

## ENGINEERING MATHEMATICS – III

**CODE: 10 MAT 31**  
**Hrs/Week: 04**  
**Total Hrs: 52**  
**Marks:100**

**IA Marks: 25**  
**Exam Hrs: 03**  
**Exam**

### **PART-A**

#### **Unit-I: FOURIER SERIES**

Convergence and divergence of infinite series of positive terms, definition and illustrative examples\*

Periodic functions, Dirichlet's conditions, Fourier series of periodic functions of period  $2\pi$  and arbitrary period, half range Fourier series. Complex form of Fourier Series. Practical harmonic analysis. [7 hours]

#### **Unit-II: FOURIER TRANSFORMS**

Infinite Fourier transform, Fourier Sine and Cosine transforms, properties, Inverse transforms [6 hours]

#### **Unit-III: APPLICATIONS OF PDE**

Various possible solutions of one dimensional wave and heat equations, two dimensional Laplace's equation by the method of separation of variables, Solution of all these equations with specified boundary conditions. D'Alembert's solution of one dimensional wave equation. [6 hours]

#### **Unit-IV: CURVE FITTING AND OPTIMIZATION**

Curve fitting by the method of least squares- Fitting of curves of the form  $y = ax+b$ ,  $y = ax^2 + bx + c$ ,  $y = ae^{bx}$ ,  $y = ax^b$

Optimization: Linear programming, mathematical formulation of linear programming problem (LPP), Graphical method and simplex method.

[7 hours]

## **PART-B**

### **Unit-V: NUMERICAL METHODS - 1**

Numerical Solution of algebraic and transcendental equations: Regula-falsi method, Newton - Raphson method. Iterative methods of solution of a system of equations: Gauss-seidel and Relaxation methods. Largest eigen value and the corresponding eigen vector by Rayleigh's power method.

[6 hours]

### **Unit-VI: NUMERICAL METHODS – 2**

Finite differences: Forward and backward differences, Newton's forward and backward interpolation formulae. Divided differences - Newton's divided difference formula, Lagrange's interpolation formula and inverse interpolation formula.

Numerical integration: Simpson's one-third, three-eighth and Weddle's rules (All formulae/rules without proof)

[7 hours]

### **Unit-VII: NUMERICAL METHODS – 3**

Numerical solutions of PDE – finite difference approximation to derivatives, Numerical solution of two dimensional Laplace's equation, one dimensional heat and wave equations

[7 hours]

## **Unit-VIII: DIFFERENCE EQUATIONS AND Z-TRANSFORMS**

Difference equations: Basic definition; Z-transforms – definition, standard Z-transforms, damping rule, shifting rule, initial value and final value theorems. Inverse Z-transform. Application of Z-transforms to solve difference equations.

[6 hours]

**Note: \* In the case of illustrative examples, questions are not to be set.**

### **Text Books:**

1. B.S. Grewal, Higher Engineering Mathematics, Latest edition, Khanna Publishers
2. Erwin Kreyszig, Advanced Engineering Mathematics, Latest edition, Wiley Publications.

### **Reference Book:**

1. B.V. Ramana, Higher Engineering Mathematics, Latest edition, Tata Mc. Graw Hill Publications.
2. Peter V. O'Neil, Engineering Mathematics, CENGAGE Learning India Pvt Ltd. Publishers

## **MINING ELECTRICAL ENGINEERING**

<b>Sub Code</b>	<b>: 10 MN 32</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hrs/week</b>	<b>: 04</b>	<b>Exam Hours</b>	<b>: 03</b>
<b>Total Hrs.</b>	<b>: 52</b>	<b>Exam Marks</b>	<b>: 100</b>

### **PART-A**

**UNIT 1:**

**Introduction:** Scope and importance of electrical engineering in mining, Role of electrical engineer in mining. Indian Electricity Rules Applicable to Mining.

**6 Hours**

**UNIT 2:**

**Introduction to Electric Drives:** Electrical drives, advantages of electric drives, parts of electrical drives, choice of electrical drives, status of DC and AC drives.

**6 Hours**

**UNIT 3:**

**Industrial Applications:** Precautions, Electric winder, Types of electric drivers for mine hoists, DC hoist drives, AC hoist drives, Shearer and Conveyors in longwall mining method, Auxiliary motors, Methods of Fan drives – toothed gearing, belt drive, rope drive.

**7 Hours**

**UNIT 4:**

**Starting and Braking of Motors:** Introduction to motor starting, DC motor starters, starting of polyphase induction motors, electric braking of DC motors and AC motors.

**7 Hours**

**PART-B**

**UNIT 5:**

**Speed Control of Motors:** The methods of speed control, speed control of DC shunt motors, ward Leonard Control, Dynamics of induction motor starting, load equalization, speed control of squirrel cage induction motors, speed control of slip-ring induction motors.

**7 Hours**

**UNIT 6:**

**Protective Devices:** Air break switches, Air circuit breakers, oil circuit breakers. Principles of underground signaling. Types of motor enclosures in mines.

**6 Hours**

**UNIT 7:**

**Typical Power Equipment in Mines:** Power distribution in mines, Surface and Underground power distribution in mines, Main Lighting equipment, Surface auxiliaries, Underground Cables, Underground plant, Flameproof apparatus, Intrinsically safe apparatus.

**7 Hours**

**UNIT 8:**

**Mine Illumination:** General lighting in mines, lighting in opencast mines, standards for mine lighting, Illumination measurements: luminance measurements, reflectance measurements. Design of lighting system in mines.

**6 Hours**

**TEXT BOOKS:**

1. **“Electric Motors: Applications and Control.”** Chapter 3 & 4, M.V. Deshpande, Wheeler Edition, 1990.
2. **“Elements of Mining Technology, vol. II,”** Chapter 8, vidyasewa Prakasham, Nagpur. 8<sup>th</sup> edition 1995.

**REFERENCE BOOKS:**

1. **“Environmental Engineering in Mines”** V.S. Vutukuri & R.D. Lama, Chapter 13.3, Cambridge University Press, 1986.
2. **“Fundamentals of Electrical Drives,”** G.K. Dubey, Narosa Publishing House, 1995.
3. **“Universal Mining School Reports”,** Cardiff, Mining publication London, 1<sup>st</sup> Ed., 1977.
4. **“The Indian Electricity Rules 1984”,** Chapter X.

