surface mines.	**10 Hours**

Course Outcomes:

1. Students will be aware of Indian Electricity Rules 1956.
2. They will understand the Roles and Responsibilities of Electrical Engineer in Mines.
3. They will be able to differentiate various Motors used in Electrical Drives in Mines.
4. They will be able to draw the single line diagram of distribution system in Mines.
5. They will understand types of lighting used in mines and its design.
6. They will be familiar with Electrical Safety devices and its operating principles.

TEXT BOOKS:

1. "**Fundamentals of Electrical Drives**." G.K. Dubey, Narosa Publishing House, 1995 (Module-1)
2. "**Electrical Technology**," B.L. Theraja, A.K. Theraja, Volume II AC and DC Machines, S.Chand& Company, 1999 (Module-2&3)
3. " **Electrical Power**," J.B. Gupta, S.K. Kataria& Sons, 1992 (Module-4&5)

REFERENCE BOOKS:

1. " **Universal Mining School Reports**", Cardiff, Mining publishing London, 1st Ed., 1997
2. " **The Indian Electricity Rules 1956**", Chapter X (Module-1)
3. " **A Study of Indian Electricity rules, 1956,**" L.C. Kaku, Lovely Prakashan, 2007
4. " **Electric Drives**", N.K. De, P.K. Sen, Prentice Hall of India, 2001
5. " **The Lighting of underground Mines**", Donald A Trotter, Transtech Publications, 1982
6. "**Electric Motors: Applications & Controls**" by M.V.Deshpande.

MINING GEOLOGY-I

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III (Mining Engineering)

Course Code	**17MN33**	**CIE Marks**	**40**
Number of Lecture Hours/week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Marks**	**03**

Credit = 04

Course objectives:

This course will enable students to:

1. To be familiarized with the size, shape, mass & density of earth, age of earth, internal structure of earth, earthquake and volcanism.
2. To study physical properties of the mineral.
3. To study igneous, sedimentary and metamorphic rocks, and associated geological disturbances like folds, faults and joints.
4. To learn the principles of stratigraphy, units of stratigraphy, classification and correlation of stratigraphy. To be familiarized with the important geological formations: Archeans, Cuddaphs, Vindhyans, Gondwanas and Tertiaries.

Modules	Teaching Hours
MODULE-1: Physical Geology	
Geology and its role in Mining, Earth as a planet- internal structure and composition of the earth, Geological work of wind, rivers, lakes, glaciers, seas, oceans and ground water, influences of these process on Mining Engineering sectors, earthquakes and seismic hazards and their relation with volcanoes, Engineering protection against earthquakes.	**10 Hours**
MODULE-2: Mineralogy & Petrology	
Mineralogy : Definitions, Physical properties of minerals, chemical composition, occurrence and uses of Quartz and its varieties, Felspar, Carbonates Mica, Garnet, Olivine, Pyroxenes and Amphiboles. **Petrology**: Broad classification of rocks into Igneous, Sedimentary and Metamorphic rocks with examples. Structures, classification of igneous rocks, classification of sedimentary rocks depending upon the grain size, metamorphic agents and kinds.	**10 Hours**
MODULE-3: Texture, Structure and Mineralogy of Rocks	
Igneous Rocks: Granite, Diorite, Gabbro, Dunite, Pegmatite, Porphyries, Dolerite, Basalt, Rhyolite & Obsidian **Sedimentary Rocks:** Conglomerate, Breccia, Sandstone, Limestone & Shale. **Metamorphic Rocks:** Gneiss, Schist, Quartzite Marble & Slate.	**10 Hours**
MODULE-4: Geological Time Scale & Indian Stratigraphy	
Geological Time Scale: Correlation, Catastropism, Geological Clock, Law of order of superposition, Uniformitarianism, fossil and their uses. **Indian Stratigraphy:** Physio-geographic divisions of India with special reference to Dharwar, Cuddapah, Vindhyans, Gondwanas and Tertiary system with their economic importances.	**10 Hours**
MODULE-5: Structural Geology	
Structural Geology: Primary & Secondary Structure, Dip& strike, True Dip & Apparent Dip, Compass clinometers, Structural features of rocks, interpretation of topographic maps, Classification of folds, faults, joints and unconformities, their recognition in the field and importance	**10 Hours**

in mining operations.

Course Outcomes:

1. The students will gain technical knowledge on shape, size, mass & density of earth, age of earth, structure of the earth.
2. They will be able to identify, formulate, and solve engineering problems related to properties of minerals, structural geology, types of rocks and geological maps.
3. They will possess ability to use the techniques, skills and modern engineering tools necessary for Engineering Geology.
4. The students will gain technical knowledge on stratigraphy of India and important geological formation of India.

TEXT BOOKS:

1. **"Engineering and General Geology,"** Parbin Singh. Katson publisher, Ludhiana, 1st Ed. 2002.
2. **"A Text Book of Geology,"** P.K.Mukerjee. The World Press Pvt. Ltd., Calcutta.2000

REFERENCE BOOKS:

1. **"Principles of Petrology"** G.W.Tyrill, B.I. Publications Pvt. Ltd., New Delhi.1999.
2. **"Geology of India,"** Wadia, D.N., Tata Mc. Graw Hill Publilshing co. Ltd., 2000
3. "**Structural Geology,"** Marland& Billings, Prentice Hall of India Pvt. Ltd., New Delhi.2000.
4. "**Geology of the Himalayas**", E.T Attikinson, Cosmo Publications, New Delhi, India, 1980.
5. "**Principles of Engineering Geology**" by K.M Bangar, Standard Publishers, Delhi, 1995.
6. "**Physical & Engineering Geology**" by S.K.Garg.

MECHANICS OF MATERIALS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III (Mining Engineering)

Course Code	**17MN34**	**CIE Marks**	**40**
Number of Lecture Hours/week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Marks**	**03**

Credit = 04

Course objectives:

This course will enable students to:

1. To understand the basic concepts of mechanics of materials, which is the base of rock mechanics.
2. To know the relation between stress, strain and between different elastic constants.
3. To analyze stresses and strains at any point in a material with various stress conditions.
4. To draw the bending moment and shear force diagram and to find out bending and shear stresses at any point in a cross section of the beam.
5. To understand the concept behind torsion.

Modules	**Teaching Hours**
MODULE -1	
Stress and Strain: Definition of Stress, Strain and Stress-strain relations, Mechanical behaviour of materials, Linear elasticity, Young's modulus of elasticity and Poisson's ratio, Stress-Strain curves in tension for Mild steel, Cast iron and non-ferrous metals. Bars of uniform cross section, varying cross section and discontinuous/stepped cross section, Extension / Shortening under point (axial) load, body force (self-weight), temperature change, Compound bars, Composite Sections, Numerical examples	**10 Hours**
MODULE- 2	
Compound Stress: Uniaxial, Biaxial, General 2D stress state, Definition of Plane stress and Plane strain states, Stresses on inclined sections, Principal stresses, Principal planes, Principal axes, Maximum shear stress, Mohr's circle, Numerical examples. Expression for Volumetric strain, Elastic constants, Numerical examples Cylinders: Determination of deformations, strains and stresses in thin cylinders subjected to internal pressure, Numerical examples	**10 Hours**
MODULE- 3	
Bending Moment and Shear Force diagrams: Types of beams, loads and reactions, Definition of shear force and bending moment, sign conventions, Relationship between shear force, bending moment and rate of loading, Shear force and bending moment diagrams for different beams, Numerical examples involving beams subjected to concentrated loads, uniformly distributed load (UDL), uniformly varying load (UVL) and couple.	**10 Hours**
MODULE- 4	
Stresses in Beams: Euler-Bernoulli beam theory, Relationship between bending moment, bending stress, and radius of curvature. Transverse Shear stresses, shear stress across rectangular, circular, symmetrical I and T- sections only, Numerical examples. Deflection of Beams : Governing differential equation and its solution, Double integration method for cantilever and simply supported beams for point load, UDL, UVL and Couple, Macaulay's method, Numerical examples	**10 Hours**

MODULE- 5	
Torsion of shafts with circular cross section: Derivation of governing equation, Torsional rigidity, Torsional strength, Power transmitted by solid and hollow shafts, Numerical examples Elastic stability of Columns: Euler's theory for axially loaded elastic long columns, Derivation of Euler's load for various end conditions, limitations of Euler's theory, Rankine's formula, Numerical examples	**10 Hours**

Course outcomes:

At the end of the course students will have:

1. The basic concepts of Mechanics of materials are clear to students.
2. By knowing the stresses and strains developed in a structure, the student is able to find out at which point structure is strong and at which point it requires strengthening.
3. The bending moments and shear force at any cross section of the beam can be easily found out with the help of BMD and SFD, which enables the student now to study and design the beam.
4. The student is now ready to learn designing of different structures. The base of study of rock mechanics and ground control, which are the subjects of higher semesters.

TEXT BOOKS:

1. "Mechanics of Materials" by R.C.Hibbeler, Printice Hall, Pearson Edu., 2005
2. "Mechanics of materials", James.M.Gere, Thomson, Fifth edition2004
3. "Mechanics of materials", S.I. Units, Ferdinand Beer &RussellJohnstan, TATA Mac GrawHill 2003.

REFERENCE BOOKS:

1. "Strength of Materials", S.S.Bhavikatti, Vikas publications House – Pvt. Ltd., 2nd Ed., 2006.
2. "Mechanics of materials" K.V. Rao, G.C. Raju, First Edition,2007
3. "Engineering Mechanics of Solids" Egor.P. Popov, Pearson Edu. India, 2nd, Edition, 1998.
4. "Mechanics of Solids", Mubeen, Pearson Edu. India, 2002
5. "Strength of Materials", W.A. Nash, Sehaum's Outline Series, Fourth Edition-2007.

ELEMENTS OF MINING ENGINEERING

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III (Mining Engineering)

Course Code	**17MN35**	**CIE Marks**	**40**
Number of Lecture Hours/week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Marks**	**03**

Credit = 04

Course objectives:

This course will enable students to:

1. To understand the basic concept of mining industry in relation to national economy and infrastructure building.
2. To be familiar with the various methods for opening up of deposits.
3. To understand the technical details of various unit operations involved in shaft sinking.
4. To learn various methods of shaft sinking and Tunneling methods
5. To be familiar with the various types of Mine supports.

Modules	Teaching Hours
MODULE-I: Introduction to Mining Engineering and Opening up of Deposits	
Introduction to Mining Engineering: Significance to mining industry in national economy and infrastructure building, basic mining terminologies, stages in mine life cycle, geo-technical investigations, classification of mining methods and their selection criteria. **Opening up of Deposits**: Types, size and location of entries into underground coal and other minerals.	**10 Hours**
MODULE-2: Shaft Sinking Operation, Special and Mechanized Methods of Shaft Sinking	
Shaft Sinking Operation: Preliminary geo-technical investigations for a shaft sinking, surface arrangements for sinking shafts and equipment. Unit-operations of drilling, blasting, mucking; temporary and permanent lining. Construction of insets and shaft stations. **Special and Mechanized Methods of Shaft Sinking:** Methods of sinking shaft in water-logged, pressurized strata in loose and running soils. Mechanized shaft sinking, shaft borers and drop raise method. Need for widening and deepening of operating shafts. Different methods for widening and deepening shafts- cycles of operation, equipment and manpower needed. Numerical related to shaft sinking.	**10 Hours**
MODULE-3: Development of Workings	
Development of Workings: Drivage of cross cuts, drifts, inclines and raises by conventional and mechanized methods. Calculation of OMS. Arrangements for ventilations, supports, lightings, transportations and drainages. Drilling patterns for underground coal mines and hard rock mines.	**10 Hours**
MODULE-4: Mine supports	
Mine Supports: Types of support: timber, prop, chock/cog, cross bar, concrete, steel and hydraulic supports. Yielding and rigid supports. Fore poling, roof stitching, roof bolting, applicability, advantages and limitations of various supports. Systematic support rules.	**10 Hours**
MODULE-5: Tunneling Methods	

Conventional Method: drilling and blasting method, types of drill patterns, blasting and transportation of muck. **Mechanized Method**: construction and working principle of tunnel boring machine, applicability, advantages and limitations of tunnel boring machine. **Shield Tunneling Method**: construction and working principle, applicability, advantages and limitations.	**10 Hours**

Course outcomes:

At the end of the course students will have:

1. The students will gain technical knowledge on stages of mining and methods of development.
2. They will be able to design various drilling patterns used in drivage of adit, shaft, incline, drives, cross-cut and tunnel.
3. They will be able to identify, formulate and solve engineering problems in shaft sinking.
4. They will possess ability to use the techniques, skills, and modern engineering tools necessary for mine development practice.

TEXT BOOKS:

1. "**Elements of Mining Technology"**, vol. I, "D.J.Deshmukh, Vidyasewa, Prakashan, Nagpur.7th Ed.1996.
2. "**Introductory Mining Engineering**" by Hartman H.L., John Wiley Sons. 1st Ed. 2004.
3. **Tunnel Engineering Book**

REFERENCE BOOKS:

1. "**Underground mining methods handbook,**" W.A.Hustrulid, Published by S.M.E. of the American institute of mining metallurgical and petroleum Engineers inc., New York, 1982.
2. **"Universal mining school volumes"** Cardiff Gt.Britain, 1931.
3. **"Winning and working"** by B.Ghosh.
4. **"Advances in Drilling & Blasting"** by V.R.Sastry.
5. **"Drilling & Blasting"** by Carlos Lopez Jimeno.

COMPUTER AIDED MACHINE DRAWING

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III (Mining Engineering)

Course Code	**17MN36**	**CIE Marks**	**40**
Number of Lecture Hours/week	**06 (2 Hour Instruction + 4 Hours Drawing)**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Marks**	**03**

Credit = 03

Course objectives:

This course will enable students to:

1. To know and comprehend the standards of machine drawing practiced by Bureau of Indian standards (B.I.S.)
2. To understand general projection theory, with an emphasis on the use of orthographic projection to represent three-dimensional objects in Two-dimensional views
3. To gain knowledge on Assemble of machine elements in mining engineering applications.
4. To gain knowledge of modern engineering software tools for mining engineering design and analysis

INTRODUCTION Review of graphic interface of the software. Review of basic sketching commands and navigational commands. Starting a new drawing sheet. Sheet sizes. Naming a drawing, Drawing units, grid and snap.	**02 Hours**
Part -A	**Teaching Hours**
Sections of Solids: Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on axis inclinations, spheres and hollow solids). True shape of sections. **Orthographic Views:** Conversion of pictorial views into orthographic projections. of simple machine parts with or without section. (Bureau of Indian Standards conventions are to be followed for the drawings) Hidden line conventions. Precedence of lines.	**06 Hours**
Thread Forms, Thread terminology, sectional views of threads. ISO Metric (Internal & External) BSW (Internal & External) square and Acme. Sellers thread, American Standard thread. Fasteners Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen	**08 Hours**
Part- B	
Keys: Parallel key, Taper key, Feather key, Gibhead key and Woodruff key Riveted Joints: Single and double riveted lap joints, butt joints with single/double cover straps (Chain and Zigzag, using snap head rivets). Cotter joint (socket and spigot), knuckle joint (pin joint) for two rods.	**08 Hours**

Couplings: Split Muff coupling, Protected type flanged coupling, pin (bush) type flexible coupling, Oldham's coupling and universal coupling (Hooks' Joint)	**08 Hours**
Part - C	
Assembly Drawings (Part drawings should be given) **1. Plummer block (Pedestal Bearing)** **2. Rams Bottom Safety Valve** **3. I.C. Engine connecting rod** **4. Screw jack (Bottle type)** **5. Machine vice** **6. Tool Head of a shaper.**	**18 Hours**

Course outcomes:

At the end of the course students will be able to:

1. Students will be able to understand the steps in producing drawings according to Bureau of Indian Standards (B.I.S.)
2. Students will be able to understand and create drawings of machine parts and their assemblies
3. Students can work effectively with engineering and science teams as well as with multidisciplinary designs.
4. Students will be able to skillfully use modern engineering software tools for mining engineering design and analysis Graduate Attributes

TEXT BOOKS:

1. **"A Primer on Computer Aided Machine Drawing-2007",** Published by VTU, Belgaum.
2. **"Machine Drawing"** by Sri N.D.Bhat & V.M.Panchal.

REFERENCE BOOKS:

1. **"A Text Book of Computer Aided Machine Drawing",** S. Trymbaka Murthy, CBS Publishers, New Delhi, 2007.
2. **"Machine Drawing with Auto CAD"** Goutam Pohit& Goutham Ghosh, 1st Indian print Pearson Education, 2005.
3. **"Auto CAD 2006, for engineers and designers"** Sham Tickoo. Dream tech 2005.
4. "Machine Drawing", by R.K.Swamy.
5. **"A Text Book of Computer Aided Machine Drawing",** by K.R.GopalKrishna.
6. **"Machine Drawing",** by K.L.Narayana

Internal Assessment: 40 Marks

Sketches shall be in sketch books and drawing shall through use of software on A3/A4 sheets. Sketch book and all the drawing printouts shall be submitted.

Scheme of Evaluation for Internal Assessment (40 Marks)

(a) Class work (Sketching and Computer Aided Machine drawing printouts in A4/A3 size sheets): 20Marks.
(b) Internal Assessment test in the same pattern as that of the main examination (Better of the two Tests): 20 marks.

Scheme of Examination:

Two questions to be set from each Part A, part B and Part C.
Student has to answer one question each from Part A, Part B for 20 marks each and one question from Part C for 60 marks.

Part A 1 x 20	=	20 Marks
Part B 1 x 20	=	20 Marks
Part C 1 x 60	=	60 Marks
Total	=	100 Marks

INSTRUCTION FOR COMPUTER AIDED MACHINE DRAWING (17MN36) EXAMINATION

1. No restriction of timing for sketching/ computerization of solutions. The total duration is 3 hours.
2. It is desirable to do sketching of all the solutions before computerization.
3. Drawing instruments may be used for sketching.
4. For Part A and Part B 2D drafting environment should be used.
5. For Part C 3D part environment should be used for parts assembly drawing and extract 2D views.

MINING GEOLOGY LABORATORY – I

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III (Mining Engineering)

Course Code	**17MNL37**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03 (1 Hour Instruction + 2 Hours Laboratory)**	**SEE Marks**	**60**
		Exam Hours	**03**

Credit = 02

Course objectives:

This course will enable students:

1. To be familiar with physical properties of the mineral.
2. To be able to identify igneous rock, sedimentary rock and metamorphic rock.
3. To be able to identify the folds, faults and joints.
4. To be able to prepare Geological maps and Topographic maps.

Part-A

I. Experimental study of Minerals

Physical properties, chemical composition, mode of occurrence, Distribution, identification and uses with reference to mining importance.

Experiment No.01: Quartz, Felspar and Mica Group of Minerals.

Experiment No. 02: Calcite, Magnesite, Ferromagnesium Minerals

II. Experimental study of Rocks

Physical Properties, Mineral composition, Texture, Petrogenesis, Engineering properties, distribution and uses.

Experiment No. 03: Igneous Rocks.

Experiment No. 04: Sedimentary Rocks.

Experiment No. 05: Metamorphic Rocks.

Part-B

III Structures Based study of Rocks

Zenolithic, Vesicular, Amygdaloidal, pegmatitic, Stratification, Graded bedding, Current bedding Ripple Marks, Cataclastic, Maculose, Slaty, Schistose, Gneissose, Granulose & Hornfelsic Structures.

Experiment No. 06: Igneous, Sedimentary & Metamorphic Rocks.

IV Experimental study of Geological Maps.

Drawing sections along the profile areas, Interpretations, descriptions on structural features, Order of super position and geological history and concluding the various forms of land mass.

Experiment No. 07: Topographic Maps, Geological Maps, Structural geological maps – Dipping strata.

Experiment No. 08: Structural Geological Maps – Folded strata.
Experiment No. 09: Structural Geological Maps –Faulted strata & Unconformities.
Experiment No. 10: Tracing of Out Crop Maps.

Course Outcomes:

On the completion of this laboratory course, the students will:

Possess ability to identify, formulate, and solve engineering problems in properties of minerals, structural geology, types of rocks and geological maps.

Scheme of Examination:

ONE question from part -A:	**40 Marks**
ONE question from part -B:	**40 Marks**
Viva -Voice:	**20 Marks**
Total :	**100 Marks**

MINING ELECTRICAL ENGINEERING LABORATORY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III (Mining Engineering)

Course Code	**17MNL38**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03 (1 Hour Instruction + 2 Hours Laboratory)**	**SEE Marks**	**60**
		Exam Hours	**03**

Credit = 02

Course objectives:

This course will enable students:

1. Learn to calculate Resistance / Inductance / power / Efficiency / Power Factor.
2. To study the speed / Torque characteristics of AC and DC machines and to calculate losses and find their Efficiency,
3. To calculate losses in a transformer and to plot the efficiency curves

Part-A

1. Measurement of
   a) Resistance by voltmeter and Ammeter method.
   b) Inductance and Power factor of choke by ammeter voltmeter, wattmeter method.
2. Open circuit characteristics of a D.C. Generator.
3. Load test on shunt generator.
4. Load test on compound generator.
5. Speed control of DC shunt motor.

Part-B

6. Load test on DC shunt motor
7. O.C. and S.C. test on a single-phase transformer and predetermination of efficiency and regulation.
8. Load test on a single phase Induction motor.
9. Load test on 3-phase Induction motor.
10. Calibration of energy meter.

At the end of the course the student will be able to:

1. Find the resistance of a given conductor calculate inductance of a coil and hence power factor.
2. Conduct tests on transformer and evaluate their performance.
3. Identify and conduct tests on AC and DC machines and draw its performance characteristics.
4. Connect and use energy meter and find out its error.

5. Assess the performance of a compound generator with varying load.

Scheme of Examination:

ONE question from part -A:	**40 Marks**
ONE question from part -B:	**40 Marks**
Viva -Voice:	**20 Marks**
Total :	**100 Marks**

B.E. Mining Engineering

IV SEMESTER

Sl. No	Subject Code	Title	Teaching Department	Teaching Hours /Week			Examination				Credits
				Lecture	Tutorial	Practical	Duration (Hours)	SEE Marks	CIE Marks	Total Marks	
1	17MAT41	Engineering Mathematics – IV	Maths	04			03	60	40	100	04
2	17MN42	Thermodynamics & Fluid Mechanics	ME/MN	04			03	60	40	100	04
3	17MN43	Mining Geology-II	MN	04			03	60	40	100	04
4	17MN44	Mine Mechanization-I	MN	04			03	60	40	100	04
5	17MN45	Mine Surveying-I	MN	04			03	60	40	100	04
6	17MN46	Drilling & Blasting Engineering	MN	03			03	60	40	100	03
7	17MNL47	Mining Geology Laboratory-II	Geology/MN	01		02	03	60	40	100	02
8	17MNL48	Mine Surveying Laboratory-I	MN	01		02	03	60	40	100	02
9	17KL/CPH39 /49	Kannada/Constitution of India, Professional Ethics and Human Rights	Humanities	01			01	30	20	50	01
TOTAL				**26**		**04**		**510**	**340**	**850**	**28**

Engineering Mathematics – IV [As per Choice Based Credit System (CBCS) scheme] SEMESTER – IV (Mining Engineering)			
Course Code	**17MAT41**	**CIE Marks**	**40**
Number of Lecture Hours/week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Marks**	**03**
Credit = 04			

TO BE TAKEN FOR MATHEMATICS BOARD

THERMODYNAMICS AND FLUID MECHANICS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV (Mining Engineering)

Course Code	**17MN42**	**CIE Marks**	**40**
Number of Lecture Hours/week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Marks**	**03**

Credit = 04

Course objectives:

This course will enable students to:

- To understand basic principles and basic concepts of Thermodynamics.
- To understand Principles of Fluid mechanics
- To understand working principles of compressor.
- To understand the working principles of pumps, flow through pipes

Modules	**Teaching Hours**
MODULE- 1:Basic Concepts of Thermodynamics and Energy	
Basic concepts of Thermodynamics: Thermodynamic system, classification of thermodynamic system. Thermodynamic property-extensive and intensive properties. Thermodynamic state, thermodynamic process. Reversible, irreversible process, Quasi-static process. Thermodynamic equilibrium, zeroth law of thermodynamics. **Energy**: classification, stored energy and energy in motion. Work and heat-definition, work done at the moving boundary. Comparison between work and heat.	**10 Hours**
MODULE- 2: Laws of Thermodynamics and Air Compressors	
I and II Laws of Thermodynamics: I and II Laws of thermodynamics: Statements, cyclic processes, numerical problems. **Air Compressors:** Single stage and multistage reciprocating air compressors on surface and in underground mines. Expression for work done during single stage air compression with and without clearance volume. Volumetric efficiency. Simple numerical problems on single stage compressors only.	**10 Hours**
MODULE- 3: Fluid Mechanics and Fluid Flow Measurements	
Fluid Mechanics: Definition and properties of Fluids, ideal and real fluid units, systems of measurement. Fluid properties-density, specific weight, specific volume, specific gravity, viscosity, compressibility, surface tension and capillarity, vapour pressure and cavitation, **Fluid flow measurements**: Venturimeter, Orifice meter. Flow through orifices and notches. Loss of head due to friction in pipes. Discharge measurements in pipes.	**10 Hours**
MODULE- 4: Fluid Statistics and Buoyancy	
Fluid Statistics: pressure, atmospheric pressure, gauge and absolute pressure, measurement of pressure, piezometer tube, double	**10 Hours**

column u-tube manometer, differential and inverted U-tube measurements, Bourdon's pressure gauge, diaphragm pressure gauge and dead weight pressure gauge. Total pressure and center of pressure on submerged plane surfaces; horizontal, vertical and inclined planes, curved surface submerged in liquid. **Buoyancy:** definition, center of buoyancy, metacenter and metacentric height, conditions of equilibrium of floating and submerged bodies, determination of metacentric height experimentally and theoretically.	
MODULE- 5: Fluid Dynamics	
Fluid Dynamics: Introduction to equation of motion, Euler's equation of motion, Bernoulli's equation from first principles and also from Euler's equation, limitations of Bernoulli's equation, assumptions, hydraulic gradient line and total energy line. Numerical Problems.	**10 Hours**

Course outcomes:

At the end of the course students will be able to:

- Able to understand basic concepts of Thermodynamics
- Enables to solve problem related to work & heat
- Able to understand principle and operation of reciprocating compressor.
- Able to understand pumps &flow through pipes
- Able to understand basic principles of Fluid mechanics

TEXT BOOKS:

1. **"Engineering thermodynamics",** Nag P.K., Tata McGraw Hill publications. 2nd Ed. 2002
2. **"A Text Book of Fluid Mechanics and Hydraulic Machines,"** R.K.Bansal. Laxmi publications. 2006

REFERENCE BOOKS:

1. **"Fundamentals of Classical Thermodynamics**", Van Wylengordenet. Al, John Wiley Intl. publications, New York. Thermodynamics.2000
2. **"Thermal Engineering,"** R.K.Rajput, laxmi publications, New Delhi.2002
3. **"Hydraulics and Fluid Mechanics,"** Modi P.N. and Seth, S.M., Standard Publishers, New Delhi.1999.
4. "Thermodynamics &Fluid Mechanics", B.E.T, A.Venkatesh, Universities Press.2008
5. "An Introduction to Thermodynamics", Y.V.C.Rao,Wiley Eastern,1993.
6. **"Fluid mechanics",** by Ramamrutham

MINING GEOLOGY – II

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV (Mining Engineering)

Course Code	**17MN43**	**CIE Marks**	**40**
Number of Lecture Hours/week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Marks**	**03**

Credit = 04

Course objectives:

This course will enable students to:

- To be familiar with application of geology in Mining Engineering.
- To gain knowledge of various aspects of Economic Geology &various processes of formation of Mineral Deposits.
- To know the occurrence & distribution of Minerals in India.
- To learn various methods of prospecting.

Modules	Teaching Hours
MODULE- 1:Application of geology in Mining Engineering	
Application of geology in Mining Engineering: Classification of Geology- Pure & Applied Geology, Mining Geology, Delineation of deposits, Limits of Economic Mining, Role of Mine Geologist, Geological Work in Operating Mine	**08 Hours**
MODULE- 2:Economic Geology & Mineral Deposits	
Economic Geology: Definitions, Scope of economic geology, classification of mineral deposits – ore mineral, gangue minerals and tenor of ores. **Mineral Deposits:** Study of Various processes of formation of mineral deposits- Magmatic, Hydrothermal, Weathering, Sedimentation, Sublimation, Evaporation, Oxidation and Supergene enrichment and Metamorphic deposits.	**10 Hours**
MODULE- 3: Occurrence & Distribution of Minerals in India	
Occurrence & Distribution of Minerals in India: Iron, Copper, Lead, Zinc, Chromite, Gold, Manganese, Beach sand, Diamond, Radio-active minerals- Uranium, Radium, Rubidium, Stroncium, Refractory minerals, Ceramic minerals and Building stones.	**10 Hours**
MODULE- 4: Coal, Petroleum and Natural Gas	
Coal: Definitions, physical and chemical properties, variations and ranks of coal. Important constituents of coal, origin of coal, structural features of coal seams, Chief characteristics of Indian coals. Important coal fields of India. **Petroleum & Natural gas:** Meaning, Origin, Composition, Accumulation, Structural features, Migration of petroleum and natural gas, Major oil fields of India.	**10 Hours**
MODULE- 5: Exploration Geology& Mining Geology	
Exploration Geology: Definition, Principles of mineral exploration, stages of mineral Exploration.Prospecting: definition, types- Geological, Geophysical and geo-chemical methods. Remote sensing techniques for prospecting. Factors involved in planning and drilling in detail exploration. Core drilling and core recovery.	

Mining Geology: Methods of sampling, assaying and estimation of ore reserves. Guides for location of ore deposits with particular reference to structural and stratigraphic guides. Geological field work, Methods of surface, sub-surface mapping, Interpretation and use of field data.	**12 Hours**

Course outcomes:

At the end of the course students will be able to:

- The students will be able to identify, formulate and solve the problems of economic minerals.
- The students learn to use the techniques, skills, and modern engineering tools necessary for geophysical and geochemical prospecting.

TEXT BOOKS:

1. "**Mining Geology ",** Module-I & II, Mckinistry, , Asia Publication. 2nd Ed. 2005.
2. **"Economic Mineral Deposits,"** Module-III, IV &V, Bateman A.M John Wiley and sons, 2nd Ed. 1999.
3. A Text Book of Geology:- P.K.Mukharjee
4. Engineering and General Geology:- Parbin Singh

REFERENCE BOOKS:

1. **"Ore Deposits of India",** Gokhale&Rao T.C., Thompson press. India, Faridabad.1999.
2. **"Courses in Mining Geology",** Arogyaswamy, Oxford & IBH Pvt. Ltd.3rd Ed. 1999.
3. **"A Handbook of Economic Geology"**, A.K.Sen & P.K.Guha, Modern Publishers, Calcutta, 1981.
4. **"Geological Prospecting & Exploration"** by V.M.Kreiter, MIR Publishers, Moscow, 1968.
5. **"Geology of India & Burma"** by M.S.Krishna.
6. **"India's Mineral Resources"** by S. Krishnaswamy.
7. **"Petroleum Geology"** by Levorson.

MINE MECHANIZATION –I

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV (Mining Engineering)

Course Code	**17MN44**	**CIE Marks**	**40**
Number of Lecture Hours/week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Marks**	**03**

Credit = 04

Course objectives:

This course will enable students to:

- To choose proper transportation system for shaft, incline and roadways in underground mines depending on the geo-mining conditions of the mineral deposit.
- To analyze the basic element of haulage systems and winding systems in mining industry.
- To learn the construction and working of various haulage system and winding system.

Modules	**Teaching Hours**
MODULE- 1:Principles,Generation, Distribution & Utilization of Compressed air and Introduction to Mine Transport Systems	
Compressed Air: Definition- Air pressure, Laws governing compression & expansion of gases (derivation & simple problems), Specific heat of gas. **Generation & Distribution of compressed air**: Transmission and distribution of compressed air in mines, loss of compressed air. **Utilization of compressed air:** Jack hammer, Rocker shovel, Air turbines & Reciprocating compressed air engine. **Introduction to Mine Transport Systems**: Elements of Mine haulage system and classification, Techno economic indices of Mine haulage system.	**10 Hours**
MODULE- 2:Ropes & Rope haulage systems	
Ropes: Types and details of construction of different types of ropes and their respective uses in mines, selection, care and storage of ropes, socketing - split, cone & inter locking wedge; rope splicing, safety factor for ropes used in winding. Numerical problems. **Rope haulage systems:** Different types- direct, endless, main & tail, gravity and Ariel ropeways. Limitations, applications merits & demerits of different haulages. Numerical problems.	**10 Hours**
MODULE- 3: Conveyors and Locomotives	
Conveyors: Types of conveyors-belt, scraper chain, shaker, high angle conveyor, cable belt, rope belt and steel plate, its limitations and their applications, problems on calculation of power requirement and capacity of conveyors, Numerical Problems. **Locomotives:** Types-Diesel, Electric battery, Trolley wire, its limitations and their applications. Numerical problems.	**10 Hours**

MODULE- 4: Winding systems in Mines	
Winding systems in Mines: Elements of winding system, types- drum, friction, electric, compressed air, koepe winding and multirope winders, method of balancing the loads, numerical problems. Skip and cage winding. Winding from different levels in a shaft.	**10 Hours**
MODULE- 5: Breaking system of winders and Study of layouts for Mine transportation	
Breaking system of winders: Mechanical, Electrical and Automatic breaking system of winders, Safety devices on winders**.** **Study of Layouts for Mine transportation:** Study of respective layouts for all the systems of transportation. Study of pit top and pit bottom layouts. Track laying and maintenance.	**10 Hours**

Course outcomes:

At the end of the course students will be able to:

- Apply knowledge of mine machinery for understanding, formulating and solving transportation problems in underground mine.
- Acquire knowledge and hands-on competence in applying the concepts in the design and development of transportation systems.

TEXT BOOKS:

1. **"Elements of mining technology Vol III",** D.J.Deshmukh, Vidyasewa prakashan, Nagpur, 7th Ed. 2000 Module-I to V.
2. **"Mine pumps haulage & winding", S. Ghatak, Coalfield Publishers, Asansol, 1st Ed. 1995.Module-II to V.**

REFERENCE BOOKS:

1. **"Coal Mining Practice",** I.C.F.Stathem, The Caxton publishing Company Ltd, 2000.
2. "**Universal Mining School reports Vol I and Vol II,"** Cardif, Great Britain **1999**.
3. "**Mine Transport",** Karerlin, Orient Longmans, 1967.
4. **"Mining Machinery"** by S.C.Walker.
5. **"Coal Mining Practice"** by Stathum.
6. **"Deep Mined Coal Industry Advisory Committee"**

MINE SURVEYING – I

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV (Mining Engineering)

Course Code	**17MN45**	**CIE Marks**	**40**
Number of Lecture Hours/week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50**	**Exam Marks**	**03**

Credit = 04

Course objectives:

This course will enable students to:

- To measure distance and directions by chain, compass and plane table surveying.
- To compute areas and volumes.
- To be familiar with various types of leveling instruments, temporary adjustment of leveling instruments and to learn various methods of determination of RL.
- To use theodolite instrument to measure angle.

Modules	Teaching Hours
MODULE- 1: Introduction to Surveying and Measurements of Distance and Directions	
Introduction: Plane & Geodetic survey, classification of survey, objectives, principles, types & uses of chain, tape, compass& plane table survey. **Distance:** Distance measurements using chain, compass & Electronic Distance Measurements (EDM) instruments. **Directions:** Meridians, azimuths and bearings, declination, computation of angles using compass & introduction to total station.	**10 Hours**
MODULE- 2:Leveling	
Leveling: Principles and basic definition, types of levels – including modern level (Auto, Tilting & Precise level), fundamental axis and parts of dumpy level, temporary adjustments, sensitiveness of bubble tube, curvature and refraction correction (Theory & problems). Reduction of levels – height of instrument method – raises & fall method (Theory & problems), transfer of levels from surface to underground, errors and its precautions.	**10 Hours**
MODULE- 3: Triangulation & Contouring	
Triangulation Survey: Principles, classification, steps in triangulation survey, base line measurements and corrections, base networks, Problems. **Contouring:** Contour, contour interval and characteristics, methods – direct and indirect, interpretation – arithmetic and graphical method, uses of contours.	**10 Hours**
MODULE- 4: Computation of Areas and Volumes	
Computation of Areas: General methods for regular & irregular boundaries, area computed from map measurements, construction &	**10 Hours**

uses of planimeter. Problems **Computation of Volumes:** General methods of calculation of volumes for Embankments and cuttings, spot levels, volume from contour plans & capacity of reservoirs & volume of borrow pits. Problems	
MODULE- 5: Introduction to Theodolite and Traversing	
Theodolite: Definition and terms, parts, temporary adjustments, horizontal and vertical angles, miscellaneous operations, errors. **Traversing:** Principles of Traversing, open traverse and closed traverse using chain, compass and theodolite. Balancing of traverse - Bowditch& transit rule.	**10 Hours**

Course outcomes:

At the end of the course students will be able to:

- The students will be able to apply technical knowledge on linear measurements by chain, tape, compass and plane table surveying.
- The students will possess ability to identify, formulate, and solve engineering problems in leveling.
- The students will possess ability to determine angles using theodolite.
- The students will possess ability to use the techniques, skills and modern engineering tools necessary for mine surveying.