**Scheme of Exam:** One question to be set from each chapter. Students have to answer any **FIVE** full questions out of **EIGHT** questions. Choosing at least **TWO** questions from **PART- A** and two questions from **PART- B**.

## MINING GEOLOGY –1

<b>Sub Code</b>	<b>: 10 MN 33</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hrs/week</b>	<b>: 04</b>	<b>Exam Hours</b>	<b>: 03</b>
<b>Total Hrs.</b>	<b>: 52</b>	<b>Exam Marks</b>	<b>: 100</b>

### PART-A

#### UNIT 1:

**Physical Geology:** Geology and its role in Mining, Earth as a planet-internal structure and composition of the earth. Geological work of atmosphere, rivers, lakes, glaciers, sea and ground water, influences of these process on mining and engineering. Earthquakes and seismic hazards and their relation with volcanoes. Engineering protection against earth quakes.

**7 Hours**

#### UNIT 2:

**Mineralogy:** Physical properties of minerals, study of minerals and their chemical composition, occurrence and uses of Quartz and its varieties, Felspar, carbonates mica, garnet, olivine, Pyroxenes and amphiboles.

**7 Hours**

**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.

**6 Hours**

#### UNIT 3:

**Study of Textural, Structural and Mineralogical characters of the following rocks:** Igneous Rocks: Granite, diorite, gabbro, dunite, pegmatite, porphyries, dolerite, basalt, Rhyolite, Obsidian and Pumice.

- a. Sedimentary Rocks: Conglomerate, Breccia, Sandstone, Limestone & Shale.
- b. Metamorphic Rocks: Gneiss, Schist, Quartzite Marble & Slate.

**6 Hours**

## **PART-B**

### **UNIT 4:**

**Principles of Stratigraphy:** Geological Time Scale, Correlation, Catastropism, Geological Clock, Law of order of superposition, Uniformitarianism, fossil and their uses.

**6 Hours**

### **UNIT 5:**

**Stratigraphy of India:** Physiogeographic divisions of India with special reference to Dharwar, Cuddapah, vindhyans, gondwanas and tertiary system with their economic importance.

**7 Hours**

### **UNIT 6:**

**Introduction to Structural Geology:** Primary & Secondary Structure, Dip& strike, True Dip& Apparent Dip, Compass clinometers.

**6 Hours**

### **UNIT 7:**

**Structural Geology:** Structural features of rocks, interpretation of topographic maps. Classification of folds, faults, joints and unconformities, their recognition in the field and importance in mining operations.

**7 Hours**

### **TEXT BOOKS:**

1. **“Engineering and General Geology,”** Parbin Singh. Katson publisher, Ludhiana, 1<sup>st</sup> 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.

**SCHEME OF EXAM:** One question to be set from each chapter. Students have to answer any **FIVE** full questions out of **EIGHT** questions. Choosing at least **TWO** questions from **PART- A** and two questions from **PART- B**.

**MECHANICS OF MATERIALS**  
(Common to ME/IP/IM/AU/MA/MN/AE)

<b>Sub Code</b>	<b>: 10 ME 34</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hrs/week</b>	<b>: 04</b>	<b>Exam Hours</b>	<b>: 03</b>
<b>Total Hrs.</b>	<b>: 52</b>	<b>Exam Marks</b>	<b>: 100</b>

**PART – A**

**UNIT 1:**

**Simple stress and strain:** Introduction, stress, strain, mechanical properties of materials, Linear elasticity, Hooke’s Law and Poisson’s ratio, Stress-Strain relation – behaviour in Tension for Mild steel and non ferrous metals. Extension / Shortening of a bar, bars with cross sections varying in steps, bars with continuously varying cross sections (circular and rectangular), Elongation due to self weight, Principle of super position.

**7 Hours**

**UNIT 2:**

**Stress in composite section:** Volumetric strain, expression for volumetric strain, elastic constants, simple shear stress, shear strain, temperature stresses (including compound bars).

**6 Hours**

**UNIT 3:**

**Compound stresses:** Introduction, plane stress, stresses on inclined sections, principal stresses and maximum shear stresses, Mohr’s circle for plane stress.

**7 Hours**

**UNIT 4:**



**Thick and thin cylinders:** Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume), Thick cylinders subjected to internal and external pressures (Lame's equation), (compound cylinders not included).

**6 Hours**

**PART – B**

**UNIT 5:**

**Bending moment and Shear force in beams:** Introduction, Types of beams, loads and reactions, shear forces and bending moments, rate of loading, sign conventions, relationship between shear force and bending moments, shear force and bending moment diagrams for different beams subjected to concentrated loads, uniform distributed load (udl) and couple for different types of beams.

**7 Hours**

**UNIT 6:**

**Bending and shear stresses in beams:** Introduction, theory of simple bending, assumptions in simple bending, relationship between bending stresses and radius of curvature, relationship between bending moment and radius of curvature, moment carrying capacity of a section, shearing stresses in beams, shear stress across rectangular, circular, symmetrical I and T sections (composite / fletched beams not included).

**7 Hours**

**UNIT 7:**

**Deflection of beams:** Introduction, differential equation for deflection, equations for deflections, slope and moments, double integration method for cantilever and simply supported beams for point load, UDL, UVL and Couple, Macaulay's method.

**6 Hours**

**UNIT 8:**

**Torsion of circular shafts and Elastic stability of columns :** Introduction, pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts, power transmitted by solid and hollow circular shafts. Introduction to 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.

**6 Hours**

**Text books:**

1. **“Mechanics of Materials”** by R.C.Hibbeler, Printice Hall, Pearson Edu., 2005
2. **“Mechanics of materials”**, James.M.Gere, Thomson, Fifth edition 2004
3. **“Mechanics of materials”**, S.I. Units, Ferdinand Beer & Russell Johnstan, TATA Mac GrawHill-2003.

**Reference books:**

1. **“Strength of Materials”**, S.S.Bhavikatti, Vikas publications House – Pvt. Ltd., 2<sup>nd</sup> 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, 2<sup>nd</sup>, 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.

**Scheme of examination:**

One Question to be set from each chapter. Students have to answer any FIVE full questions out of EIGHT questions, choosing at least 2 questions from part A and 2 questions from part B.

## MINE CONSTRUCTION AND DEVELOPMENT

Sub Code	: 10 MN 35	IA Marks	: 25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

### PART-A

#### UNIT 1:

**Introduction of Mining Engineering:** Significance to Mining industry in national economy and infrastructure building, Basic mining terminologies, sequence in opening up a deposit, prospecting and geo-technical investigations. Selection criteria for underground or open cast mining methods. Classification of mining methods.

**6 Hours**

#### UNIT 2:

**Opening up of Deposits:** Types, size and location of entries into underground coal and other minerals. Introduction to surface mining methods. Box cut and formations of benches in mines.

**6 Hours**

#### UNIT 3:

**Shaft Sinking operations:** Preliminary geo-technical investigations for a shaft sinking project. Surface arrangements for sinking shafts, tools and equipment. Unit operations of drilling, blasting, mucking, defuming, temporary and permanent lining. Construction of insets and shaft stations.

**7 Hours**

#### UNIT 4:

**Special & Mechanized Methods of Shaft Sinking:** Methods of sinking shaft in water – logged, pressurized strata in loose and running soils. Mechanized Sinking, multi-deck Platforms, and Shaft borers, Blind Shaft Boring & Pilot Shaft Boring. Drop Raise Method.

**7 Hours**

## PART-B

### **UNIT 5:**

**Widening and Deepening of Existing Shafts:** Need for widening and deepening operating shafts. Different methods for widening and deepening shafts – cycles of operations, equipment needed.

**6 Hours**

### **UNIT 6:**

**Development of Workings:** Drivage of cross cuts, drifts, inclines and raises by conventional and mechanized methods. Ventilation, supporting, lighting and transporting arrangements.

**7 Hours**

### **UNIT 7:**

**Mine Supports:** Need for support excavations. Types of support: timbers, stone, concrete, steel and hydraulic supports. Yielding and rigid supports. Fore poling, roof stitching, roof bolting. Supports for roadways, faces and junctions.

**7 Hours**

### **UNIT 8:**

**Tunneling Methods:** Conventional and mechanized methods of tunneling. Tunnel boring machines and shield tunneling.

**6 Hours**

### TEXT BOOKS:

1. **“Elements of Mining Technology, Vol. I,”** D.J. Deshmukh, Vidyasewa prakashan, Nagpur. 7<sup>th</sup> Ed. 1996.
2. **“Introductory Mining Engineering,”** Hartman H.L., John Wiley Sons. 1<sup>st</sup> Ed. 2004.

### 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.

**SCHEME OF EXAM:** One question to be set from each chapter. Students have to answer any **FIVE** full questions out of **EIGHT** questions. Choosing at least **TWO** questions from **PART- A** and two questions from **PART- B**.

### COMPUTER AIDED MACHINE DRAWING

<b>Sub Code</b>	<b>: 10 MN 36</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hrs/week</b>	<b>: 04</b>	<b>Exam Hours</b>	<b>: 03</b>
<b>Total Hrs.</b>	<b>: 52</b>	<b>Exam Marks</b>	<b>: 100</b>

#### PART – A

**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.

**2 Hours**

**UNIT 1:**

**Orthographic views:** Conversion of pictorial views into orthographic projections of simple **machine parts** with section. (Bureau of Indian Standards convention to be followed for the drawings) Hidden line conventions. Precedence of lines.

**4 Hours**

**UNIT 2:**

**Thread forms:** Thread terminology, sectional views of threads. ISO Metric (Internal & External) BSW (Internal & External) square and Acme. Sellers thread, American Standard thread. Etc. **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 screw.

**6 Hours**

**UNIT 3:**

**Keys & Joints:**

Parallel, Taper, Feather key, Gibhead key, Woodruff key

**Riveted Joints:** single and double riveted lap joint, butt joint (Chain and Zigzag. using snap head rivet) cotter joints, knuckle joint (pin joint) for two rods.

**5 Hours**

**UNIT 4:**

**Couplings:**

Protected type flange coupling, pin type flexible coupling, and universal coupling, Oldham's coupling, Muff coupling. Etc.

**5 Hours**

**PART – B**

Assembly Drawings

**(Part drawings should be given)**

Drawing formats, title block, revision block, tolerance block, release block, BOM, (Bill of Materials) drawing details, and drawing notes.

1. Screw jack (Bottle type)
2. Tailstock of lathe
3. Steam stop valve
4. Machine vice
  
5. Petrol Engine piston
6. I.C. Engine connecting rod
7. Fuel Injector
8. Plummer block (Pedestal Bearing)
9. Feed check Valve
10. Tool Head of shaper
11. Rams bottom safety valve

**30 Hours**

**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 Book:**

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, 1<sup>st</sup> Indian print Pearson Education, 2005.

3. “Auto CAD 2006, for engineers and designers” Sham Tickoo. Dream tech 2005.

**Note:**

**Internal assessment: 25 Marks**

All the sheets should be drawn in the class using software. Sheet size should be A3 size. All sheets must be submitted at the end of the class by taking a printout. The students shall score minimum of 60% marks in Internal Assessment to be eligible for taking the final examination.

**Scheme of Examination:**

1. From part A four questions to be set i.e. One question from each Unit 1, 2, 3 & 4. Student has to answer any TWO questions from PART – A. 20 marks for each questions i.e. 2x20=40
2. From Part B 2 Questions to be set from 11 Assemblies students has to answer any ONE Question For 60 Marks.

i.e.	<b>PART-A 2x20= 40 Marks</b>
	<b>PART-B 1x60= 60 Marks</b>
	<b><u>Total</u> =100 Marks</b>

**MINING GEOLOGY LABORATORY – I**

<b>Sub Code</b>	<b>: 10 MNL 37</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hrs/week</b>	<b>: 03</b>	<b>Exam Hours</b>	<b>: 03</b>
<b>Total Hrs.</b>	<b>: 42</b>	<b>Exam Marks</b>	<b>: 50</b>

**PART A**

I. Megascopic study of minerals: Physical properties chemical composition, mode of occurrence, Distribution, identification and uses with reference to mining importance.