TEXT BOOKS:

1. **"Surveying Vol I"** B.C.Punmia, Laxmi publications, 1999 (Module-I to V).
2. "**Mine Surveying Vol I"** Ghatak, Coal Field Publishers1998 (Module-I to V).

REFERENCE BOOKS:

1. "**Surveying Vol I,"** S.K.Duggal, Tata McGraw Hill Publications, New Delhi, 2000
2. **"Elementary Plane and Mine Surveying,"** V.Borshch, Kompowets, Bfedarer M .Kolesnikova, Mir publications,Moscow, 1986.
3. Plan & Geodetic Surveying for Engg. By Late David Clark, Vol-2.
4. Hand Book of Mine Surveyors by S.Ghatak.
5. Surveying &Levelling By P.B.Shahani, Vol-I.
6. Surveying by S.K.Duggal, Vol-I

DRILLING AND BLASTING ENGINEERING

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV (Mining Engineering)

Course Code	**17MN46**	**CIE Marks**	**40**
Number of Lecture Hours/week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40**	**Exam Marks**	**03**

Credit = 03

Course objectives:

This course will enable students to:

- To understand the basic concepts of drilling and blasting.
- To gain knowledge on various types of explosives and accessories, and their applicability in blasting.
- To understand the safety measures that are required for storing and handling of explosives.
- To understand the mechanics of blasting and its effects on environment.

Modules	**Teaching Hours**
MODULE- 1: Principles of Drilling & Drill Bits	
Principles of drilling: Principles of rock drilling, drillability, drillability index, factors affecting the drillability. Mechanics of drilling.Selection of drills, care of drills.Energy correlation of drills. **Drill Bits:** Various types of drill bits and their design aspects. Study of bit life, factors affecting the bit life. Thrust feed and rotation, alignment and deviation in drilling	**08 Hours**
MODULE- 2:Explosive	
Explosives: Historical Development, properties of explosives, Low and High explosives, ANFO, slurries, Emulsion explosives, heavy ANFO, permitted explosives, testing of permitted explosives, bulk explosives system-PMS, SMS.	**08 Hours**
MODULE- 3: Firing of Explosives & Blasting Methods	
Firing of Explosives: Safety fuses, Detonating cord and accessories, Detonators, Exploders. Electric firing and non-electric firing, Electronic Detonators, NONEL blasting. **Blasting Methods:** Preparation of charge, stemming and shot firing. Choice and economical use of explosives, misfires, blown out shots, incomplete detonation, their causes, prevention and remedies.	**08 Hours**
MODULE- 4: Handling of Explosives	
Handling of Explosives: Surface and underground transport of explosives, bulk transport in quarries. Storage and handling of explosives. Magazines, accidents due to explosives. Precautions and safety measures during transportation. Substitutes for explosives and their applications-Hydrox, Cardox, Hydraulic coal burster, Airdox, pulsed infusion shot firing.	**08 Hours**
MODULE- 5: Mechanics of Blasting & Effects of Vibration	
Mechanics of Blasting: Factors affecting rock breakage, Crater theory and its applications, theories of rock breakage using explosives.	**08 Hours**

Theory of shaped charge, detonation pressure, coupling, shock waves impedance, critical diameter etc. calculation of charge and powder factor. **Effects of Vibration:** Vibrations due to blasting and damage criteria, controlled blasting methods, design of blasting, air overpressure and fly rock. Economics of blasting.	

Course outcomes:

At the end of the course students will be able to:

- Ability to select drilling equipment for drilling in mines under various conditions.
- Ability to select explosives and accessories for mine specific blasting.
- Ability to handle explosives and other accessories with safety.
- Ability to understand the mechanics of blasting which in turn helps in blasting design.

TEXT BOOKS:

1. **"Explosives and Blasting Practices in Mines,"** S.K. Das, Lovely Prakashan, Dhanbad, 1993.(Module I-V)
2. **"Explosives and Blasting Techniques,"** G.K. Pradhan, Minetech Publication, 1996. .(Module I-V)

REFERENCE BOOKS:

1. **"Surface Mining"**, G.B. Mishra, Module 1, Dhanbad Publishers, Dhanbad, 1978.
2. **"Rock Fragmentation by Blasting,"** B.Mohanty, Module 4, A.A. Balkema, Rotterdam, 1996.
3. **"Advances in Drilling and Blasting"** V.R. Sastry, Module 1 and 2, Allied Publishers Ltd., 1993.
4. **"Principles of Rock Drilling"** U.M. Rao Karanam and B.Mishra, Module 1 and 2 Oxford and IBH, 1998.
5. **"Drilling and Blasting of Rocks"**, Carlopez Jimeno, etal. Module 7, A.A. Balkema, Rotterdam, Brook fields, 1995.
6. **"Engineering Rock Blasting operations"**, Sushil Bhandari, Module 3 and 6, , A.A. Balkema, Rotterdam, Brook fields, 1997

MINING GEOLOGY LABORATORY – II

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV (Mining Engineering)

Course Code	**17MNL47**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03 (1 Hour Instruction + 2 Hours Laboratory)**	**SEE Marks**	**60**
		Exam Hours	**03**

Credit = 02

Course objectives:

This course will enable students to:

- Able to identify the various structural and mineralogical aspects of ore and rock forming minerals by Microscope.
- To be able to designate the megascopic features of Ore Minerals and Rock minerals.
- Determinations of Dip & Strike of strata.
- Able to gain the knowledge of Geophysics & Bore hole based Problems.
- Ore reserve estimation of limited and unlimited boundaries.

Part-A

I. Microscopic studies of Rock Forming Minerals

Experiment No. 01: Study of optical properties, Texture, Alteration and Identification of Rock forming Minerals.

II. Megascopic Studies of Ore Minerals

Experiment No.02: Physical properties, Chemical composition, Mode of occurrence, distribution and uses of Iron, Manganese, Copper, Lead, Chromium, Aluminum etc.

III. Determinations of Dip & Strike

Experiment No. 03: To determine the true dip, when two apparent dips are known.

Experiment No. 04: To determine the amount of apparent dip, when true dip and the direction of apparent dips are given.

Experiment No. 05: To determine the direction of apparent dip, when true dip and amount of apparent dips are known

Part-B

IV. Thickness based Calculations

Experiment No. 06: On Horizontal Ground

Experiment No. 07: On Slope Ground

Experiment No. 08: Slope against the direction of dip.

V. Geophysics & Bore hole based Problems (3 points problem)

Experiment No. 09: Electrical resistivity survey

Experiment N0.10: On Ground Level

VI. Estimation of ore reserves

Experiment No. 11: Bedded deposits, Vein deposits and load deposits

Course Outcomes:

On the completion of this laboratory course, the students will be able to:

- To identify, formulate, and solve engineering problems in Microscopic studies of Rock Forming Minerals and Megascopic Studies of Ore Minerals
- To possess ability to identify, formulate, and solve engineering problems in Dip & Strike determination, Geophysics & Bore-hole and ore reserve estimation.

Scheme of Examination:

ONE question from part -A:	**40 Marks**
ONE question from part -B:	**40 Marks**
Viva -Voice:	**20 Marks**
Total :	**100 Marks**

MINE SURVEYING LABORATORY-I

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV (Mining Engineering)

Course Code	**17MNL48**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03 (1 Hour Instruction + 2 Hours Laboratory)**	**SEE Marks**	**60**
		Exam Hours	**03**

Credit = 02

Course objectives:

This course will enable students to:

- Study about different instruments used in surveying
- Study about chain traversing, compass traversing and plane table traversing.
- Study about handling of leveling instrument and determination of RL
- Study about handling of theodolite and to measure the angles.
- To determine co-ordinates of points.

I. Demonstration of Mine Surveying Instruments such as clinometer, abney level, box sextant, ediograph, pentagraph, ceylonghat tracer and planimeter.

II. Chain and cross staff Survey

a) Setting of regular polygon using chain and tape.

b) Cross Staff Survey

III. Compass Survey

a) Setting of regular polygon using compass and tape.

b) Compass Traversing

c) Inaccessible Distance

IV. Plane table methods.

a) Radiation methods

b) Intersection Method

V. Reduction of levels.

a) R.L by H.I.Method and Rise and Fall Method

b) Profile Levelling

VI. Theodolites traversing and co-ordinate calculation.

Balancing of the traverse.(closed traverse- Bowditch and Transit Rule)

Course outcomes:

On the completion of this laboratory course, the students will be able to:

- The students will be able to do linear measurements by chain, tape, compass and plane table surveying.
- They will possess the ability to identify, formulate, and solve engineering problems in leveling.

Scheme of Examination:

Note: 1) All the above experiments are to be conducted

2) Two experiments are to be performed by the students in the examination

B.E. Mining Engineering

V SEMESTER

Sl. No	Subject Code	Course	Title	Teaching Dept.	Teaching Hours /Week			Examination				Credits
					Lecture	Tutorial	Practical / Drawing	Duration (Hours)	SEE Marks	CIE Marks	Total Marks	
1	17MN51	Core course	Mine Environment and Ventilation Engineering	MN	4	0	0	03	60	40	100	4
2	17MN52	Core course	Mine Mechanization-II	MN	4	0	0	03	60	40	100	4
3	17MN53	Core course	Mine Surveying-II	MN	4	0	0	03	60	40	100	4
4	17MN54	Core course	Underground Coal Mining	MN	4	0	0	03	60	40	100	4
5	17MN55X	Professional Elective-I	Professional Elective-I	MN	3	0	0	03	60	40	100	3
6	17MN56X	Open Elective-I	Open Elective-I	MN	3	0	0	03	60	40	100	3
7	17MNL57	Laboratory	Mine Mechanization Lab	MN	1	0	2	03	60	40	100	2
8	17MNL58	Laboratory	Mine Surveying Lab-II	MN	1	0	2	03	60	40	100	2
TOTAL					**21**	**00**	**04**		**480**	**320**	800	26

Professional Elective-I		Open Elective-I	
17MN551	Mineral Economics	17MN561	Industrial Safety Engineering
17MN552	Project Management	17MN562	Human Resource Management

1. Core subject: This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

2. Professional Elective: Elective relevant to chosen specialization/ branch

3. Open Elective: Electives from other technical and/or emerging subject areas.

MINE ENVIRONMENT AND VENTILATION ENGNEERING

B.E, V Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN51	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50(10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course Objectives:

This course will enable students to:

1. To gain insights of mine air, mine climate and mine ventilation.
2. To comprehend the ventilation requirements of an underground mine.
3. Analysis of mine air, mine climate, natural ventilation, mechanical ventilation and to conduct ventilation survey.

MODULE- 1: Mine Air and Study of Fire Damps

Mine Air: Atmospheric air and composition of mine air, Mine Gases: - Occurrence, properties, detection, measurements and physiological effects. Problems.

Study on Fire Damps: Methane content, emission of methane, degree of gassiness of a coal mine, gas blowers, gas outbursts, dealing of firedamp in mines. Methane streaming and layering, methane drainage, testing of firedamp. Problems.

MODULE- 2: Mine Climate

Mine Climate: Physiological effects of mine climate, objective of mine ventilation, air quantity requirement, pressure, barometric pressure, temperature, sources of heat in mines, moisture content of mine air, effects of heat and humidity on the miner, cooling power of mine air, psychometry and air conditioning. Problems.

MODULE- 3: Air Flow Through Mine Openings

Air flow through mine openings: Fundamentals of air flow, Reynolds number, laminar and turbulent flow, pressure losses due to friction and shock resistance, resistance of airways:- laws of mine air friction, co- efficient of friction, resistance of roadways in series and parallel, resistance of leaky airways, characteristic of an airway (or) mine, equivalent orifice, Economic design of an airway. Distribution of air and flow control devices. Problems.

MODULE- 4: Natural and Mechanical Ventilation

Natural Ventilation: Mechanism, causes, calculation of Natural Ventilation Pressure from air densities, other methods of determining Natural Ventilation Pressure, motive column. Problems.

Mechanical Ventilation: Types of fans, theory, efficiencies, characteristic curves and suitability of fans, selection, testing and output control of a mine fan. Fans in series and parallel, forcing and exhaust ventilation, reversal of air currents, diffusers, evasees, ventury, booster and auxiliary fans. Problems.

MODULE- 5: Ventilation Survey and Elements of Ventilation Planning

Ventilation survey: Importance of ventilation survey, types: - qualitative surveying, pressure survey and quantity survey. Problems.

Elements of Ventilation Planning: Objective, steps in ventilation planning, desirable features of a ventilation system, types of ventilation system,

quantity requirement, analysis of ventilation cost.Problems.

Course outcomes:

At the end of the course students will be able to:

1. To be familiar with the mine air composition, climate and physiological effects
2. An ability to estimate the requirements of ventilation in an underground mine
3. An ability to analyze the components of mine air sample, design natural and mechanical ventilation and conduct ventilation survey.

An ability to decide and design ventilation system for underground mine.

TEXT BOOKS:

1. Elements of Mining Technology Vol II- D.J. Deshmukh, 9th Edition, Central Techno Publication, Nagpur, 1998.
2. Mine Environment and Ventilation – G.B. Mishra, Oxford University Press, 1994.

REFERENCE BOOKS

1. Mine ventilation and air conditioning – Howard L. Hartman. Wiley International, 1976.
2. Environmental Engineering in Mines – Vutukuri & Lama, Cambridge University Press, Cambridge, 1992.
3. Legislation in Indian mines a critical appraisal Vol. I and Vol. II – Prasad and Rakesh. Vivek Publications, Varanasi 1999.
4. Mine Ventilation Vol. – II, S. Ghatak, Coalfield Publishers, 1993.
5. Numerical Problems on Mine Ventilation, L.C. Kaku, Lovely Prakashan, Dhanbad.
6. Basics of Mine Ventilation, P.C. Shyam, Lovely Prakashan, Dhanbad.

MINE MECHANIZATION– II

B.E, V Semester, Mining Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN52	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50(10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course Objectives:

This course will enable students to:

1. Gain knowledge of various types of pumps, inflow of water into mine working, basic principles of drilling, cutting and ploughing.
2. Comprehend the performance and characteristics of the pumps, layouts of underground pumping station, operating parameters of underground mine machinery and maintenance of machinery.
3. Know applications of different types of support and underground mine machinery under given conditions.

Select pumps for underground mines under given conditions.

MODULE- 1:Drainage and Pumping and Performance and Characteristic of Pumps

Drainage and Pumping: Methods to prevent inflow of water into mine workings, mine pumps, different types of pumps-Centrifugal, Turbine, Roto pump, Reciprocating pump.

Performance and Characteristic of Pumps: Performance and characteristic of centrifugal and turbine pumps. Pumps in shafts and roadways and their maintenance. Sumps: location and capacity. Layout of main underground pumping stations.

MODULE- 2:Face Mechanization and Allied Face Machineries

Face Mechanization: Classification-continuous and intermittent road headers, Shearer, their application, limitation and specification.

Allied Face Machineries: Coal Ploughs, coal cutting machines, their application, limitation and specification.

MODULE- 3: Allied Machinery

Allied Machinery: Basic Principles of drilling, cutting and ploughing machines. Different types of hydraulic props, chocks, chock shields, canopies, Armoured Face Conveyors(AFC) and Stage loaders

MODULE- 4: Development of Face Mechanization

Development of Face Mechanization: Recent developments in face mechanization. L.H.D., S.D.L., L.P.D.T. and Rocker Shovel.
Trackless equipment's: application and limitation.

MODULE- 5: Machinery Maintenance

Machinery Maintenance: Maintenance management and safety, CAD, Remote monitoring and controlling in mines and automation. Application of Computer for Maintenance.

Course outcomes:

At the end of the course students will be able to:

1. Familiar with the various types of pumps, inflow of water into mine workings, basic principles of drilling, cutting and ploughing.
2. Ability to understand the performance and characteristics of pumps, layouts of underground pumping station, operating parameters of underground mining machinery.
3. Ability to select different types of supports and mine machinery under given conditions.
4. Capable of choosing pumps for underground mines under given conditions.

TEXT BOOKS:

1. Elements of Mining Technology Vol. III – D.J.Deshmukh, 6th edition Central Techno Publication, Nagpur, 1998.
2. Modern Coal Mining Technology – S. K. Das, 2nd edition, Lovely Prakashan.

REFERENCE BOOKS

1. Coal Mining – I.C.F. Statham Vol. I and Vol. III The Caxton Publishing Company Ltd. Inc. 1958.
2. Longwall Mining – Syd. S. Peng and H.S. Chang, John Wiley and Sons Inc. 1983.
3. Selection, Installation and maintenance of mine pumps. – rakesh and M.G. Lele. 2nd edition, Nishkam Press Meerut 1975.
4. Mine Pumps, Haulages and Winding, S. Ghatak, Coal Field Publisher, Asansol, 1995.
5. Mine Hoisting, M.A. Ramulu, Oxford and IBH 1996.

MINE SURVEYING –II

B.E, V Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN53	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50(10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course Objectives:

This course will enable students to:

1. Knowledge of distance and elevation using optical means, area and volume of underground and opencast mine, network of triangles, baseline in underground and surface, the duties and responsibilities of surveyor.
2. Application of the network of triangles, setting of curve in mine survey, transfer reduced level from surface to underground.
3. To evaluate the accuracy of the survey.

MODULE- 1:Tachometric Survey

Tachometric Survey: Application and limitation, principles and methods, anallactic lens, reduction of stadia notes, errors. Problems

MODULE- 2:Curve Ranging

Curve Ranging: Linear and angular methods of setting out of simple curves, requirements and functions of a transition curve. Problems

MODULE- 3: Correlation Survey

Correlation Survey: Principles, Classification, Methods, Shaft Plumbing, Assumed Bearing, Weisback Triangle, Coplanning, Weisback quadrilateral, Problems on correlation survey etc. and degree of accuracy. Problems.

MODULE- 4: Stope and Subsidence Survey

Stope Surveying: Definition, purpose, methods: Tape triangulation, Ray, steeply dipping ore bodies, moderately dipping ore bodies, degree of accuracy.
Subsidence Survey: Principles, method and degree of accuracy, underground traversing, setting out gradients in tunnels and adits, Mine plans and sections, duties and responsibilities of surveyors care and precaution in storage statutory responsibilities.