**Experiment No.                      Experiment Name**

1. Quartz group of minerals
2. Feldspar group of minerals
3. Mica Group of Minerals
4. Carbonates – Calcite group and magnesite group of minerals
5. Ferro magnesium minerals

II. Megascopic study of rocks: Mineral composition, texture, petrogenesis, Engineering properties, distribution and uses,

<b>Experiment No.</b>	<b>Experiment Name</b>
6.	Igneous rocks
7.	Sedimentary rocks
8.	Metamorphic Rocks

### **PART B**

III. Study of important structures of Igneous, Sedimentary and Metamorphic rocks.

IV. Geological Maps: Interpretation of topographic, geological and structural maps & tracing of outcrop maps.

<b>Experiment No.</b>	<b>Experiment Name</b>
9.	Interpretation & description of topographic maps
10.	Interpretation & description of Geological maps
11.	Interpretation & description of structural geological maps – Dipping strata
12.	Interpretation & description of structural geological maps – Folded strata
13.	Interpretation & description of structural geological maps –Faulted strata
14.	Interpretation & description of structural geological maps – Unconformities
15.	Tracing of out crop maps.

**Part A:- Any one question 20 marks**

**Part B:- Any one question 20 marks**

**Viva question:- 10 marks**



## MINING ELECTRICAL ENGINEERING LABORATORY

<b>Sub Code</b>	<b>: 10 MNL 38</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hrs/week</b>	<b>: 03</b>	<b>Exam Hours</b>	<b>: 03</b>
<b>Total Hrs.</b>	<b>: 42</b>	<b>Exam Marks</b>	<b>: 50</b>

### 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 shunt motor

### PART B

6. Load test on 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

**Part A: - Any one question 20 marks**

**Part B: - Any one question 20 marks**

**Viva question: - 10 marks**

## ENGINEERING MATHEMATICS – IV

**CODE: 10 MAT 41**  
**Hrs/Week: 04**  
**Total Hrs: 52**  
**Marks:100**

**IA Marks: 25**  
**Exam Hrs: 03**  
**Exam**

### **PART-A**

#### **Unit-I: NUMERICAL METHODS - 1**

Numerical solution of ordinary differential equations of first order and first degree; Picard's method, Taylor's series method, modified Euler's method, Runge-kutta method of fourth-order. Milne's and Adams - Bashforth predictor and corrector methods (No derivations of formulae).

**[6 hours]**

#### **Unit-II: NUMERICAL METHODS – 2**

Numerical solution of simultaneous first order ordinary differential equations: Picard's method, Runge-Kutta method of fourth-order.

Numerical solution of second order ordinary differential equations: Picard's method, Runge-Kutta method and Milne's method.

**[6 hours]**

#### **Unit-III: Complex variables – 1**

Function of a complex variable, Analytic functions-Cauchy-Riemann equations in cartesian and polar forms. Properties of analytic functions.

Application to flow problems- complex potential, velocity potential, equipotential lines, stream functions, stream lines.

**[7 hours]**

#### **Unit-IV: Complex variables – 2**

Conformal Transformations: Bilinear Transformations.  
Discussion of Transformations:  
 $w = z^2$ ,  $w = e^z$ ,  $w = z + (a^2 / z)$ . Complex line integrals-  
Cauchy's theorem and Cauchy's integral formula.

[7 hours]

### **PART-B**

#### **Unit-V: SPECIAL FUNCTIONS**

Solution of Laplace equation in cylindrical and spherical systems leading Bessel's and Legendre's differential equations, Series solution of Bessel's differential equation leading to Bessel function of first kind. Orthogonal property of Bessel functions. Series solution of Legendre's differential equation leading to Legendre polynomials, Rodrigue's formula.

[7 hours]

#### **Unit-VI: PROBABILITY THEORY - 1**

Probability of an event, empirical and axiomatic definition, probability associated with set theory, addition law, conditional probability, multiplication law, Baye's theorem.

[6 hours]

#### **Unit-VII: PROBABILITY THEORY- 2**

Random variables (discrete and continuous), probability density function, cumulative density function. Probability distributions – Binomial and Poisson distributions; Exponential and normal distributions.

[7 hours]

## **Unit-VIII: SAMPLING THEORY**

Sampling, Sampling distributions, standard error, test of hypothesis for means, confidence limits for means, student's t-distribution. Chi -Square distribution as a test of goodness of fit

**6 hours]**

### **Text Books:**

1. B.S. Grewal, Higher Engineering Mathematics, Latest edition, Khanna Publishers
2. Erwin Kreyszig, Advanced Engineering Mathematics, Latest edition, Wiley Publications.

### **Reference Book:**

1. B.V. Ramana, Higher Engineering Mathematics, Latest edition, Tata Mc. Graw Hill Publications.
2. Peter V. O'Neil, Engineering Mathematics, CENGAGE Learning India Pvt Ltd.Publishers

## **THERMODYNAMICS AND FLUID MECHANICS**

<b>Sub Code</b>	<b>: 10 MN 42</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hrs/week</b>	<b>: 04</b>	<b>Exam Hours</b>	<b>: 03</b>
<b>Total Hrs.</b>	<b>: 52</b>	<b>Exam Marks</b>	<b>: 100</b>

### **PART-A**

#### **UNIT 1:**

**Basic concepts of thermo dynamics:** Thermo dynamic system, classification of Thermo dynamic system. Thermodynamic property-extensive and intensive properties. thermodynamic state, thermodynamic process. Reversible, irreversible process, Quasi-static process. Thermodynamic equilibrium, zeroth law of thermodynamics.

**6 Hours**

**UNIT 2:**

**Energy and I and II Laws 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. I and II Laws of thermodynamics : Statements, Cycles processes , Problems.

**7 Hours**

**UNIT 3:**

**Air Compressors:** single stage and multistage reciprocating air compressors. Expression for work done during single stage air compression with and without clearance volume. Volumetric efficiency. Simple problems on single stage compressors.

**7 Hours**

**UNIT 4:**

**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.

**6 Hours**

**PART-B**

**UNIT 5:**

**Pressure and it's Measurements for Liquids:** pressure, atmospheric pressure, gauge and absolute pressure, measurement of pressure, piezometer tube, double column u-tube manometer, differential and inverted U-tube measurements, Bourdon's pressure gauge and diaphragm pressure gauge and dead weight pressure gauge.