MODULE- 5: Photogrammetry and Remote Sensing

Photogrammetry: Introduction, Basic Principles, Definition, horizontal and vertical angles from terrestrial photograph, horizontal position of a point from photographic measurement: camera axis horizontal, elevation of a point by photographic measurement, determination of focal length of the lens. Computation of length of line between points of different elevations from measurements of vertical photograph.

Remote Sensing: Introduction, basic principle, Idealized remote sensing system, electromagnetic energy and spectrum, wavelength regions and their applications in remote sensing, application of remote sensing.

Course outcomes:

At the end of the course students will be able to:

1. Ability to use optical means determine distance, elevation, area and volume. To set out baseline according to the rules and responsibilities of

surveyor.

2. To set out a curve and to locate the underground features through survey.
3. Determination of the reduced level in underground.
4. Ability to determine the accuracy of the surveyed area.

TEXT BOOKS:

1. Surveying Vol. II – B.C. Punmia, 12th edition, Lakshmi Publications, 1994.
2. Surveying Vol. III – B.C. Punmia, 12th edition, Lakshmi Publications, 1994.
3. Metalliferous Mine Surveying Fedrickm Wini Berg, 2nd edition Mining Publications, London, 1935.

REFERENCE BOOKS

1. Mine Surveying Vol. I, II, III, Ghatak, 5th edition, Coal Field Publishers, 1996.
2. Mine Surveying by V.Borsheh – Komponiets, Mir-Publishers, 1989.
3. A Text Book of Advanced Surveying JawaharLal Sharma, C.B.S. Publishers and Distributors, 1985.

UNDERGROUND COAL MINING

B.E, V Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN54	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50(10 Hours per Module)**	**Exam Hours**	**03**
Credits – 04			

Course Objectives:

This course will enable students to:

1. Understand the mode of access to reach coal seams and choice of mine seam
2. Gain knowledge of bord and pillar method of mining
3. Gain knowledge of longwall method of mining.
4. Knowledge of extracting of thick coal seams by special methods

MODULE- 1: Introduction to Coal Mining

Introduction: Coal mining in major coal producing countries, Growth of coal mining industry in India, Grading and analysis of coal, **Opening of Coal Seams**: Access by adits, Opening up of coal seams by surface drifts on incline, vertical shafts, Division of mine into blocks.

Choice of Coal Mining Methods: Basic Mining Methods, Bord and Pillar, Longwall and Shortwall, Factors influencing choice of mining methods.

MODULE- 2:Board and Pillar Mining

Board and Pillar Mining: Board and Pillar Mining System. Design of Bord and Pillar workings, Mining Processes, Development of Panels, Extraction of Pillars and Examples of Pillar extraction techniques.

Room and Pillar Mining: Applicability, Merits and Demerits. Variants of Room and Pillar Mining Method. Simple Problems.

MODULE- 3: Longwall Mining

Longwall Mining: Elements of a Longwall face, Classification of Modern Longwall faces, Planning of Longwall Mining System, Development of Panel and faces, face support system, Power supply, and material supply and face organization. Strata mechanics around Longwall panel.

Thin seam Mining by Longwall Method: Method of working thin, medium thick and thick seams by Longwall Mining with case studies of Indian and foreign Mines. Simple Problems

MODULE- 4: Thick Seam Mining

Thick seam Mining: Problems of Mining Thick Coal Seams, Choice of Method of Mining Thick Coal Seams, Inclined Slicing, Horizontal Slicing, Diagonal Slicing, Transversely Inclined Slicing, Sublevel Caving, Working Steep and Moderately Thick Seams, The Velenjee Method, Descending Shield Method of Mining.

MODULE- 5: Special Methods of Mining

Special Methods of Mining: Inseam Mining and Horizon Mining, Hydraulic Mining, Blasting Gallery Method, Coal Bed Methane. Goaf Control:

Caving, strip packing or solid stowing, Hydraulic Stowing etc. Procurement of stowing materials and its transportation, theoretical aspects and case studies.

Course outcomes:

At the end of the course students will have:

1. Ability to identify mode of access to reach coal seam and choice of mining method
2. Ability to design bord and pillar method of mining
3. Ability to design longwall method of mining.
4. Ability to design the extraction of thick coal seams by special methods.

TEXT BOOKS:

1. Principles and Practices of Modern Coal Mining – R.D. Singh, New Age International, 1997.
2. Modern Coal Mining Technology – S.K. Das, 2 nd edition, Lovely Prakashan Publishers, 1994.

REFERENCE BOOKS

1. Underground Coal Mining Methods – J.G.Singh, BrajKalpa Publishers, Varnasi, 2000.
2. Coal Mining – I.C.F. Statham, Vol. I, II, III and Vol. III. The Caxton Publishing Company Ltd. Inc. 1958.
3. Longwall Mining – S.Peng&H.S.Chang, John Wiley and Sons Inc. 1983.
4. Winning & Working of Coal, Vol. I, II – D.J.Deshmukh, Asia Publsihing House, Bombay, 1967.
5. Universal Mining School Volumes. Cardiff [GT. Britain], 1931.
6. SME Mining Engg. Hand Book – Hartman, 2 nd edition S.M.M. & Exploration Inc. 1992.
7. Underground Winning of Coal – T.N. Singh, Oxford and IBH. 1992.
8. Advanced Coal Mining, Vol. 1 and 2 – Vorbojev&Deshmukh, Asia Publishing House, Bombay, 1964.
9. Thick Seam Mining – T.N. Singh and B.B.Dhar, Oxford and IBH, 1992.

Professional Elective-I

Mineral Economics

B.E, V Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN551	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40(08 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Course Objectives:

This course will enable students to:

1. Gain knowledge on role of mineral industry in national economy, national mineral policy, financial management and cost accounting applicable to mining industry.
2. Comprehend sampling, classification of ore reserves and resources.
3. Learn various methods of ore reserve estimation and mine valuation.
4. Evaluate the economic feasibility of a mining project.

Module - 1

Introduction: Economic importance of mineral industry, special features of mineral industry, demand and supply analysis, National Mineral Policy.
Mineral Price and Pricing: International Monetary system, Factors affecting mineral price, Kinds of price quotation, Mineral Price Index, Mineral Price.

Module - 2

Sampling: Definition, purpose, scope, common methods of sampling, types of samples, errors in sampling.
Estimation of reserves: Classification of reserves, tenor, grade. Preparation of assay plans, various methods of ore reserve estimation and problems on ore reserves

Module - 3

Mine Valuation –1 : Factors affecting mine valuation, life of mine, redemption of capital, project assessment by D.C.F., net present value methods, Hoskold's two rate formula.
Mine valuation – 2: mining fixed costs, operating costs, feasibility study, project evaluation, depreciation, problems on mine valuation and depreciation.

Module - 4

Financial Management: Methods of financing industrial enterprises, structure, formation and capitalization. Sources of finance.

Principles of book keeping as applied to mining industry and accountancy. Balance sheet, profit and loss accounts.

Module - 5

Cost Accounting: Introduction, need for cost accounting, elements of cost, overheads, allocation of over heads, breakeven analysis.
Budget and Budgetary control: Definition of budget, Principle of budget and budgetary control, types of budgets.

Course outcomes:

At the end of the course students will have:

1. An overall knowledge of mineral industry and related policy issues, basics of financial and cost accounting aspects.
2. An ability to select proper sampling method and to classify the ore reserve and resources.
3. An ability to compute ore reserve and value of a mining project.
4. An ability to evaluate the economic feasibility of a mining project given the geological, mining and financial parameters.

TEXT BOOKS:

1. Mineral and Mine Economics by R.T. Deshmukh, Myra Publications, Nagpur, 1986.
2. Mineral Economics by N.L.Sharma and Sinha, Oxford and IBH, 1992.

REFERENCE BOOKS

1. Mineral Economics by Truscot, John Wiley and Sons, Inc, 1987.
2. Mining Geology by Arogyaswamy. R.N.P. 4th edition, Oxford and IBH, 1992.
3. Prospecting for Atomic Minerals by Knoerr, A.W. and Lutgetn. GP. Oxford and IBH, 1992.
4. Industrial Management O.P. Khanna, DhanpatRai and Sons, 1999.

Professional Elective-I

PROJECT MANAGEMENT

B.E, V Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN552	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40(08 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Module - 1

Introduction: Definition of project, characteristics of projects, understand projects, types of projects, scalability of project tools, project roles

Project Selection And Prioritization – Strategic planning process, Strategic analysis, strategic objectives, portfolio alignment – identifying potential projects, methods of selecting projects, financial mode / scoring models to select projects, prioritizing projects, securing and negotiating projects.

Module - 2

Planning Projects: Defining the project scope, Project scope checklist, Project priorities, Work Breakdown Structure (WBS), Integrating WBS with organisation, coding the WBS for the information system.

Scheduling Projects: Purpose of a project schedule, historical development, how project schedules are limited and created, develop project schedules, uncertainty in project schedules, Gantt chart.

Module - 3

Resourcing Projects: Abilities needed when resourcing projects, estimatere source needs, creating staffing management plant, project team composition issues, Budgeting Projects: Cost planning, cost estimating, cost budgeting, establishing cost control.

Project Risk Planning: Risk Management Planning, risk identification, risk analysis, risk response planning, Project Quality Planning and Project Kickoff: Development of quality concepts, project quality management plan, project quality tools, kickoff project, baseline and communicate project management plan, using Microsoft Project for project baselines.

Module - 4

Performing Projects: Project supply chain management: - Plan purchasing and acquisitions, plan contracting, contact types, project partnering and collaborations, project supply chain management.

Project Progress and Results: Project Balanced Scorecard Approach, Internal project, customer, financial issues, Finishing the project: Terminate project early, finish projects on time, secure customer feedback and approval, knowledge management, perform administrative and contract closure.

Module - 5

Network Analysis

Introduction, network construction - rules, Fulkerson’s rule for numbering the events, AON and AOA diagrams; Critical path method (CPM) to find the expected completion time of a project, floats; PERT for finding expected duration of an activity and project, determining the probability of completing a project, predicting the completion time of project; crashing of simple projects.

Course Outcomes

On completion of the course the student will be able to

1. Understand the selection, prioritization and initiation of individual projects and strategic role of project management.
2. Understand the work breakdown structure by integrating it with organization.
3. Understand the scheduling and uncertainty in projects.
4. Students will be able to understand risk management planning using project quality tools.
5. Understand the activities like purchasing, acquisitions, contracting, partnering and collaborations related to performing projects.
6. Determine project progress and results through balanced scorecard approach
7. Draw the network diagram to calculate the duration of the project and reduce it using crashing.

TEXT BOOKS:

1. Project Management, Timothy J Kloppenborg, Cengage Learning, Edition 2009.
2. Project Management, A systems approach to planning scheduling and controlling by Harold kerzner, CBS publication.
   Project Management by S Choudhury, Mc Graw Hill Education (India) Pvt. Ltd. New Delhi, 2016

REFERENCE BOOKS

1. Project Management, Pennington Lawrence, Mc Graw hill
2. Project Management, AModer Joseph and Phillips New Yark Van Nostrand, Reinhold.
3. Project Management,Bhavesh M. Patal, Vikas publishing House,

Open Elective-I

Industrial Safety Engineering

B.E, V Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN561	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40(08 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Course objectives:

This course will enable students to:

1. Gain insights of hazards and accidents of different working conditions in industries.
2. Have knowledge of occupational health and safety in different industries

MODULE- 1:HOT WORKING AND COLD WORKING OF METALS

Introduction, Hot working of metals, Cold working of metals, Foundry operations, Steps in casting process, Different types of furnaces, Process wise hazards and safety measures in casting, Major health hazards and safe methods in foundry, Forging operations, Specific safety measures in different forging operations, Preventive maintenance of forging machines, Safe work practices in forging, Operation in hot and cold rolling mills, Preventive maintenance and periodic check for safe operations, Heat treatment operations, Heat treatment methods, Hazards and safety measures, Control measures, Safety in handling medium_ Disposal methods, Power presses(all types)Shearing, Bending, Rolling, Drawing, Turning, Boring, Milling, Planning, Grinding.

MODULE- 2:SAFETY IN OPERATION

Permit to work-safety in operations, confined spaces, Safety in painting, welding, cutting and soldering operations, Safety in finishing operations like cleaning, polishing and buffing and related hazards, Selection, care and maintenance of associated equipment's and instruments, Maintenance of these machines and selection of equipment w.r.t safety, Shot blasting.

MODULE- 3: SAFETY IN CONSTUCTION INDUSTRY

WORK AT HEIGHT-High incidence of serious accidents in working at heights, Types of operations, Safety features associated with design, construction and use of stairways, rungs, ramps, gangways, floors, ladders of different types, working on roofs, d).Other safety requirements while working at height, Bootswain's chair-safety harness etc.,

Prevention of fall of persons at floor level, Potential tripping and slipping hazards, Erection, Inspection and Certification and safe use of various types of scaffolds, Safety of high rise building, Bridges and tunnels

Safety in demolition operation, Safety in underground works such as Excavation, Drilling and Blasting, Tunnelling, Pneumatic, Trenching, Safety in working of fragile roof

MODULE- 4: SAFETY IN SPECIFIC INDUSTRIES

Mining industry, Ceramic industry, Textile industry, Leather industry, Sugar industry, Fertilizer industry, Cement industry, Tanneries

MODULE- 5: EMERGING ISSUES ON OSH
Safety in Nano Technology, Safety in Robots, Safety in hospital, Safety in film industry
Course outcomes: At the end of the course students will be able to: 1. Be familiar with hazards in different industries2. 2. Decide precautions of safety and health in different occupation.
TEXT BOOKS: 1. Industrial Safety, Dr. K U Mistry, Siddharth Prakashan; Ahmedhabad-380014 2. Fundamentals of Industrial Safety and Health, Dr. K U Mistry, Siddharth Prakashan; Ahmedhabad-380014.
REFERENCE BOOKS 1. Industrial Safety Management, L M Deshmukh, Mcgrawhill Education, July 2017

Open Elective-I

HUMAN RESOURCE MANAGEMENT

B.E, V Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN562	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40(08 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Course objectives:

This course will enable students to:

1. **To develop a meaningful understanding of HRM theory, functions and practices.**
2. **To apply HRM concepts and skills across various types of organizations**.

Module - 1

Human Resource Management

Introduction, meaning, nature, scope of HRM. Importance and Evolution of the concept of HRM. Major functions of HRM, Principles of HRM, Organization of Personnel department, Role of HR Manager.

Job Analysis: Meaning, process of job analysis, methods of collecting job analysis data, Job Description and Specification, Role Analysis.

Module - 2

Human Resource Planning: Objectives, Importance and process of Human Resource planning, Effective HRP

Recruitment: Definition, Constraints and Challenges, Sources and Methods of Recruitment, New Approaches to recruitment.

Selection: Definition and Process of Selection.

Module - 3

Placement: Meaning, Induction/Orientation, Internal Mobility, Transfer, Promotion, Demotion and Employee Separation.

Training and development: Training v/s development, Training v/s Education, Systematic Approach to Training, Training Methods, Executive Development, Methods and Development of Management Development, Career and Succession Planning.

Module - 4

Performance Appraisal: Concept of Performance Appraisal, the Performance Appraisal process, Methods of Performance Appraisal, Essential Characteristic of an Effective Appraisal System.

Compensation: Objectives of Compensation Planning, Job Evaluation, Compensation Pay Structure in India, Wage and Salary Administration, Factors Influencing Compensation Levels, Executive Compensation.

Module - 5

Employee Welfare: Introduction, Types of Welfare Facilities and Statutory Provisions.

Employee Grievances: Employee Grievance procedure, Grievances management in Indian Industry.

Discipline: Meaning, approaches to discipline, essential of a good disciplinary system, managing difficult employees.

Course outcomes:

1. Understand the importance, functions and principles Human Resource Management and process of Job analysis
2. Summarize the objectives of Human Resource planning, Recruitment and selection process
3. Understand the process involved in Placement, Training and development activities.
4. Understand the characteristics of an effective appraisal system and compensation planning.
5. Understand the issues related to employee welfare, grievances and discipline.

TEXT BOOKS:

1. 1. Human Resource Management- Rao V.S.P, Excel books, 2010
2. Human Resource Management- Cynthia D. Fisher, 3/e, AIPD, Chennai
3. Human Resource Management: A South Asian Perspective, Snell, Bohlander&Vohra, 16th Rep., Cengage Learning, 2012
4. Human Resource Management- Lawrence S Kleeman, Biztantra, 2012
5. Human Resource Management- Aswathappa K, HPH

REFERENCE BOOKS

1. 1. Human Resource Management- John M. Ivancevich, 10/e, McGraw Hill.
2. Human Resource Management in Practice- Srinivas R. Kandulla, PHI.
3. Human Resource Management- Luis R Gomez-Mejia, David B. Balkin, Robert L Cardy, 6/e, PHI, 2010

MINE MECHANIZATION LABORATORY

B.E, V Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17MNL57**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03 (1 Hour Instruction+ 2 Hours Laboratory)**	**SEE Marks**	**60**
		Exam Hours	**03**

Credits – 02

Course Objectives:

This course will enable students to:

1. Gain knowledge of the percussive drilling, track laying and their turnouts and cross-overs
2. Comprehend the cage/skip winding, construction and working of pumps.
3. Select the type of rope according to the given conditions

EXPERIMENTS

1: To study constructional details and functioning of Jack Hammer.

2: To study constructional details of different wire ropes.

3: Sketch and write details of safety hook and its function.

4: To study the procedure for splicing the wire ropes

5: To study the capping and recapping procedures of wire ropes

6:To study construction and working of a turbine pump

7: To study Lilly controller and automatic contrivances in a winder.

8: To study skip loading and unloading arrangement and skip design.

9: Write details of good track laying and also details of diamond crossing.

10: To study the constructional details of lubricator and air leg.

Course outcomes:

On the completion of this laboratory course, the students will be:

1. Familiar with the percussive drilling, their turnouts and cross overs
2. Able to understand the cage/skip winding, construction and working of pumps.
3. Capable of choosing the type of rope according to the given conditions.

Scheme of Examination:

Note: 1) All the above experiments are to be conducted

2) Two experiments are to be performed by the students in the examination

MINE SURVEYING LABORATORY-II

B.E, V Semester, Mining Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17MNL58**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03 (1 Hour Instruction+ 2 Hours Laboratory)**	**SEE Marks**	**60**
		Exam Hours	**03**

Credits – 02

Course Objectives:

This course will enable students to:

1. To gain insights to measure distance and elevation using optical instruments
2. To set out an curve in underground and surface
3. To connect the baseline from surface to underground
4. To know the location of a point in underground traverse

EXPERIMENTS

I. Demonstration of precise level, digital planimeter EDM and total station.

II. Tachometric survey

1. Determine the constant K and C of the tachometer.
2. Determine the distance and elevation by a) Stadia Method b) Tangential Method
3. Determine the gradient between two points by Tachometric Survey

III. Curve Ranging

1. Simple curve ranging by linear and angular method using Deflection distance Method
2. Simple curve ranging by linear and angular method using Rankin's Method.

IV. Correlation Survey:

1. Correlation survey by Direct Traversing through Incline
2. Correlation survey by Direct Traversing through Incline and Shaft.
3. Correlation survey by Weisback Co-planning Method.
4. Correlation survey by Weisback Triangle Method
5. Correlation survey by assumed bearing method.

V. Underground survey

1.Underground Traversing

2. Transfer of levels from surface to underground.
3. To control the directions of underground workings.
4. To determine the center of the shaft.

Course outcomes:

On the completion of this laboratory course, the students will be:

1. An ability to measure distance and elevation using optical instruments
2. An ability to set out an curve in underground and surface
3. An ability to connect the baseline from surface to underground
4. An ability know the location of a point in underground traverse

Scheme of Examination:

Note: 1) All the above experiments are to be conducted
2) Two experiments are to be performed by the students in the examination

B.E. Mining Engineering

VI SEMESTER

Sl. No	Subject Code	Course	Title	Teaching Dept.	Teaching Hours /Week			Examination				Credits
					Lecture	Tutorial	Practical / Drawing	Duration (Hours)	SEE Marks	CIE Marks	Total Marks	
1	17MN61	Core course	Mine Management	MN	4	0	0	03	60	40	100	4
2	17MN62	Core course	Surface Mining	MN	4	0	0	03	60	40	100	4
3	17MN63	Core course	Underground Metal Mining	MN	4	0	0	03	60	40	100	4
4	17MN64	Core course	Rock Mechanics	MN	4	0	0	03	60	40	100	4
5	17MN65X	Professional Elective-II	**Professional Elective -II**	MN	3	0	0	03	60	40	100	3
6	17MN66X	Open Elective-II	**Open Elective – II**	MN	3	0	0	03	60	40	100	3
7	17MNL67	Laboratory	Rock Mechanics Lab	MN	1	0	2	03	60	40	100	2
8	17MNL68	Laboratory	Mine Environment and Ventilation Lab	MN	1	0	2	03	60	40	100	2
TOTAL					**21**	**00**	**04**		**480**	**320**	800	26

Professional Elective-II		Open Elective-II	
17MN651	Mine Disasters and Rescue	17MN661	Tunneling Engineering
17MN652	Mine Safety Engineering	17MN662	Underground Space Technology

1. Core subject: This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

2. Professional Elective: Elective relevant to chosen specialization/ branch

3. Open Elective: Electives from other technical and/or emerging subject areas.

MINE MANAGEMENT

B.E, VI Semester, Mining Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN61	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50(10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

MODULE- 1:Brief History of Management

Evolution of Management, traditional management, Scientific management, Contribution of pioneers to scientific management, Functions of management, Principles of Management. Mine management: Duties and responsibilities of mines manager.

MODULE- 2: Organization and Industrial Ownership

Characteristics of Organization, Principles of organization, types of organization, management of conflict, management by exception, management by objective (MBO). Mine organization: Opencast and underground mines.

Industrial ownership: Definition, types of ownership, single ownership, partnership, Joint Stock Companies, co-operatives organization and State and central government owned. Mine ownership: duties and responsibilities of mine owner.

MODULE- 3: Personal Management, Industrial Psychology and Human Relation

Personal Management: Functions of personnel management, recruitment and selection of employees. Education and training: mines vocational training center. Communication: formal and informal communication, barriers in communication and techniques to overcome barriers and improve communication.

Industrial Psychology and Human Relation: Definition, scope of industrial psychology, aims of industrial psychology. Group Dynamics. Motivation: definition, characteristics of motivation, kinds of motivation, factors affecting motivation, motivational techniques, theories of motivation. Maslow's hierarchy of needs, Theory X and Y, Hawthorne experiment.

MODULE- 4: Industrial Relations and Legislation

Introduction, basic requirement of industrial –relation programme. Trade unions: definition, functions of trade unions. Industrial disputes: causes, settlement of industrial disputes, handling of workers' grievances. Workers participation in management, work of ILO. Necessity of labour legislation, principles of labour legislation. Important provisions of factories act, payment of wages act, Workmen's Compensation act, Employee state insurance Act.

MODULE- 5: Work Study and Management Information System (MIS)

Definition, productivity and work study, postion of work study department in the organization, work study man, work study and the workers, work study and the management. Motion Study: Definition, aims of motion study, procedure for motion study, micro motion study, motion economy. Time Study: Definition, uses of time study, procedure, performance rating number of cycles to be timed, allowances, uses of time study data for wage incentives. Standard Data: Advantages, Methods for determining Standard Data, Work factor system, Method Time Measurement (MTM), Basic Motion Time Study.

Management Information System (MIS): Introduction, Need for Information System, Characteristics of Good MIS, Sources of Information, application of MIS, design of MIS, development, Implementation of MIS.

TEXT BOOKS:

1. Mine Management, Legislation and General Safety, S. Ghatak, Coal Field Publishers, Asansol, 1999.
2. Management by Harold Koontz and Heinz Weihrich, Mc Graw Hill Company, 1990.

REFERENCE BOOKS

1. Industrial Organization and Engineering Economics, Banga and Sharma, Khanna Publication, New Delhi, 1999.
2. Legislation in Indian Mines: A Critical Appraisal, Published by Vivek, P-8, New Medical Enclave, B.H.U., Varanasi, 1992.
3. Modern Production Management, Buffa, John Wiley and Sons, 1998. Industrial Management, O.P.Khanna, Dhanpat Rai and Sons, 1999.
4. Mine Management, V.N. Singh, Lovely Prakashan, 2003.

SURFACE MINING

B.E, VI Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN62	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50(10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course Objectives:

This course will enable students to:

1. Understand the basic concept of surface mining and associated methods.
2. Learn various aspects of drilling and blasting practices in open cast mines.
3. Learn application of various heavy earth moving machinery and their selection criteria.

MODULE- 1: Introduction

General consideration for the applicability of opencast mining, limits of open cast mining and its advantages and disadvantages. Method of opening box cut, selection of site for box cut.

MODULE- 2: Open Pit Layout and Design

Planning the layout and open pit mine with special reference to large mechanized mines. Optimum dimensions of open pit mines. Removal of over burden and disposal, open cast bench- number, height, width and slope angle of the bench. Factors affecting the stability of the slope. Various types of slope failures, problems on slope failures. Ground water control.

MODULE- 3: Drilling and Blasting

Major types of drilling machines- DTH, Rotary drilling machines with tri-cone roller bits with their construction, applications, advantages and limitations. Mechanics of blasting, principles of fragmentation. Design of blasting: with special reference to heavy blasting, air blasting, ground vibration, fly rocks novel methods of drilling, smooth blasting and pre-splitting. Initiation systems: various patterns.

MODULE- 4: Surface Mining Methods and Machinery

Casting, strip, quarrying and Placer Mining. Excavation and loading: Shovels: different types like rope shovel, hydraulic shovel, dragline, Front-end loader, Stackers, Graders. Non-Cyclic Surface Mining: Bucket Wheel Excavators and Continuous surface miners. Selection criteria of equipment their advantages and limitations.

MODULE- 5: Transport Equipment

Dumpers, Shovel – dumper combination, high angle conveyor and in-pit crusher. Selection criteria of equipment, advantages and limitations.

Course outcomes:

1. An understanding of various design parameters associated with different methods of surface mining.
2. Ability to design blasting round to have desired productivity with minimum damaging effect.

3. Ability to select appropriate equipment for excavating, loading and transporting material in opencast mines.

TEXT BOOKS:

1. Surface Mining Technology by S.K.Das, Lovely Prakashan, Dhanbad, 1994.
2. Surface Mining by G.B.Mishra, Dhanbad Publishers, 1978.

REFERENCE BOOKS

1. Elements of Mining Technology, Vol. – I, D.J.Deshmukh, 6th Edition, Central Techno Publications, Nagpur, 1998.
2. Opencast Mining – R.T. Deshmukh, M. Publications, Nagpur, 1996.
3. Latest Development of Heavy Earth Moving Machinery Amithosh De, Annapurna Publishers, Dhanbad, 1995.
4. Rock Slope Engineering, Hock and Bray, The Institution of Mining and Metallurgy, 1981.
5. Introductory Mining Engineering, Hartman, John Wiley and Sons, 1987.
6. Surface Mining: The American Institute of Mining Metallurgical And Petroleum Engineers In. 1968.

UNDERGROUND METAL MINING

B.E, VI Semester, Mining Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN63	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50(10 Hours per Module)**	**Exam Hours**	**03**
Credits – 04			

Course Objectives:

This course will enable students to:

1. Understand the construction of the mine developments to the deposit.
2. Understand the different methods of extraction of ore blocks in metal mine.
3. Understand the modern methods of extraction of ore blocks in metal mine.
4. Understand the problems, method of extraction in deep mining and machineries used.

MODULE- 1: Introduction to Metal Mining and Mine Development

Present status of Indian metal mining industry, scope and limitations of underground Metal mining, Methods of developments, Choice of level interval and block length- shape, size, position; excavation and equipping of shaft station, grizzly, ore/waste bin, main ore pass system, underground crushing and loading stations, arrangements for dumping into main ore pass, Cross-cuts, drifts, and declines: their shape, size and position.

MODULE- 2: Stope and Stoping

Classification of stoping methods, factors affecting the choice of stoping methods like depth, dip, width, grade of ore, physio mechanical characteristics of ore and wall rock.

Open stoping/Unsupported stoping – room and pillar, sublevel, large diameter blast hole/DTH, shrinkage and vertical crater retreat methods - their applicability, stope layouts, stope preparation, ground breaking, mucking, ventilation and supporting, haulage and dumping.

MODULE- 3: Stoping Methods

Supported stoping – post and pillar, square set, longwall, cut and fill- their applicability, stope layouts, stope preparation, ground breaking, mucking, ventilation and supporting, haulage and dumping

Caving stoping – top slicing, sublevel caving, and block caving; their applicability, stope layouts, stope preparation, ground breaking, mucking, ventilation and supporting, haulage and dumping. Indian case studies.

MODULE- 4: Special Methods:

Solution mining, in-situ leaching, borehole mining, underground retorting Problems of deep mining and their remedial measures. Case studies.

MODULE- 5: Design of Stopes

Mining of parallel and superimposed veins, Pillar recovery Dilution, loss and recovery in stoping.

Design of stopes: Stope design and production planning, scheduling, oms.

Course outcomes:

At the end of the course students will be able to:

1. Ability to construct the mine developments to the deposit
2. Ability to extract the ore block by different methods.
3. Ability to extract the ore block by modern methods.
4. Ability to identify the machineries used, methods of extraction and to analyse the problems in deep underground mine.

TEXT BOOKS:

1. Elements of Mining Technology Vol. II – D.J.Deshmukh, 6th edition Central Techno Publication, Nagpur, 1998.
2. Introductory Mining Engg - by H.L.Hartman

REFERENCE BOOKS

1. Underground mining methods handbook - by Hustrulid SME publication
2. Metalliferrious mining of ores - by Borosov et.al.
3. SME Mining Engineering Handbook, Edited - by H.L.Hartman SME publication
4. Techniques in Underground Mining Selection - Richard E. Gertsch et al, SME 1998

ROCK MECHANICS

B.E, VI Semester, Mining Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN64	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50(10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course Objectives:

This course will enable students to:

1. To describe the importance of Rock Mechanics in the field of mining and identify of the physical and mechanical properties of rocks.
2. To understand stress and strain in rocks and the physical and mechanical properties of rocks, and failure criteria for rock and rockmass.
3. To understand the methods of in-situ strengths of rock mass, rheological models and elastic constants of rocks.

MODULE- 1:Introduction to Rock Mechanics:

Definition, Scope and importance, development and application of rock mechanics in mining. Discontinuities; Description of discontinuities, Introduction to mapping and hemispherical projection of discontinuities, Barton's shear strength of joints.

MODULE- 2:Analysis of Stress and Strain

Analysis of Stress: Introduction, definition and basic concepts, stress in a plane, (two dimensional stress), Mohr's Circle of stress, Secondary principal stress, equations of equilibrium, plane stress equations. Simple numerical problems.

Analysis of Strain: Introduction, definition and basic concepts, strain in a plane, (two dimensional strain), Mohr's Circle of strain, equations of compatibility, stress-strain relationship, plain strain equations, elasto plastic behaviour of rocks.

MODULE- 3: Physico-Mechanical Properties of Rocks

Definition and explanation - Specific gravity, hardness, porosity, moisture content, permeability, thermal conductivity. Compressive, tensile and shear strengths. Modulus of elasticity, Poisson's ratio and triaxial strength.Swell index, slake durability, point load index, Protodyakonov index and RQD. Creep behavior.

MODULE- 4: In-situ Strength and failure criteria of rocks

In-situ Strength Properties of Rocks: Necessity and requirement, methods of in-situ stress measurements - Plate load test, cable jack test, borehole test, dilatometer test, flatjack test, hydraulic fracture and velocity propagation.

Failure criteria for rock: Theories of rock failure; Coulomb, Mohr Griffith and Empirical criteria.

MODULE- 5: Rheological and Elastic Constants of Rocks

Rheological models: Introduction, simple and complex rheological models.

Elastic constants: Introduction and determination of static and dynamic elastic constant.

Course outcomes:

At the end of the course students will be able to:

1. Ability to describe the importance of Rock Mechanics in the field of mining and identify of the physical and mechanical properties of rocks.
2. Ability to calculate the stress and strain in rocks and rockmass.
3. Ability to understand the time dependent behaviour by rheological models and determination of elastic constants of rocks.

TEXT BOOKS:

1. Strata Mechanics in Coal Mining, Jeremic, K.L. Jeremic, Rotterdam, Balkema, 1985.
2. Fundamentals of Rock Mechanics – Jager & Cook, Methuen andco. London, 1969.

REFERENCE BOOKS

1. Continuum Theory of rock Mechanics CsabaAsszonyi, Transtech Publications, 1979.
2. Hand Book on Mechanical Properties of rocks R.D. Lama, V.S.Vutukuri, Vol. I to IV, Transtech Publications, 1978.
3. Mechanics and Engineering, Charles Jaeger, Cambridge University Press, 1979.
4. Rock Mechanics for Underground Mining, 2nd edition, Brady and Brown, Kluwer Academic Publlishers, 1993.
5. Ground Mechanics in Hard rock Mining, M.L. Jeremic, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.

Professional Elective-II

MINE DISASTERS AND RESCUE

B.E, VI Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN651	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40(08 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Course Objectives:

This course will enable students to:

1. To understand the causes of mine fire and spontaneous heating.
2. To know how to tackle the mine disasters like mine fire and inundation.
3. To understand the lighting in underground and open cast mine.
4. To understand the rescue and recovery operation in a mine.

MODULE- 1: Mine Fires

Mine Fires: Classification, surface and underground fires, prevention and control of underground fires, firefighting, study of atmosphere behind sealed-off area, re-opening of sealed off area.

MODULE- 2: Spontaneous Heating

Spontaneous Heating: Mechanism, factors governing spontaneous heating, stages of spontaneous heating, symptoms of spontaneous heating in underground mines, detection and prevention of spontaneous heating, interpretation of mine air samples, Graham's Index, Problems.

MODULE- 3: Disasters

Disasters: Types of Disasters, mechanism, ignition temperature, lag on ignition, causes and coal dust and fire damp explosions. Stone dusting, stone dust barriers and water barriers, investigation after the explosion, explosibility Limit, Problems on explosibility limit, Inundation: Causes, measures against inundation. Dewatering water logged workings, precautions to be taken when approaching old water logged workings, safety boring apparatus. Simple problems.

MODULE- 4: Mine Illumination

Mine Illumination: Technical terms in lighting and photometry, Underground lighting, electric safety lamp, different types of portable lamps, Layout of lamp room. Methods of illumination in underground mines- fixed system, mobile system. Mine Lighting in Opencast mines: Standards of mine lighting in opencast mines, Illumination survey, Luminance calculations. Simple problem

MODULE- 5: Mine Rescue and Recovery

Mine Rescue: Mine Rescue and equipment, short distance apparatus, self-contained breathing apparatus (not specific to any equipment), Principle of operation, advantages, self-rescuers, organization of rescue. Mine Recovery: recovery work in connection with fires, explosions and inundations.

Course outcomes:

At the end of the course students will be able to:

1. An ability to know the causes of mine fire and spontaneous heating.
2. An ability to tackle the mine disasters like mine fire and inundation.
3. An ability to design the lighting in underground and open cast mine.
4. An ability to carry out the rescue and recovery operation in a mine.

TEXT BOOKS:

1. Mine Disasters and Mine Rescue, M.A. Ramulu, Oxford & IBH Publishing Co. Ltd., 1991.
2. Elements of Mine Technology Vol. II by D.J.Deshmukh, 6 th Edition, Central Techno Publications, Nagpur.

REFERENCE BOOKS

1. Fires in Coal Mines L.C. Kaku, 2 nd Edition Oriental Publishers, 1985.
2. Mine Ventilation, S. Ghatak, Vol. I, Coal Field Publishers, Asansol, 1983.
3. Underground Mine Lighting – Torter, Vol. II, Trans Tech Publication, Frg, 1982.
4. Environmental Engineering in Mines, V.S. Vutukuri& R.D. Lama, Cambridge University Press, 1992.

Professional Elective-II

MINE SAFETY ENGINEERING

B.E, VI Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN652	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40(08 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Course Objectives:

This course will enable students to:

1. Describing safety management system and risk management in Indian mining industries.
2. Formation of safety audits and control in mining industries.
3. Producing of risk analysis using statistical methods and analysis of mine accidents.

MODULE- 1: Introduction

Need for safety management system in mining industry; Safety policy, Internal Safety Organization (ISO); structure and its functions; publicity campaign; safety competition and its awards; safety weeks.

MODULE- 2: Risk Management

Risk Management related terms and definitions; Basic concept of risk; Difference between hazard and risk; Components and types of risks, Risk management objectives and its process; Risk analysis objectives in hazardous system life cycle; Functions of a risk manager; Hazards Identification and Risk Assessment (HIRA).