**7 Hours**

**UNIT 6:**

**Dynamics of Fluid Flow:** Bernolli's theorem for liquids, Assumptions, Hydraulic gradient line and total energy line.

**6 Hours**

**UNIT 7:**

**Flow through pipes:** Loss of head due to friction in pipes. Discharge measurements in pipes. Venturimeter, Orifice meter. Flow through orifices and notches.

**6 Hours**

**UNIT 8:**

**Centrifugal and Reciprocating pumps:** working principle of single stage centrifugal pump and single acting and double acting reciprocating pumps. Vane pumps and submersible pumps.

**TEXT BOOKS:**

1. **“Engineering thermodynamics”**, Nag P.K., , Tata McGraw Hill publications. 2<sup>nd</sup> Ed. 2002
2. **“A Text Book of Fluid Mechanics and Hydraulic Machines,”**, Bansal. Laxmi publications. 2006

**REFERENCE BOOKS:**

1. **“Fundamentals of Classical Thermodynamics”**, Van wylen Gordon et. 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.

**SCHEME OF EXAM:** One question to be set from each chapter. Students have to answer any **FIVE** full questions out of **EIGHT** questions. Choosing at least **TWO** questions from **PART- A** and two questions from **PART- B**.

**MINING GEOLOGY – II**

<b>Sub Code</b>	<b>: 10 MN 43</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hrs/week</b>	<b>: 04</b>	<b>Exam Hours</b>	<b>: 03</b>
<b>Total Hrs.</b>	<b>: 52</b>	<b>Exam Marks</b>	<b>: 100</b>

**PART-A****UNIT 1:**

**Geology in Mining Industry:** Pure/Applied/ Mining Geology, Geology in Mining – Delineation of deposits, Limits of Economic Mining, Role of Mine Geologist, Geological Work in Operating Mine.

**6 Hours****UNIT 2:**

**Economic Geology:** Scope of economic geology, classification of mineral deposits – ore mineral, gangue minerals and tenor of ore.

**6 Hours**

**UNIT 3:**

Study of Various processes of formation of mineral deposits- Magmatic, Hydrothermal, weathering, Sedimentation, evaporation, Oxidation and Supergene enrichment and metamorphic deposits.

**7 Hours**

**UNIT 4:**

**Distribution of Minerals with reference to Origin, Occurrence and Uses:** Iron, Copper, Lead & Zinc, Chromite, Manganese, Beach sand, Diamond & uranium, Refractory minerals, ceramic minerals and building stones.

**7 Hours**

**PART-B**

**UNIT 5:**

**Mineral Fuel (Coal):** Coal, physical and chemical characteristics, variation and rank. Important constituents of coal, origin of coal, structural features of coal seams, Chief characteristics of Indian coals. Important Coal fields of India.

**6 Hours**

**UNIT 6:**

**Petroleum & Natural Gas:** Origin, composition, accumulation, structural features, migration of petroleum and Natural Gas, Major oil fields of India.

**6 Hours**

**UNIT 7:**

**Exploration Geology:** Principles of mineral exploration, stages of mineral Exploration. Geological, Geophysical and geo-chemical methods of mineral exploration. Remote sensing techniques for prospecting and exploration of mineral deposits. Factors involved in planning and drilling in detail exploration. Core Drilling and Core recovery.

**7 Hours**

**UNIT 8:**

**Mining Geology:** Methods of sampling, assaying and estimation of ore reserves. Guides for location of ore deposits with particular reference to structural and stratigraphical guides. Field techniques equipment, Methods of surface, sub-surface mapping, Interpretation and use of field data.

**7 Hours**

**TEXT BOOKS:**

1. **“Economic Mineral Deposits,”** Bateman A.M John Wiley and sons, 2<sup>nd</sup> Ed. 1999.
2. **“Mining Geology “,** Mckinistry, , Asia Publication. 2<sup>nd</sup> Ed. 2005.

**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.3<sup>rd</sup> Ed. 1999

**SCHEME OF EXAM:** One question to be set from each chapter. Students have to answer any **FIVE** full questions out of **EIGHT** questions. Choosing at least **TWO** questions from **PART- A** and two questions from **PART- B**.

**MINING MACHINERY-I**

<b>Sub Code</b>	<b>: 10 MN 44</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hrs/week</b>	<b>: 04</b>	<b>Exam Hours</b>	<b>: 03</b>
<b>Total Hrs.</b>	<b>: 52</b>	<b>Exam Marks</b>	<b>: 100</b>

**PART-A**

**UNIT 1:**

**Transmission of Power:** Relative merits and field of application of power generation by steam, by electricity, compressed air, oil and gas with special mention to distribution and utilization. Track laying and maintenance.

**6 Hours**

**UNIT 2:**

**Compressed Air:** Sources of power for compressors, Transmission and distribution of compressed air in mines, Compressed air drills, Equipments using compressed air. Safety appliances.



**6 Hours**

**UNIT 3:**

**Mine Transportation:** Elements of Mine transport system and classification, Techno economic indices of Mine transport system, Rope haulage: Different types—direct, endless, main & tail, gravity, Limitations, applications merits & demerits of different haulages, haulage calculation,

**7 Hours**

**UNIT 4:**

**Ropes:** Types and details of construction of different types of ropes and their respective uses in mines. Care and storage of ropes, Rope splicing and socketing, Safety factor for ropes used in winding.

**7 Hours**

**PART-B**

**UNIT 5:**

**Locomotives:** Types-Diesel, Electric battery, Electric, Trolley wire, compressed air and steam locomotive, its limitations and their applications.

**6 Hours**

**UNIT 6:**

**Conveyors:** Types of conveyors-belt, 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.

**7 Hours**

**UNIT 7:**

**Winding:** Elements of winding system and Compressed air winders, Types of winding drums, Method of balancing the loads, Duty cycle, Mechanical, Electrical, manual and automatic breaking system of winders, Koepe winding and Multirope winding.

**7 Hours**

**UNIT 8:**

**Study of Layouts:** Study of respective layouts for all the systems of transportation. Study of pit top and pit bottom layouts, Maintenance Management of Mining Machinery. Skip and cage winding. Winding from different levels in a shaft. Winding calculations.

**6 Hours**

**TEXT BOOKS:**

1. **“Elements of mining technology Vol III”**, D.J.Deshmukh, Vidyasewa prakashan, Nagpur, 7th Ed. 2000.
2. **“Mine Transport”**, Karerlin, Orient Longmans, 1967.

**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 Pumps Haulage and winding,”**, S.Ghatak, Coal field publishers, Asansol, 2001..

**SCHEME OF EXAM:** One question to be set from each chapter. Students have to answer any **FIVE** full questions out of **EIGHT** questions. Choosing at least **TWO** questions from **PART- A** and two questions from **PART- B**.

**MINE SURVEYING – I**

<b>Sub Code</b>	<b>: 10 MN 45</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hrs/week</b>	<b>: 04</b>	<b>Exam Hours</b>	<b>: 03</b>
<b>Total Hrs.</b>	<b>: 52</b>	<b>Exam Marks</b>	<b>: 100</b>

**PART-A**

**UNIT 1:**

**Basic Concepts:** Plane and Geodetic survey, classification survey, conventional Signs, conventional instruments, linear measurements, error in chaining, problems.

**6 Hours**

**UNIT 2:**

**Chaining Surveying:** Principles, instruments, methods, obstacles, offsets, booking and plotting, problems.

**7 Hours**

**UNIT 3:**

**Compass Surveying:** Types of bearing, calculations of angles and bearings, prismatic and surveyor compass (dial), local attraction, estimation, dip and declination, errors, problems

**7 Hours**

**UNIT 4:**

**Plane table survey:** Equipments and accessories, methods, two-point problem and three point problem, errors, strength of fix and Lehman's rule.

**6 Hours**

**PART-B**

**UNIT 5:**

**Leveling:** Principles and definition, types of levels, adjustments, reduction of levels curvature and refraction, sensitivity of bubble, problems.

**7 Hours**

**UNIT 6:**

**Contouring:** Contour, contour interval and characteristics, methods, interpretation, of contours and Uses of contours.

**6 Hours**

**UNIT 7:**

**Theodolite:** Definition and terms, parts, temporary adjustments, Permanent adjustments, horizontal and vertical angles, miscellaneous operations, errors.

**6 Hours**

**UNIT 8:**

**Theodolite Traversing:** Method of traversing, checks, plotting, closing error, balancing, co-ordinate calculation, degree of accuracy, problems.

**7 Hours**

**TEXT BOOKS:**

1. "Surveying Vol I & II" B.C.Punmia, Laxmi publications, 1999.
2. "Mine Surveying Vol I & II" Ghatak, Coal Field Publishers, 1998.

**REFERENCE BOOKS:-**

1. "Surveying Vol I," S.K.Duggal, Tata McGraw Hill Publications, New Delhi, 2000

2. “Elementary Plane and Mine Surveying,” V.Borshch , Kom powets, Bfedarer M .Kolesnikova, Mir publications, Moscow, 1986 .

**SCHEME OF EXAM:** One question to be set from each chapter. Students have to answer any **FIVE** full questions out of **EIGHT** questions. Choosing at least **TWO** questions from **PART- A** and two questions from **PART- B**.

### DRILLING AND BLASTING ENGINEERING

Sub Code	: 10 MN 46	IA Marks	: 25
Hrs/week	: 04	Exam Hours	: 03
Total Hrs.	: 52	Exam Marks	: 100

#### PART-A

##### UNIT 1:

**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.

**6 Hours**

##### UNIT 2:

**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.

**6 Hours**

##### UNIT 3:

**Explosives:** Historical Development, properties of explosives, Low and High explosives, Liquid oxygen explosives (LOX), ANFO, Slurries, Emulsion explosives, Heavy ANFO, permitted Explosives, testing of permitted explosives, Bulk Explosives system-PMS, SMS.

**7 Hours**

##### UNIT 4:

**Firing of Explosives:** Safety fuses, Detonating cord and accessories, Detonators, Exploders. Electric firing and non-electric firing, Electronic Detonators, NONEL blasting.

**7 Hours**

#### PART - B

##### UNIT 5:

**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.

**6 Hours**

**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.

**7 Hours**

**UNIT 6:**

**Mechanics of Blasting:** Factors affecting rock breakage, Crater theory and its applications, theories of rock breakage using explosives. Theory of shaped charge, detonation pressure, Coupling, shock waves impedance, critical diameter etc. calculation of charge and powder factor.

**7 Hours**

**UNIT 7:**

**Effects of Vibration:** Vibrations due to blasting and damage criteria, controlled blasting methods, design of blasting rounds, Air overpressure and Fly Rock. Economics of blasting.

**6 Hours**

**TEXT BOOKS:**

1. **“Explosives and Blasting Practices in Mines,”** S.K. Das, Lovely Prakashan, Dhanbad, 1993.
2. **“Explosives and Blasting Techniques,”** G.K. Pradhan, Minetech Publication, 1996.

**REFERENCE BOOKS:**

1. **“Surface Mining”**, G.B. Mishra,, Chapter 1, Dhanbad Publishers, ,Dhanbad, 1978.
2. **“Rock Fragmentation by Blasting,”** B.Mohanty, Chapter4, A.A. Balkema, Rotterdam, 1996.
3. **“Advances in Drilling and Blasting”** V.R. Sastry, Chapter 1 and 2, Allied Publishers Ltd., 1993.
4. **“Principles of Rock Drilling”** U.M. Rao Karanam and B.Mishra, Chapter 1 and 2 Oxford and IBH, 1998.
5. **“Drilling and Blasting of Rocks”**, Carlopez Jimeno, et. al., Chapter 7, A.A. Balkema, Rotterdam, Brookfields, 1995.

6. **“Engineering Rock Blasting operations”**, Sushil Bhandari, Chapter 3 and 6, , A.A. Balkema, Rotterdam, Brookfields, 1997

**SCHEME OF EXAM:** One question to be set from each chapter. Students have to answer any **FIVE** full questions out of **EIGHT** questions. Choosing at least **TWO** questions from **PART- A** and two questions from **PART- B**.