MODULE- 3: Statistical methods of Risk analysis

Fault tree analysis, Failure Mode and Effect Analysis (FMEA); Failure Mode Effect and Critical Analysis (FMECA) - Definitions, descriptions, applications, benefits, similarities and differences between FMEA & FMECA

MODULE- 4: Mine Accident Analysis

Accidents due to various causes and preventive measures; and Human Behavioral Approach in mine safety; accident enquiry: procedure and preparation of report.

MODULE- 5: Safety Audits and Training

Safety audit - Objectives, Frequency, and methods; Safety Audit Process Flowchart; Baseline Data for Safety Audit;Safety management, Mine Vocational Training Rules, 1966. Recent trends of development of safety engineering approaches.

Course outcomes:

At the end of the course students will be able to:

1. Gain insights of safety management system and risk management in Indian mining industries.

2. Formulate safety audits and control in mining industries.
3. Produce risk analysis using statistical methods and analysis of mine accidents.

TEXT BOOKS:

1. Mine Safety by Prof. Kejriwal
2. Occupational Safety and Health in Industries and Mines by C.P.Singh
3. Indian Mining Legislation – A Critical Appraisal by Rakesh& Prasad.
4. Safety in Mines: A survey of accidents, their causes & prevention (1901 to 2000)

REFERENCE BOOKS

1. Safety in Mines, by Prof. B. K. Khejriwal.
2. System Safety engineering and risk assessment: A practical approach, by N. J. Bahr Publisher: Taylor and Francis
3. System Safety engineering and management, by H. E. Roland and B. Moriarty Publisher: Wiley Inter science

Open Elective-II

TUNNELING ENGINEERING

B.E, VI Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN661	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40(08 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Course Objectives:

This course will enable students to:

1. Design tunnels, rock support and grouting and evaluate the most important issues in the procedure
2. Evaluate tunnel excavation method from technical and production aspects
3. Analyze cost and time for ordinary tunnels based on risks and construction management principles
4. Carry out a basic design of tunnel ventilation

MODULE- 1

Introduction: Scope and application, historical developments, art of tunneling, tunnel engineering, future tunneling considerations. Types of Underground Excavations: tunnel, adit, decline, shaft; parameters influencing location, shape and size; geological aspects; planning and site investigations for a tunnel.

MODULE- 2

Tunnelling Methods: Types and purpose of tunnels; factors affecting choice of excavation technique; Methods - soft ground tunneling, hard rock tunneling, shallow tunneling, deep tunneling; Shallow tunnels – cut and cover, cover and cut, pipe jacking, jacked box excavation techniques, methods of muck disposal, supporting, problems encountered in tunneling and remedial measures.

MODULE- 3

Tunneling by Drilling and Blasting: Unit operations in conventional tunneling; Drilling - drilling principles, drilling equipment, drilling tools, drill selection, rock drillability factors; Blasting - explosives, initiators, blasting mechanics, blast hole nomenclature; types of cuts- fan, wedge and others; blast design, tunnel blast performance - powder factor, parameters influencing, models for prediction; mucking and transportation equipment selection.

MODULE- 4

Tunneling by Road headers and Impact Hammers: Cutting principles, method of excavation, selection, performance, limitations and problems.
Tunnelling by Tunnel Boring Machines: Boring principles, method of excavation, selection, performance, limitations and problems; TBM applications.

MODULE- 5

Supports in Tunnels: Different types of supports in tunneling and their applicability, NATM. Ground Treatment in Tunnelling: Adverse ground conditions and its effect on tunneling; introduction to ground control.
Tunnel Services: Ventilation, drainage and pumping
Tunnelling Hazards: Explosion, flooding, chimney formation, squeezing ground.

Course outcomes:

At the end of the course students will be able to:

1. Design tunnels, rock support and grouting and evaluate the most important issues in the procedure
2. Evaluate tunnel excavation method from technical and production aspects
3. Analyze cost and time for ordinary tunnels based on risks and construction management principles
4. Carry out a basic design of tunnel ventilation

TEXT BOOKS:

1. Driving Horizontal Workings and Tunnel, by Pokorovski, Mir Publishers, 1980.
2. Harbour, Dock and Tunneling Engineering by R. Srinivasan Published by R. C. Pattii, Chal'otar Book Stall, Station Road TulsiSada, Arland (W. Rly), India.

REFERENCE BOOKS

1. Rock Mechanics and Design in Mining and Tunneling, by Bieniawski, Z.T., Rotterdam A.A. Balkema, 1984.
2. Drilling and Blasting of Rocks, by Carlos L Jimeno, A.A. Balkema/Rotterdam/Brookfield 1995.
3. Hoek, E., Brown, E. Underground excavations in Rock, CRC Press, 1980.
4. Hoek, E. and Brady, J. D. Rock Slope Engineering, Taylor and Francis, 1981
5. Nick Barton, Tunnel Boring Machines, 2000

Open Elective-II

UNDERGROUND SPACE TECHNOLOGY

B.E, VI Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN662	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40(08 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Course Objectives:

This course will enable students to:

1. Excavation methods for construction of underground structures
2. Requirement of different machinery for excavation purposes
3. Facility design in under structures.
4. Hazards associated with underground construction works

MODULE- 1

Historical: Natural caves, archeological caves and their construction, tunnels for road, rail and hydropower. Need for Underground Space: Congestion driven needs for development of infrastructure for transport, water, power supply, vehicle movement in cities, storage of materials

MODULE- 2

Engineering Utilities: Hydropower tunnels and caverns, underground storage for LPG, LNG, Crude and its products – basic principles.
Nuclear Waste Disposal: Conditions for waste disposal, effect of radioactivity and heat on surrounding rock, conceptual design of a nuclear waste disposal facility.

MODULE- 3

Strategic Utilities: Defense facilities, civil shelters, navy bases, air force hangers, safety and risk assessment systems.

Other Storage: Grain storage, their advantages, disadvantages, underground cold storage and cellar for foods and beverages.

MODULE- 4

Modern Developments: Underground ring roads in mega cities, submerged and floating tunnels, underground libraries, museums, dwelling units, resorts.

MODULE- 5

Traffic surveillance and control system (TSCS) in tunnels: Traffic control signs, signals, lights, cameras. Assignment: Preparation of different underground space application plans.

Course outcomes:

At the end of the course students will be able to:

1. excavation methods for construction of underground structures

2. requirement of different machinery for excavation purposes

3. facility design in under structures

4. hazards associated with underground construction works

TEXT BOOKS:

1. Underground Space Design: A Guide to Subsurface Utilization and Design for People in Underground Spaces: John Carmody, Raymond Sterling

REFERENCE BOOKS

1. Rock Mechanics and Design in Mining and Tunneling, by Bieniawski, Z.T., Rotterdam A.A. Balkema, 1984.
2. Driving Horizontal Workings and Tunnel, by Pokorovski, Mir Publishers, 1980.
3. Harbour, Dock and Tunneling Engineering by R. Srinivasan Published by R. C. Pattii, Chal'otar Book Stall, Station Road TulsiSada, Arland (W. Rly), India.
4. Drilling and Blasting of Rocks, by Carlos L Jimeno, A.A. Balkema/Rotterdam/Brookfield 1995.
5. Hoek, E., Brown, E. Underground excavations in Rock, CRC Press, 1980.
6. Hoek, E. and Brady, J. D. Rock Slope Engineering, Taylor and Francis, 1981.
7. Nick Barton,Tunnel Boring Machines, 2000

ROCK MECHANICS LAB

B.E, VI Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17MNL67**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03 (1 Hour Instruction+ 2 Hours Laboratory)**	**SEE Marks**	**60**
		Exam Hours	**03**

Credits – 02

Course Objectives:

This course will enable students to:

1. Prepare rock specimen for lab tests.
2. Select suitable lab testing method to determine strength of rock specimen.
3. Analyze discontinuities using hemispherical projection.

Experiments

1. Plotting of Stereographic Hemispherical projections of Discontinuities
2. Determination of Rock Quality Designation of rock.
3. Preparation of rock specimens for laboratory tests.
4. Determination of uniaxial compressive strength of rocks.
5. Determination of tensile strength of rock by Brazilian test.
6. Determination of compressive strength index of rocks by using point load tester.
7. Determination of slake durability index of rocks.
8. Determination of Protodyakanov index of the given rock specimen.
9. Schmidt hammer test.
10. Determination of shear strength by direct and indirect test
11. Determination of triaxial compressive strength of rock

Course Outcomes:

On the completion of this laboratory course, the students will be:

1. Ability to prepare suitable rock specimen for lab tests.
2. Ability to select suitable testing methods to determine strength.
3. Ability to plot Stereographic Hemispherical projections of Discontinuities.

Scheme of Examination:

Note: 1) All the above experiments are to be conducted

2) Two experiments are to be performed by the students in the examination

MINE ENVIRONMENT AND VENTILATION LAB

B.E, VI Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17MNL68**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03 (1 Hour Instruction+ 2 Hours Laboratory)**	**SEE Marks**	**60**
		Exam Hours	**03**

Credits – 02

Course Objectives:

This course will enable students to:

1. To study the measure and monitor different types of gases in mines
2. To study ventilation survey
3. To study the handling of rescue apparatus
4. To study the dust sampling in mines

Experiments

1. Assembling and dismantling of flame safety lamp
2. Assess the percentage of methane and oxygen using flame safety lamp
3. Determine the relative humidity of the atmosphere
4. Determine the quantity of air flow in a mine
5. Determine the cooling efficiency of the atmosphere
6. Determination of characteristic curves of a fan with respect mine characteristics
7. Demonstration of fire extinguishers to quench the fire
8. To determine the quantity of particulate matter using dust samplers
9. Study of gas sampling equipment and determination of CO (MSA CO detector and other equipment).
10. Demonstration of self-contained breathing apparatus, self-rescuers, and short distance apparatus.

Course outcomes:

On the completion of this laboratory course, the students will be:

1. An ability to measure and monitor different types of gases in mines.
2. An ability to do ventilation survey.
3. An ability to handling of rescue apparatus.
4. An ability to dust sampling in mines.

Scheme of Examination:

Note: 1) All the above experiments are to be conducted

2) Two experiments are to be performed by the students in the examination

B.E. Mining Engineering

VII SEMESTER

Sl. No	Subject Code	Course	Title	Teaching Dept.	Teaching Hours /Week			Examination				Credits
					Lecture	Tutorial	Practical / Drawing	Duration (Hours)	SEE Marks	CIE Marks	Total Marks	
1	17MN71	Core course	Underground Mine Planning & Design	MN	4	0	0	03	60	40	100	4
2	17MN72	Core course	Ground Control	MN	4	0	0	03	60	40	100	4
3	17MN73	Core course	Mineral Processing & Fuel Technology	MN	4	0	0	03	60	40	100	4
4	17MN74X	Professional Elective-III	**Professional Elective -III**	MN	3	0	0	03	60	40	100	3
5	17MN75X	Professional Elective-IV	**Professional Elective -IV**	MN	3	0	0	03	60	40	100	3
6	17MNL76	Laboratory	Mineral Processing Lab	MN	0	0	1I+2P	03	60	40	100	2
7	17MNL77	Laboratory	Computer Application in Mining Lab	MN	0	0	1I+2P	03	60	40	100	2
8	17MNP78	Core course	Project Phase-I + Project Seminar	MN	0	0	3	-	-	100	100	2
TOTAL					**18**	**00**	**09**	**21**	**420**	**380**	800	24

Professional Elective-III		Professional Elective-IV	
17MN741	Open Pit Slope Analysis and Design	17MN751	Mine System Engineering
17MN742	Occupational Health & General Safety	17MN752	Numerical Modeling and Instrumentation in Rock Mechanics
17MN743	Surface Mine Planning and Design	17MN753	Small Scale and Marine Mining

1. Core subject: This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.

2. Professional Elective: Elective relevant to chosen specialization/ branch

3. Open Elective: Electives from other technical and/or emerging subject areas.

UNDERGROUND MINE PLANNING AND DESIGN

B.E, VII Semester, Mining Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN71	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50(10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course Objectives:

This course will enable students to:

1. Understand the basic principles of mining law in India and role and influence of government on mining industries. To identify software for mine planning and designing.
2. Explain the process of strategic mine planning and its impact on decision-making during project development and the factors considered in underground coal mine planning. Explain novel mining methods.
3. Illustrate surface layouts, pit bottom and pit top layouts for different transport systems.
4. Analyze and select suitable mine development and working methods.

MODULE- 1:Government Role in Mining and Mine Development

Introduction, Social-Legal-Political-Economic impacts, Environmental consequences: air, water and land pollution; causes and preventive measures.

General principles of mine development, Land Acquisition, Plant silting and construction, environmental Protection and Permission, impoundments and dams.

MODULE- 2: Planning of Coal Mines

Principles of mine planning, stages of planning of new mines: pre-feasibility report, feasibility report and DPR, selection of mine sites, geological aspects, and division of a coal field into mining areas. Surface layouts, pit bottom layout, transport system. Application of computers in mine planning.

MODULE- 3: Underground Coal Mine Design

Mining Area, Term of life and mine capacity, division of mining property into parts, length, number and position of productive Longwall faces, dimensions of development workings.

MODULE- 4: Planning of Metal Mines

Stope planning: Cut-off grade, evaluate stope boundaries, selection criteria for stoping methods, application of computers in stope design, economics of each stope.

Production planning: Stope reserve, development, manpower, ore/wastehandling, equipment, essential services, production scheduling, time and work study for improvement of production, Optimization ofmine size (mine production capacity) based on techno-economic considerations.

MODULE- 5: Miscellaneous

Planning of mine closure: factors to be considered for mine closure; mine closure plan; rehabilitation. Novel and Innovative Mining Methods.

Course outcomes:

1. Knowledge of Mining laws in India and role and influence of government on mining industries and software for mine planning and designing.
2. Ability to explain Process of strategic mine planning, Factors considered in underground coal mine planning and Novel mining methods.
3. Ability to apply Surface layouts, pit bottom and pit top layouts for different transport systems.
4. Ability to analyze and select suitable mine development and working methods.

TEXT BOOKS:

1. Advanced Coal Mining – B.M. Vorobjev & R.T.Deshmukh, Asia Publishing House, Bombay 1966.
2. Introductory Mining Engineering – Hartman, John Wiley and Sons Inc. 1987.

REFERENCE BOOKS

1. S.M.E. Mining Engineering Handbook, Vol. I & II. Hartman, Society for Mining metallurgy and Exploration Inc. 1992. (Sections 3, 6, 7,8, 22 and 23).
2. Underground Winning of Coal – T.N. Singh, Oxford IBH, 1992.
3. Modern Coal Mining Technology – S.K.Das, Lovely Prakashan, Dhanbad, 1996.
4. Principles & Practices of Modern Coal Mining – R.D. Singh, New Age International (P) Ltd. Publishers, 1997, Section 16.
5. Mine Planning for Coal S.P.Mathur, MG Consultants Bilaspur, 1993. Mining B. Boky Mir Publishers, 1967.

GROUND CONTROL

B.E, VII Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN72	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50(10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course Objectives:

This course will enable students to:

1. Knowledge of underground excavation ; stability around the excavation, subsidence and stress around the excavation
2. To comprehend the rock mass classification and support system for underground excavation
3. To monitor and predict subsidence and underground disasters
4. To design single and multiple opening and support system for underground excavations

MODULE- 1: Design and stability of structures in rock

Definition, types of underground excavation, excavation design and constraints. Methods for design and stability analysis of underground excavations; Energy released by making an underground excavation; Design of single and multiple openings in massive, stratified and jointed rock mass. Numerical problems.

MODULE- 2: Design of mine pillars

Mine pillars and their classification; pillar mechanics; Design of mine pillars and shaft pillar: stresses acting on pillars; stress distribution in pillars; mechanics of pillar failure; interaction of pillar, floor and roof; design of rooms and pillars; design of barrier and yield pillars, Numerical Problems.

MODULE- 3: Subsidence

Causes and impacts of subsidence; Mechanics of surface subsidence, discontinuous and continuous subsidence; Monitoring, prediction, control and management of subsidence, prediction of subsidence using graphical and analytical method, monitoring and determination. Numerical Problems.

MODULE- 4: Caving of rock mass

Rock caving in mining; Mechanics of rock caving; Assessment of cavability; caving prediction and control.

Rockburst and coal bump: Phenomenology of rockbursts and coal bump; causes, prediction, monitoring and control of rockbursts; gas outbursts.

MODULE- 5: Classification of Rock Masses

Introduction, methods and approaches: Terzaghi, RQD, Rock structure Rating, Rock Slope Rating(RSR), RMR, Q, NATM, ISRM, Paul committee Report, CMRI Classification, Limitations, Suggestion of various support system based on the classification.

Course outcomes:

1. To be familiar with the types of underground excavation and to stabilize the excavation.
2. Support the rock mass based on different properties of rock.

3. Ability to estimate the subsidence and monitor the disasters.
4. To design an opening and support system for underground.

TEXT BOOKS:

1. Rock Mechanics and the Design of Structures in Rocks, L.Obert and W.I.Duvall, John Wiley and Sons, 1966.
2. Coal Mine Ground Control, S.Peng, John Wiley and Sons, Inc. 1978.
3. Strata Mechanics in Coal Mining, M. Jeremic, CRC Press, 1985

REFERENCE BOOKS

1. S.M.E. Mining Engineering Hand Book, Volume I and II, Society for Mining, Metallurgy & Exploration. Inc. 1992.
2. Underground Mining Methods Hand Book, W.A. Hustralid, Society for Mining, Metallurgy & Exploration Inc. 1982.
3. Ground Mechanics in Hard Rock Mining, M.L.Jeremic, Oxford & IBH Publishing Co. New Delhi, 1986.
4. Design of Supports in Mines, C.Biron& E. Arioglu, John Wiley & Sons, New York, 1983.
5. Underground Mining Methods and Technology, Proceedings of the International Symposium, Nottingham, Elsevier 1986. Coal Mining Technology Theory and Practice Robert Stefanko SME 1983.
6. Underground Excavations in rock E. Hoek and E.T. Brown IMM, 1980. Support of Underground Excavation in Hard Rock E. Hoeket. al., Oxford and IBH 1995.

MINERAL PROCESSING & FUEL TECHNOLOGY

B.E, VII Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN73	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50(10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

Course Objectives:

This course will enable students to:

1. To review all unit operations in mineral processing and fuel technology.
2. To understand the importance and principles of materials handling in the mineral processing plant.
3. To explain the methods of analysis of comminution theory, selection criteria for crushing, grinding and screening equipment, selection principles for mineral concentration techniques, criteria for mineral concentration equipment selection.
4. To analyze mineral beneficiation flow sheets for coal, copper, lead, iron, chromite and uranium.

Module 1: Fuel Technology

Solid fuels: Wood, peat, lignite, coal, anthracite; proximate and ultimate analyses; coal characteristics for different industrial uses; characteristics of Indian coals; caking and coking properties; Liquid fuels: Petroleum - its products and testing methods. Geseous fuels: Natural gas, producer gas and water gas.

Combustion of Coal: Mechanism of coal combustion, combustion systems (combustion stoichiometry), carbonization of coal: Low temperature carbonization, high temperature carbonization.

Module 2: Introduction to Mineral Processing, and Comminution

Introduction: Scope, objectives and limitations of mineral processing; Liberation and beneficiation characteristics of minerals and coal. Laboratory sampling.

Comminution: Definition, objectives and principles of comminution, theories of comminution, stages of comminution,

Module 3: Crushing, Grinding and Size Separation

Crushing & Grinding: Different types of crushing and grinding equipment - their application and limitations; numerical Problems.

Size separation: Laboratory size analysis and interpretation; Settling of solids in fluids; Industrial screens; Mechanical classifiers and hydro-cyclones: Numerical problems.

Module 4: Concentration Process

Gravity concentration methods: Jigging, heavy media separation, flowing film concentration - theory, application and limitations.

Froth flotation: Physico-chemical principles; Reagents; Machines; Flotation of sulphides, oxides and coal.

Electrical and magnetic methods of concentration: Principles, fields of application and limitations.

Module 5: Float & Sink Test, Dewatering and Flow Sheets

Float and sink test: procedure for float and sink test, construction of washability curves and their use/application

Dewatering: Principles and techniques: thickening, filtration, and drying techniques.

Simplified processing/ beneficiation flow sheets: coal, copper, lead, zinc, gold, iron, manganese ores and lime stone.

Course outcomes:

At the end of the course students will be able to:

1. Ability to understand the importance and principles of materials handling in the mineral processing plant.
2. Ability to explain the methods of analysis of comminution theories, selection criteria for crushing, grinding and screening equipment, selection principles for mineral concentration techniques, criteria for mineral concentration equipment selection.
3. Ability to analysis the mineral beneficiation flow sheets for coal, copper, lead, iron, chromite and uranium.

TEXT BOOKS:

1. Fuels and Combustion, Dr. Samir Sarkar, Published by Orient Longman Ltd., 1990.
2. Mineral Processing Technology, B.A.Wills, 5th Edition, Pergamon Press.
3. Ore Processing, S.K.Jain, @nd Edition, Oxford IBH, 1990.
4. Coal Its Beneficiation, D.V. Subba Rao, M.K. Publications, 2003.

REFERENCE BOOKS

1. Hand Book of Mineral Processing taggart, John willy & Sons, 1945.
2. Introduction to Mineral Processing Errol G.Kelly and David J. Spottiswood, John Wiley and Sons, 1982.
3. Principles of Mineral Dressing, A.K. Gaudin, TMH Edition, Tata Mc. Graw Hill, 1971.
4. Coal Conversion Technology, Edited by C.Y.Wen, Addison Wesley Publishing Company, 1979.
5. Coal Carbonisation, T.K.Basu et al., Allied Publishers, 1996.
6. The Chemistry and Technology of coal, James G. Speight, Mercel Dekker, Inc. 1994.
7. Text Book of Metallurgical Analysis, B.G.Agarwal and S.P.Jain, Khanna Publications, New Delhi, 1984. 8. Coal Preparation Practice, G.G.Sarkar, Oxford and IBH Publishing Co. 1986.
9. Coal Mining Practice – I.C.F. Statham Vol. IV, the Caxton Publishing company Ltd. Inc. 1958.

Professional Elective-III

OPEN PIT SLOPE ANALYSIS AND DESIGN

B.E, VII Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN741	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40(08 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

MODULE- 1: Introduction

Types and formation of slopes in surface mines, pit slope vis-à-vis mine economics, mechanism of common modes of slope failure, factors influencing stability of slopes, and planning of slope stability investigations.

MODULE- 2: Geotechnical Information

Geotechnical data required for highwall slope stability studies. Collection of Geological Data and their interpretation for stability studies of highwall slopes.

MODULE- 3: Shear Strength

Shear strength of intact rock, discontinuity surfaces, filled discontinuities and rock-mass - estimation and determination; Surface roughness, joint roughness coefficient – estimation and determination.

MODULE- 4: Water Flow

Concepts of water flow through a material and its permeability; water flow through rock-mass, water flow through soil type material and broken spoil material; Estimation and measurement of permeability and water pressure; Graphical solution of seepage problems (flow nets), seepage forces and seepage patterns under different conditions.

MODULE- 5: Analysis and Design of Pit Slopes and Waste Dumps

Slope stability assessment methods and techniques; Analysis and design criteria and methodology for highwall slopes and backfill and waste dumps; Probabilistic approaches of slope analysis and design.

TEXT BOOKS:

1. Derek Martin, Peter Stacey, “Guidelines for Open Pit Slope Design in Weak Rocks”, by CRCPress, ISBN 9781138298095 - CAT# K35659.

REFERENCE BOOKS

1. Surface Mining Technology, S.K.Das, Lovely Prakashan, Dhanbad, 1994.
2. Surface Mining by G.B. Mishra, Dhanbad Publishers, Dhanbad, 1978.

Professional Elective - III

OCCUPATIONAL HEALTH & GENERAL SAFETY

B.E, VII Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN742	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40(08 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

MODULE- 1: Introduction

Introduction: Safety conference and their impact, Safety Education and training; Pit Safety committee, health and safety program, Feedback on safety.

MODULE- 2: Occupational Health

Occupational Health: Safety and occupational health survey, notified and general miners diseases and their preventive measures. Permissible standard of dustiness. The Mines Rescue Rules, 1985.

MODULE- 3: Safety Rules and Regulations and Bye-Laws

Safety Rules and Regulations: Standing order in event fire, inundation and failure of main mechanical ventilator.
Bye-Laws: ANFO Explosive, A.C. mains firing, Bulk transportation of explosives, Diesel Locomotives.

MODULE- 4: Accidents

Accidents: Classification of accidents, statistics, causes and preventive measures of various accidents; Accident enquiry report for accidents due to roof fall, blasting, machinery failure etc.

MODULE- 5: Accidental Planning

Accidental Planning: Collection and presentation of accidental records, zero accidental planning (ZAP) and minimum accidental planning (MAP). Inspection for safety. Accident Compensation, Job safety Analysis.

TEXT BOOKS:

1. Legislation in Indian Mines a Critical Appraisal, Vol. I & II, Rakesh & Prasad, Tara Book Agency, Varanasi, 1999.
2. Mine Management Legislation and General Safety, Ghatak, Coal Field Publishers, Asansol, 1998.

REFERENCE BOOKS

1. DGMS Classified Circulars, Lovely Prakashan, 1998.
2. V.T. Rules 1966, Bare Act Publishers, 1999.
3. Indian Electrical rules 1956, Bare Act Publsihers, 1999.
4. Mine Rescue Rules 1985, Bare Act Publishers, 1999.

Professional Elective-III

SURFACE MINE PLANNING & DESIGN

B.E, VII Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN743	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50(10 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

MODULE- 1: Introduction

Stages/Phases of mine life; Preliminary evaluation of surface mining projects; Mine planning and its importance; Mining revenues and costs, and their estimation; Mine planning: stages of mine planning and planning inputs.

MODULE- 2: Ore reserve estimation and Stripping ratio

Ore zone and bench/level compositing; Objectives and principles of ore reserve estimation; Estimation of grade at unknown point; Methods of ore reserve estimation - vertical cross section method, horizontal cross section method and 3-D geological block method.
Concept of stripping ratio; Types of stripping ratios and their significance.

MODULE- 3: Geometrical considerations and Pit Planning

Basic bench geometry; Ore access; Pit slope geometry; Addition of haul road on pit plan; Pit layouts.
Development of economic block model; Pit Cut-off grade and its estimation; Ultimate pit configuration and its determination – hand method, floating cone technique, Lerchs-Grossmann algorithm, and computer assisted hand method.

MODULE- 4: Production planning and, Analysis and design of highwall slopes and waste dumps

Determination of optimum mine size and Taylor's mine life rule; Sequencing by nested pits; Cash flow calculations; Mine and mill plant sizing, Lanes algorithm for estimation of optimum mill cut of grade; Introduction to production scheduling.
Influence of pit slope on mine economics; Highwall slope stability analysis and design methodology; Stability analysis and design methodology for waste dumps.

MODULE- 5: Miscellaneous

Design of haul roads: Design of road cross section; Design of road width, curves and gradient; Haul road safety features and their design.
Design of drainage system in surface mines. Selection of mining system vis-à-vis equipment system. Closure of surface mines and rehabilitation.

TEXT BOOKS:

1. **Surface Mining Technology, S.K.Das, Lovely Prakashan, Dhanbad, 1994.**
2. **Surface Mining by G.B. Mishra, Dhanbad Publishers, Dhanbad, 1978.**
3. **Surface Mining: The American Institute of Mining Metallurgical AndPetroleum Engineers In. 1968.**

REFERENCE BOOKS

1. S.M.E. Mining Engineering hand Book Vol. I and II, Hartman, Society for Mining, Metallurgy and Exploration Inc. 1992.
2. Method of Mining, Working Coal and Metal Mines, Vol. I, II and III – Wood ruff S.D., Pergoman Press, 1968.
3. Introductory Mining Engineering – Hartman H.L. John Wiley and Sons Inc. 1987.
4. Opencast Mining – R.T. Deshmukh, M. Publications, Nagpur, 1996.
5. Latest Development of Heavy Earth Moving Machinery Amithosh De, Annapurna Publishers, Dhanbad, 1995.
6. Rock Slope Engineering, Hock and Bray, The Institution of Mining and Metallurgy, 1981.
7. Principles and Practices of Modern Coal Mining – R.D. Singh, New Age International, 1997.

Professional Elective-IV
MINE SYSTEMS ENGINEERING

B.E, VII Semester, Mining Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN751	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40(08 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Course objectives:

This course will enable students to:

1. Identify and develop operational research models from the verbal description of the Real Systems.
2. Enables to create mathematical models that are useful to solve optimization problems.
3. Ability to estimate the optimum cost/distance in transporting the goods.
4. Able to apply the different types of strategies of game theory in decision making.
5. Able to design and develop the analytical models like PERT and CPM for planning, scheduling and controlling projects.

MODULE- 1: System Engineering and Linear Programming

System Engineering: Introduction to systems concept, analysis and systems engineering. Models in systems analysis. Basic concepts of statistical decision theory.

Linear Programming: Definition, mathematical formulation, standard form, solution space, solution-feasible, basic feasible, optimal,infeasible, multiple, optimal, Redundancy, Degeneracy, Graphical and Simplex methods.

MODULE- 2: Variants of Simplex algorithm, Simulation and Inventory Model

Variants of Simplex algorithm – Artificial basis techniques. Duality, Economic interpretation of Dual, Solution of LPP using duality concept, Dual simples method.

Simulation: Simulation techniques for equipment selection and production scheduling, Significance of management information systems in controlling and managing the mining activities.

Inventory Model: Definition, deterministic models, probabilistic models and their applications to mining.

MODULE- 3: Transportation Problem

Transportation Problem: Formulation of transportation model, Basic feasible solution using different methods, Optimality Methods, Unbalanced transportation problem, Degeneracy in transportation problems, Applications of Transportation problems. Assignment Problem**:** Formulation, unbalanced assignment problem, Traveling salesman problem.

MODULE- 4: Project Management Using Network Analysis and PERT CPM

Project Management Using Network Analysis: Network construction, Network techniques for mining projects, determination of critical path and duration, floats.

PERT –Estimation of project duration, variance.
CPM – Elements of crashing, least cost project scheduling. Flow innetworks: Determination of shortest route, Determination of Maximum flowthrough the networks for mining project.

MODULE- 5: Queuing Theory and Game Theory

Queuing Theory: Queuing system and their characteristics. The M/M/I Queuing system, Steady state performance analyzing of M/M/I and M/M/C queuing model.
Game Theory: Formulation of games, Two Person - Zero sum game, games with and without saddle point, Graphical solution (2xn, mx2game), and dominance property.

Course Outcomes:

At the end of the course students will be able to:

1. Mine Systems Engineering presents the theoretical principals and practical applications for strategic mine planning in surface and underground mining operations.
2. It covers planning and valuation methodologies applicable to metal and coal mining projects.
3. The students will explore and apply basic manual procedures, algorithms, computer applications and mathematical models for strategic mine planning.

TEXT BOOKS:

1. Cummins .Mining Engineers Handbook, Vol. II SME, AIME, New York, 1979.
2. Sharma J.K. Mathematical Models in Operations Research. Tata Mcgraw-Hill, New Delhi, 1989.
3. Taha H.A. – Operations Research and Introduction, Mc. Millan. ISBN -0-02-418940-5.

REFERENCE BOOKS

1. Hiller and Liberman, Introduction to Operation Research, Mc. GrawHill V Edition.
2. S.D. Sharma – Operations Research, Kedarnath, Ramnath& Co.
3. Philips, Ravindran and Soleberg – Principles of Operations Research – Theory and Practice, PHI.
4. KanthiSwarup& Others – Operations Research, Sultanch and Sons.

Professional Elective-IV

NUMERICAL MODELLING AND INSTRUMENTATION IN ROCK MECHANICS

B.E, VII Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN752	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40(08 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

MODULE- 1:Basic Concepts and Principles

Basic Concepts: Sensitivity, range, reproducibility and accuracy, drift, absolute and relative measurements, error, environmental factors and planning for instrumentation.

Principles: Mechanical, pneumatic, optical, vibrating wire, piezoelectric, electrical and thermal.

MODULE- 2: Field and Laboratory Instruments

Load cells, MPBX, tape extensor meters, convergence recorders.

Load, stress, deformation and strain measuring instruments.

MODULE- 3: Instrumentation monitoring

Introduction, purpose, monitoring systems, data collection, interpretation and application in mining engineering.

MODULE- 4: Introduction to numerical modelling

Introduction, need, domain and boundary conditions; discretisation, approach to numerical simulation for excavations in mining. Steps followed in numerical modelling.

MODULE- 5: Methods of Numerical modelling

Methods of numerical modelling: Basic principle, advantages and their limitations of Finite difference method, finite element method, boundary element method and discrete element code.

TEXT BOOKS:

1. Rock mechanics, instrumentation, room and pillar workings, tests: Parker, Jack. 02650.
2. Numerical Methods in Rock Mechanics, by G. N. Pande, Publisher: John Wiley & Sons Inc (June 1, 1990)

REFERENCE BOOKS

1. Geotechnical observations and instrumentation in tunneling. Vols. 1 & 2, Report No. UILU-ENG ... Proceedings, 8th Symposium on Rock Mechanics, American Institute of Mining, Metallurgy, and Petroleum Engineering, Minneapolis, Minnesota, pp. 237-302.
2. Strata Mechanics in Coal Mining, Jeremic, K.L. Jeremic, Rotterdam, Balkema, 1985.
3. Fundamentals of Rock Mechanics – Jager & Cook, Methuen and co. London, 1969.

Professional Elective-IV

SMALL SCALE AND MARINE MINING

B.E, VII Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN753	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40(08 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

MODULE- 1: Introduction to Small Scale Mining

Introduction to Small Scale Mining: Concept of small-scale mining, small scale mines – worldwide Indian Policy in small scale Mines – Practices, policies and prospective, problems of small scale mines finance, Legislative support technical expertise.

MODULE- 2: Small Scale Mining Methods

Small Scale Mining Methods: Classification and mode of occurrence of granite and minor minerals, physical, mechanical and chemical properties. Geological aspects of mining, granite and dimensional stone mining – manual, semi mechanized mining and mechanized mining processing, finishing, quality control, marketing and export of minerals.

MODULE- 3: Environmental Aspects and Some case studies of mining

Environmental Aspects: Environmental obligations, Safety health and training, environmental impacts and protection.
Some case studies of mining: Mica, Barites, Diamond and Gemstones etc.

MODULE- 4: Introduction to Marine Mining and Marine Geology and Resources

Introduction to Marine Mining: Introduction to marine environment, characteristics of ocean floor, profile of the sea, continental shelf, slope and rise, nature of deposits of nectic, Bathyl and abyssal environments, coastal zone.
Marine Geology and Resources: Introduction to marine geology, marine mineral resources mineralogical students of continental slope, continental shelf and deep sea-bed mineral resources.

MODULE- 5: Miscellaneous

Exploitation of Marine Deposits: Exploitation systems of dissolved an undissolved mineral deposits, shallow water mining upto 200 mts depth direct picks up and transport.
Deep sea mining: deep sea mining upto 2000 mts. Mining of manganese nodules, under water vehicle. Crabs, transportation.

TEXT BOOKS:

1. Ghose A.K. (Ed) Small Scale Mining Global Overview, Oxford – IBH Publishers, 1991.
2. Herbich J.B. Coastal and Deep Ocean Dredging Gulf Publishing Co. Houston.

REFERENCE BOOKS

1. Chatterjee S.K. An Introduction to Mineral resources, Wiley Eastern Ltd., 1993.
2. Shepherd F.P. Sub –Marine Geology, Harper and Row New York, 1963.
3. Graff, W.J. Introduction and offshore Structure, Design, Fabrication and Installation, Gulf Publishing Company, London, 1963.

MINERAL PROCESSING LABORATORY

B.E, VII Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MNL76	CIE Marks	40
Number of Lecture Hours/Week	03 (1 Hour Instruction+ 2 Hours Laboratory)	SEE Marks	60
		Exam Hours	03

Credits – 02

Course Objectives:

This course will enable students to:

1. To study the different types of sampling methods
2. To study the laboratory sizing and separation of particles.
3. To study the process of comminution
4. To study the settling of solids in fluids
5. To study the different types of concentration process

Experiments

1. Sampling: a) Coning and quartering b) Riffle Sampling
2. Sieve analysis and interpretation of data
3. Determination of actual capacity of a jaw crusher.
4. Determination of actual capacity of a roll crusher.
5. Determination of grindability index of the given ore.
6. Determination of free settling velocities of quartz particle and comparison of the results with theoretical results.
7. Separation of heavier from the given feed using mineral jig and calculation of ratio of concentration.
8. Study of the particle movement on the deck of an operating table.
9. Separation of ferrous minerals using magnetic separator.
10. Study of the flotation of characteristics of the sulfide and oxide ore and, calculate the ratio of concentration.