### **MINING GEOLOGY LABORATORY-II**

<b>Sub Code</b>	<b>: 10 MNL 47</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hrs/week</b>	<b>: 03</b>	<b>Exam Hours</b>	<b>: 03</b>
<b>Total Hrs.</b>	<b>: 42</b>	<b>Exam Marks</b>	<b>: 50</b>

#### **PART A**

I. Megascopic study of ore minerals: Physical properties, chemical composition. Mode of occurrence, distribution , uses of ore minerals in mining industry.

Experiment No.1-Iron, Manganese, Copper, Lead, Chromium, Aluminium ores.

II. Microscopic study of ore minerals: Optical properties. Texture, Alteration,. Identification of ore minerals.

Experiment No.2-Iron, Manganese, Copper, and Lead ores.

III. Dip and Strike problems:

Experiment No.3- To determine true dip when two apparent dips are known.

Experiment No.4- To determine the amount of apparent dip when true dip and direction of apparent dips are given.

Experiment No.5-To determine the direction of apparent dip when true dip and amount of amount of apparent are known.

#### **PART B**

IV. Thickness calculations:

Experiment No.6-When the ground is horizontal.

Experiment No.7-When the slope is in the direction of dip.

Experiment No.8-When the slope is against the direction of dip.

V. Bore Hole problems (Three point problems).

Experiment No.9-On level Ground.

VI. Ore Reservation Estimation.

Experiment No.10-Bedded deposits, vein deposits and Load deposits.

<b>Part A:- Any one question</b>	<b>20 marks</b>
<b>Part B:- Any one question</b>	<b>20 marks</b>
<b>Viva question:-</b>	<b>10 marks</b>
<b>Total</b>	<b>50 marks</b>

**MINE SURVEYING LABORATORY-I**

<b>Sub Code</b>	<b>: 10 MNL 48</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hrs/week</b>	<b>: 03</b>	<b>Exam Hours</b>	<b>: 03</b>
<b>Total Hrs.</b>	<b>: 42</b>	<b>Exam Marks</b>	<b>: 50</b>

**PART A**

- 1) Demonstration of mine survey instruments such as clinometer, abney level, box sextant, ediograph, pentagraph, Ceylon ghat tracer and planimeter.
- 2) Setting of regular figures using chain and tape.
  - a)Setting of pentagon
  - b)Setting of Hexagon
  - c)Setting of Octagon
- 3) Setting of regular figures using compass and tape.
  - a)Setting of pentagon
  - b)Setting of Hexagon
  - c)Setting of Octagon
  - d)Inaccessible Distance

**PART B**

- 4) Plane table methods.
  - a)Radiation methods
  - b)Intersection Method
  - c)Two point problem
  - d)Three point problem
- 5) Reduction of levels.
  - a)R.L by H.I.Method
  - b)R.L by Raise and Fall Method

- 6) Theodolites traversing and co-ordinate calculation.  
a)Balancing of the traverse.(closed traverse)

<b>Part A:- Any one question</b>	<b>20 marks</b>
<b>Part B:- Any one question</b>	<b>20 marks</b>
<b>Viva question:-</b>	<b>10 marks</b>
<b>Total</b>	<b>50 marks</b>

**V SEMESTER  
MINE ENVIRONMENTAL ENGINEERING – I**

<b>Sub Code : 10MN 52</b>	<b>IA Marks : 25</b>
<b>Hrs/ Week : 04</b>	<b>Exam Hours : 03</b>
<b>Total Hrs. : 52</b>	<b>Exam Marks : 100</b>

**PART-A**

1. **Mine Air:** Atmospheric air and composition of mine air, Mine Gases:- Occurrence, properties, detection, measurements and physiological effects.  
**06Hrs**
2. **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 on mine gases.  
**07 Hrs**
3. **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.  
**06 Hrs**
4. **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, coefficient 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.  
**07 Hrs**

**PART-B**



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

**06 Hrs**

6. **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.

**08 Hrs**

7. **Ventilation survey:** Importance of ventilation survey, types: - qualitative surveying, pressure survey and quantity survey. Simple problems.

**06 Hrs**

8. **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.

**06 Hrs**

**TEXT BOOKS:**

1. Elements of Mining Technology Vol II- D.J. Deshmukh, 9<sup>th</sup> 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.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

## MINING MACHINERY-II

Sub Code: 10MN 53

IA Marks: 25

Hrs/ Week: 04

Exam Hours: 03

Total Hrs. : 52

Exam Marks: 100

### PART A

- 1. Drainage and Pumping:** Methods to prevent inflow of water into mine workings, mine pumps, different types of pumps-centrifugal, turbine, roto pump, mono block pump, drill operated pump, displacement pumps.  
**07 Hrs**
- 2. 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.  
**07 Hrs**
- 3. Face Mechanization:** Classification-continuous and intermittent road headers, Shearer, their application, limitation and specification.  
**06 Hrs**
- 4. Allied Face Machineries:** Coal Ploughs, coal cutting machines, their application, limitation and specification.  
**06 Hrs**

### PART B

- 5. Allied Machinery:** Basic Principles of drilling, cutting and ploughing machines. Different types of hydraulic props, chocks, chock shields, canopies, armoured face conveyors and stage loaders.  
**07 Hrs**
- 6. Development of Face Mechanization:** Recent developments in face mechanization. L.H.D., S.D.L., L.P.D.T. and Rocker Shovel.  
**06 Hrs**
- 7. Trackless equipments:** application and limitation.  
**06 Hrs**
- 8. Machinery Maintenance:** Maintenance management and safety, CAD, Remote monitoring and controlling in mines and automation. Application of Computer for Maintenance.  
**07 Hrs**

**TEXT BOOKS:**

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

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

**MINE SURVEYING – II**

**Sub Code : 10MN 54**  
**Hrs/ Week : 04**  
**Total Hrs. : 52**

**IA Marks : 25**  
**Exam Hours : 03**  
**Exam Marks : 100**

**Part-A**

1. **Tachometric Survey:** Application and limitation, principles and methods, annalactic lense, reduction of stadia notes, errors.  
**07 Hrs**
2. **Triangulation Survey:** Principles, classification, steps in triangulation survey, base line measurements and corrections, base networks, Problems.  
**07 Hrs**
3. **Curve Ranging:** Linear and angular methods of setting out of simple curves, requirements and functions of a transition curve.