Course Outcomes:

On the completion of this laboratory course, the students will be:

1. An ability to identify different types of sampling methods, comminution methods and concentration methods.
2. An ability to explain laboratory sizing, comminution and concentration methods.
3. An ability to interpret laboratory sizing, comminution and concentration methods.

Scheme of Examination:

Note: 1) All the above experiments are to be conducted

2) Two experiments are to be performed by the students in the examination

COMPUTER APPLICATION IN MINING LABORATORY

B.E, VII Semester, Mining Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	**17MNL77**	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03 (1 Hour Instruction+ 2 Hours Laboratory)**	**SEE Marks**	**60**
		Exam Hours	**03**

Credits – 02

Course Objectives:

This course will enable students to:

1. To understand the draw, modify and dimensioning tools in the CAD package
2. To draw the orthographic projections
3. To draw mining Machineries using CAD tools.

Part-A

1. Learning of the following commands using a CAD package.
2. Drawing Commands: Line, arc, circle, polygon, Donut, Solid, Spline Pline, Text, M Line, ellipse, dimensioning, object snaps point, Hatch, layers, Units.
3. Editing Commands: Limits, Erase, Array, Copy, Move, Offset, Stretch, Pedit, change properties, Trim, Extend, Fillet, Chamfer, Break, Mirror, Scale, Rotate, Zoom, Pan.
4. Enquiry Commands: Id, list, Dist, Area, DB list, Status Selection sets i.e. window, crossing, fence, W polygon. Plotting.
5. Simple exercises using any of the above commands

Part-B

6. 08 (Eight) Exercises (Mining Drawing) using any of the above commands.

Course Outcomes:

On the completion of this laboratory course, the students will be:

1. To use the draw, modify and dimensioning tools in the CAD package.
2. Ability to draw orthographic projections using CAD package.
   Ability to draw mining Machineries using CAD tools.

Scheme of Examination:

Note: 1) All the above experiments are to be conducted

2) Two experiments (one each from part A and part B) are to be performed by the students in the examination

B.E. Mining Engineering

VIII SEMESTER

Sl. No	Subject Code	Course	Title	Teaching Dept.	Teaching Hours /Week			Examination				Credits
					Lecture	Tutorial	Practical / Drawing	Duration (Hours)	SEE Marks	CIE Marks	Total Marks	
1	17MN81	Core course	Mine Legislation	MN	4	0	0	03	60	40	100	4
2	17MN82	Core course	Computer Application in Mining	MN	4	0	0	03	60	40	100	4
3	17MN83X	Professional Elective-V	**Professional Elective-V**	MN	3	0	0	03	60	40	100	3
4	17MN84	Core course	Internship/Professional Practice		Industry Oriented			03	50	50	100	2
5	17MNP85	Core course	Project Work Phase -II	MN	0	0	6	03	100	100	200	6
6	17MNS86	Core course	Seminar on current trends in Engineering and Technology	MN	0	0	4	-	-	100	100	1
TOTAL					**11**	**00**	**10**	**15**	**330**	**370**	700	20

Professional Elective-V	
17MN831	Mining Geo-statistics
17MN832	Dimensional Stone Mining
17MN833	Coal Bed Methane
17MN834	Environmental Impacts Of Mining

Note:

Internship/ Professional Practice: Students should undergo the following during the vacations (4^{th} to 7^{th} Semester) and detailed REPORT should be submitted in 8^{th} Semester for Internal Assessment).

1. One Week Geology (after 4^{th} sem) and Survey (after 5^{th} sem) Camps.
2. Industrial Visits (Two Underground & Two Opencast Mines) or 15 Days Underground and 15 days Opencast Mines training or 15 Days in-Campus Technical Skill Development Certified Course.

MINE LEGISLATION

B.E, VIII Semester, Mining Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN81	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50(10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

MODULE- 1:Introduction and the mines Act, 1952

Brief historical perspective legislation in Indian Mines.

Preliminary, Inspectors and Certifying surgeons, committee, mining operations and management of mines. Provisions to health and safety. Hours and limitations of employment Leave with wages, Regulations and bylaws, penalties and procedures.

MODULE- 2: Mines Rules,1955

Preliminary, committee, court of enquiry, certifying surgeons, Medical Examination of persons employed. Workmen's inspector and safety committee, health and sanitation provision, first aid and medical appliance. Employment of persons, leave with wages and overtime. Welfare amenities, registers and notices.

MODULE- 3: Metalliferous mines regulation,1961 and Coal mines regulations,2017

Preliminary returns, notices and records, inspectors and mine officials, duties and responsibilities of work men, plans and sections, means of access, ladders and ladder ways, transport of men and materials, winding in shafts, transport of men and material haulage, mine workings, precaution against dangers from fire, dust gas and water, ventilation, lighting and safety lamps, Explosives and shot firing, machinery, plants and equipments.

MODULE- 4: Mines and Minerals (Development and Regulation) Act, 1952 and related rules

Mines and Minerals (Development & Regulation) Act, 1957, Mineral Concession Rules, 1960and Mineral conservation and Development Rules. Salient provisions of the mines.

MODULE- 5: Miscellaneous

Salient Features of: The Mines Creche Rules, 1966, Maternity Benefit Act and Rules; Indian electricity Rules, 1956 and Coal Mines Provident Fund Act and Rules.

TEXT BOOKS:

1. Mines Act 1952, Mines Rules 1955, Universal Law Publishing, Pvt. Ltd., 1999.
2. Metalliferous Mines Regulations 1961, Universal Law Publishing Pvt. Ltd., 1999.
3. Coal Mines Regulation 1957, Universal Law Publishing Pvt. Ltd., 1999
4. MM (R & D) Act, 1957

5. MCDR, MCR, 1960

REFERENCE BOOKS

1. Legislation in Indian Mines – A critical Appraisal Prasad and Rakesh, 5th edition Tara Printing Works, varanasi, 1990.
2. Maternity Benefit Act, & Mines Crèche Rules, Universal Law Publishing Pvt. Ltd., 1999.
3. Encyclopedia of Mining Law – D.D. Seth. Law Publishers (India) Pvt. Ltd., Allahabad, 1999.
4. Mine Management Legislation and General Safety, S. Ghatak, Coal Field Publishers, Asansol, 1999.

COMPUTER APPLICATION IN MINING

B.E, VIII Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN82	**CIE Marks**	**40**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**60**
Total Number of Lecture Hours	**50(10 Hours per Module)**	**Exam Hours**	**03**

Credits – 04

MODULE- 1:Computer Aided Design

Fundamentals of CAD, Introduction, The Design Process, The application of Computers for Design, Creating the Manufacturing Data Base, Benefits of Computer – Aided Design.

Hardware in Computer – Aided Design: Introduction, The design Workstation, the Graphics Terminal, Operator Input Devices, Plotters and Other Output Devices, The Central Processing Unit, Secondary Storage.

MODULE- 2: Computer Graphics software and Database

Introduction, The Software Configuration of a Graphics System, Functions of a Graphics Package, Constructing the Geometry, Transformations, Data base Structure and Content, Wire-frame Versus Solid Modeling, Other CAD Features, Application of Computers in Mining Industries.

MODULE- 3: Algorithms

Development of algorithms in Ore Reserve Estimation, Equipment Selection, Material Handling System, Pit Configuration, Blast Design, Pillar Design, Subsidence Protection, Ventilation Network Analysis, Ground Vibration Prediction from Blasting.

MODULE- 4: Data Base Management System

Introduction: Database Approach versus traditional file processing Approach, DBMS Administrators, Designers users, Developers, and maintenance, uses of DBMS, Data mine Package. Database System Concepts and Architecture: Architecture, Data Models, Schemes and Instances, Architecture and Data Independences, Database languages and Interfaces, Classification of Management Systems. Entity Relationship Model: Entities, Attributes, Key Attributes, relationships, Roles. Structural Constants, Weak Entity Types, E-R Diagram.

MODULE- 5: Relational Data Models and Relational Algebra and SQL - A Relational Database Language

Relational Models concept, the relational Algebra, Additional Relational Operators, Queries in the Relational Algebra

Data Definition in SQL, Views in SQL, Queries in SQL. Queries. Database Design: Normal forms based of primary keys, First, Second, Third normal forms, BCNF.

TEXT BOOKS:

1. Fundamentals of Database Systems, Elmarsi and Navathe, 3rd edition, Wesley 2000.
2. CAD/CAM : Computer Aided Design and Manufacturing, Mikell P. Groover, Emory W. Zimmers, Jr. PHI Inida, 1989.

REFERENCE BOOKS

1. Mine Ventilation and Air – Conditioning, Hartman, Wiley International, 1961.
2. Mine Environmental Engineering, V.S. Vutukuri& Lama, Cambridge University Press, 1986.
3. Database System Concepts, Korth, McGraw Hill, 1986.
4. CAD/CAM Theory and Practice by Zeid, Tat Mc. Graw Hill.

Professional Elective-V

MINING GEOSTATISTICS

B.E, VIII Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN831	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40(08 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

MODULE- 1: Introduction to Geo-statistics

Definition, Schools of geostatistics. Estimation models for mine evaluation – average method, polygonal or triangular method.

MODULE- 2:Deterministic Mathematical Model

Independent random model, trend with random noise, correlated random model and trend with correlated randomresiduals.

Module - 3

Correlated Random Theory-1: Semi Variogram: Definition of semi variogram, mathematical models of semi-variogram.
Practical problems – Isotropy and anisotropy, stationarity, regularization, nugget effect.

Module - 4

Correlated Random Theory- 2: Extension Variance and Estimation Variance: Extension and estimation variance, calculation of estimation variance, the nugget effect and estimation variance, examples, auxiliary functions.
Correlated Random Theory – 3: Kriging: Kriging and optimal valuation, kriging equations in general cases.

Module - 5

The Integrated Geological – Geostatistical System: Statistical analysis, comparative statistical analysis, geostatistical structural analysis, trend analysis, point kriging cross validation, block kriging, mineral inventory, grade – tonnage relations, examples to assess ore and metal recoveries.
Example to calculate planning cut-off grade. Optimization of drilling programme. Misclassified tonnages – actual Vs estimated. Grade control.

TEXT BOOKS:

1. An Introduction to Applied Geostatistics, Issaks and Srivastava, Oxford, IBH, 1990.
2. Mining Geostatistics, Jurnel, A.G. and Huigbregts, Ch. J., John Wiley and Sons, 1978.

REFERENCE BOOKS

1. An Introduction to Geostatistical Methods of Mineral Evaluation, Rendu J.M. John Wiley and Sons, 1981.
2. geostatistical Ore Reserve Estimation, Dravid, Michel, Mc. Graw Hill, 1977.

Professional Elective-V

DIMENSIONAL STONE MINING

B.E, VIII Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN832	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40(08 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Module - 1

Introduction: Definition, historical use of natural stones. Geology and occurrences: Classification of dimensional stones, composition, chemical and geo-chemical properties, various standards for normalization of dimensional stones.

Module - 2

Mining of dimensional stones: Various techniques of dimensional stone mining – block mining and slab mining; Manual mining; Mechanized mining – line drilling, in-situ sawing by wire saw, chain saw, portable circular saw, flame cutting.

Cutting / Sawing tools: Tool carrier – circular steel blade, steel wire rope, chain jib saw, physical and mechanical properties, elastic properties, tension etc.; Cutting tools – diamond segments, diamond pearls / bits, tungsten bits etc.; Process of manufacture, ingredients, brazing / fitting, wearing pattern and control; Cost of cutting.

Module - 3

Handling of blocks and slabs: Equipment used - derrick crane, front loaders, fork-lifts, mobile cranes, trucks and trailers.

Quarrying machines for dimensional stones: Portable circular saw, wire saw, chain saw, line drills – special design features of the machines, their use and maintenance.

Production monitoring: Recovery, waste generation, productivity, inherent defects, measurement and corrective actions, cost evaluation.

Module - 4

Environmental issues: Management of solid waste, slurry waste, soil land and water; Protection and rehabilitation.

Health, safety and welfare: Protective care from abrasive dust, personal safety and welfare.

Module - 5

Application, processing and architecture in dimensional stone: Application – flooring, roofing, cladding, stairs, paving, facets; Processing and polishing – various techniques for sawing of blocks, shaping of edges, polishing and calibration; Fixing and installation – techniques of fixing of dimensional stones in various applications like flooring, cladding, faceds, stairs, roofing and paving; Care and maintenance of dimensional stones – techniques for post fixing care and maintenance of dimensional stones in various applications.

TEXT BOOKS:

1. Rathore S. S., Bhardwaj G. S., Jain S. C; “Dimensional Stone Technology” Himanshu Publication New Delhi.

2. Rathore S. S., Gupta Y. C., Parmar R. L.; “Recent Development in Machinery and Equipment for Dimensional Stone Mining” held Dec. 13-14, 2003 at Udaipur.

REFERENCE BOOKS

1. Rathore S. S., Laxminarayana V.; “Safety and Technology in Marble Mining and Processing in New Millennium” Proc. of National Workshop held march 10-11 200 Udaipur.
2. India Stones, Business Magazine on Indian Stone Industry, Pub. ICONZ Communications, 203, Mahaveer Residency, 15 Main J. P. Nagar, 5th phase, Bangalore.

Professional Elective-V
COAL BED METHANE

B.E, VIII Semester, Mining Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN833	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40(08 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Course objectives:

This course will enable students to:

1. To understand the philosophy of coal bed methane production
2. To interpret coal specific tests such as sorption tests, sorption isotherms and well tests
3. To evaluate coal bed methane exploration and development opportunities
4. To compute gas in the reservoirs and estimate ultimate recovery

MODULE- 1: Introduction:

Overview of- coal bed methane (CBM) in India — CBM vs conventional reservoirs. Geological influences on coat formation of coals-Coal chemistry-Significance of rank-Cleat system and natural fracture.
Sorption: Principles of Adsorption-The Isotherm construction-CH_4 retention by coal seams-CH_4 content determination in coal seams-The isotherm for recovery prediction model of the micro-pores-coal sorption of other molecular species.

MODULE- 2: Reservoir Analysis

Coal as a reservoir-Permeability-Porosity-Gas flow-Reserve analysis-Well spacing and drainage area-Enhanced recovery. Well Construction: Drilling-Cementing. Completions: Open hole completions-Open hole cavitation process, Cased hole completions- Multi zone entry in cased hole.

MODULE- 3: Formation Evaluations, Logging

Borehole environment-Tool measurement response in coal-wire line log evaluation of CBM wells-Gas-In-Place calculations-Recovery factor-Drainage area calculations-Coal permeability/ Cleating-Natural fracturing and stress orientation-Mechanical rock properties in CBM evaluation.

MODULE- 4: Hydraulic fracturing of coal seams

Need for fracturing coals-Unique problems in fracturing coals-Types of fracturing fluids for coal-In situ conditions-Visual observation of fractures.

MODULE- 5: Water production and disposal

Water production rates from methane wells-Chemical content-Environmental regulations-Water disposal techniques-Economics of coal bed methane recovery.

Course outcomes:

At the end of the course students will be able to:

1. The student would be in a position to have knowledge of interpreting various techniques involved in enhancing the recovery of coal bed methane.
TEXT BOOKS: 1. Coal Bed Methane: Principles and Practice, R. E. Roger, 3rd Edition, Prentice Hall, 1991. 2. Coal Bed Methane-Robert A. Lamarre, American Association of Petroleum Geologists, 2008.
REFERENCE BOOKS 1. Fundamentals of Coal Bed Methane reservoir Engineering, John Seidle, Pennwell Corp., 2011. 2. Coal Bed Methane, Society of Petroleum, 1992. 3. A Guide to coal bed methane operations, B. A. Hollub. Society of petroleum 1992

Professional Elective-V

ENVIRONMENTAL IMPACTS OF MINING

B.E, VIII Semester, Mining Engineering

[As per Choice Based Credit System (CBCS) scheme]

Course Code	17MN834	**CIE Marks**	**40**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**60**
Total Number of Lecture Hours	**40(08 Hours per Module)**	**Exam Hours**	**03**

Credits – 03

Course objectives:

This course will enable students to:

1. To describe various environmental pollutions due to Mining industry and its monitoring and prevention measures
2. To explain the environmental pollutions controlling measures.
3. To prepare EIA and EMP

Module - 1

Introduction: Sustainable development, environmental carrying capacity - concepts & principles; Environmental impacts of mining and associated activities.

Ecology: Introduction to ecology, ecosystem structures and functions.

Module - 2

Air pollution: Atmospheric composition and meteorology; Sources of air pollution – point and non-point; Emission factors; Control measures – extraction, suppression and consolidation of dust.

Module - 3

Water pollution: Global hydrological cycle; Self-purification mechanism, sources of water pollution, important parameters–pH, turbidity, oil & grease, nitrates, DO, BOD, COD; Eutrophication, deoxygenating, acid mine drainage and heavy metal pollution– preventive and control measures.

Module - 4

Noise Pollution: Problems of noise, noise sources and levels, remedial measures; Ground vibration: Nature of ground vibration from blasting, measurement & recording, prediction of ground vibration levels, effects of ground vibrations.

Module - 5

Land environment: Land degradation due to mining; Physical and biological reclamation.

Environmental administration: Laws related to mining environment; EIA of mining projects.

Land Acquisition & Revenue: Concepts; Related laws and regulations. **Corporate Social Responsibility:** Concepts and principles.

Course outcomes:

At the end of the course students will be able to:

1. Ability to describe various environmental pollutions due to Mining industry and its monitoring and prevention measures.

2. Ability to explain the environmental pollutions controlling measures.
3. Ability to prepare EIA and EMP.

TEXT BOOKS:

1. Environmental Impact of Mining, C.G. Down Ph.D. and J. Stock, Second Edition Applied Science Publishers Ltd. London, 1980.
2. Environmental management of Mining Operations, B.B. Dhar, Ashish Publishing House, New Delhi, 1986.

REFERENCE BOOKS

1. Surface Mining Environment and Reclamation A. Hussain Samya, Standard Publishers, 1998. Mine Environment and Management (An Indian Scenario), A.B.Choudhury, Ashish Publishing House, New Delhi, 1992.
2. Environmental Pollution Control Engineering, C.S. Rao, Wiley Eastern Ltd. 1992.
3. Environmental Challenges C.K. Varshney D.R. Srdesai, Wiley Eastern Ltd. 1993.
4. Environmental Issues in Mineral Resources Development K.L. Rai, Gyan Publishing House, 1993.
5. The Impact of Mining on the Environment, Problems and Solutions, Oxford and IBH, New Delhi, 1994.
6. Water Pollution, Causes, effects and Control, P.K. Goel, New Age International Publishers, 1997.