06 Hrs

4. **Open Cast Survey:** Principles, methods and survey network, Calculation of areas and volumes, mid ordinate and average ordinate, trapezoidal method, Simpson method, contour method.

06 Hrs

**Part-B**

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

08 Hrs

6. **Stope Surveying:** Definition, purpose, methods: Tape triangulation, Ray, steeply dipping ore bodies, moderately dipping ore bodies, degree of accuracy.

06 Hrs

7. **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.

06 Hrs

8. **Theory of Errors:** Introduction to errors and its theory, propagation of errors, their prevention and elimination, methods of least square and its application probable errors of single observation and most probable value, weight and weighted observations and their probable errors.

06 Hrs

**TEXT BOOKS:**

1. Surveying Vol. II – B.C. Punmia, 12<sup>th</sup> edition, Lakshmi Publications, 1994.
2. Metalliferous Mine Surveying Fedrick Wini Berg, 2<sup>nd</sup> edition Mining Publications, London, 1935.

**REFERENCE BOOKS:**

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

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

## UNDERGROUND COAL MINING

<b>Sub Code</b> : 10MN 55	<b>IA Marks</b> : 25
<b>Hrs/ Week</b> : 04	<b>Exam Hours</b> : 03
<b>Total Hrs.</b> : 52	<b>Exam Marks</b> : 100

### PART-A

1. **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.  
**07 Hrs**
2. **Choice of Coal Mining Methods:** Basic Mining Methods, Board and Pillar, Longwall and Shortwall, Factors influencing choice of mining methods. **06 Hrs**
3. **Board and Pillar Mining:** Board and Pillar Mining System. Design of Board and Pillar workings, Mining Processes, Development of Panels, Extraction of Pillars and Examples of Pillar extraction techniques.  
**07 Hrs**
4. **Room and Pillar Mining:** Applicability, Merits and Demerits. Variants of Room and Pillar Mining Method. Simple Problems.  
**06 Hrs**

### PART-B

5. **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, material supply and face organization. Strata mechanics around Longwall panel.  
**07 Hrs**
6. **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.  
**06 Hrs**

7. **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.

**06 Hrs**

8. **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. **07 Hrs**

**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<sup>nd</sup> edition, Lovely Prakashan Publishers, 1994,

**REFERENCE BOOKS:**

1. Underground Coal Mining Methods – J.G.Singh, Braj Kalpa 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 Publishing House, Bombay, 1967.
5. Universal Mining School Volumes. Cardiff [GT. Britain], 1931.
6. SME Mining Engg. Hand Book – Hartman, 2<sup>nd</sup> 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.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

## MINERAL ECONOMICS

**Sub Code : 10MN 56**  
**Hrs/ Week : 04**  
**Total Hrs. : 52**

**IA Marks : 25**  
**Exam Hours : 03**  
**Exam Marks : 100**

### Part-A

- 1. Introduction:** Role of mineral industry in national economy, special features of mineral industry, essential and strategic minerals of India and their economic significance.  
**07 Hrs**
- 2. National mineral policy:** Appraisal of Mineral Resources, Pricing policy, Exports and Imports, taxation and subsidies, conservation of Minerals.  
**07 Hrs**
- 3. Sampling:** Definition, purpose, scope, common methods of sampling, types of samples, errors in sampling.  
**06 Hrs**
- 4. Estimation of reserves:** Classification of reserves, tenor, grade. Preparation of assay plans, longitudinal cross sections and calculation of ore reserves.  
**06 Hrs**

### Part-B

- 5. 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, effects of inflation,  
**06 Hrs**
- 6. Mine valuation – 2 :** mining fixed costs, operating costs, cut-off grade, feasibility study, project planning, project evaluation, depreciation, problems on mine valuation and depreciation.  
**07 Hrs**
- 7. Financial management:** Methods of financing industrial enterprises, structure, formation and capitalization. Sources of finance, shares, and debentures. Principles of book keeping as applied to mining industry and accountancy. Balance sheet, profit and loss accounts, wage systems and incentives.  
**07 Hrs**

8. **Cost Accounting:** Introduction, need for cost accounting, elements of cost, overheads, allocation of overheads, breakeven analysis.

**Budget and Budgetary control:** Definition of budget, Principle of budget and budgetary control, types of budgets.

**06 Hrs**

**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. 4<sup>th</sup> 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, Dhanpat Rai and Sons, 1999.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

**MINING MACHINERY LABORATORY**

**Sub Code :10MNL 57**  
**Hrs/ Week : 04**  
**Total Hrs. : 42**

**IA Marks : 25**  
**Exam Hours : 03**  
**Exam Marks : 50**

**S. No. EXPERIMENTS**

**Part-A**

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. Write details of capping and recapping procedures.
5. Write details of suspension gear with sketch

**Part-B**

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.

**Scheme of Examination:** Students should be asked to conduct two experiments in the examination.

Experiment 1	20 Marks
Experiment 2	20 Marks
<u>Viva Voice</u>	<u>10 Marks</u>
Total	50 Marks

### MINE SURVEYING LABORATORY-II

<b>Sub Code</b> :10MNL 58	<b>IA Marks</b> : 25
<b>Hrs/ Week</b> : 04	<b>Exam Hours</b> : 03
<b>Total Hrs.</b> : 42	<b>Exam Marks</b> : 50

#### EXPERIMENTS

##### Part-A

1. Demonstration of precise level, digital planimeter EDM and total station.
2. Determine the constant K and C of the tachometer.
3. Determine the distance and elevation by
  - a) Stadia Method
  - b) Tangential Method
4. Determine the gradient between Two points by Tachometric Survey
5. Simple curve ranging by linear and angular method.
  - a) Deflection distance Method.
  - b) Rankines Method.

##### Part- B

6. Correlation Survey:
  - a) Correlation survey by Direct Traversing through Incline
  - b) Correlation survey by Direct Traversing through Incline and Shaft.
  - c) Correlation survey by Weisback Coplanning Method.
  - d) Correlation survey by Weisback Triangle Method.
7. Underground Traversing.

8. Transfer of levels from surface to underground.
9. To control the directions of underground workings.
10. To determine the center of the shaft.
11. To establish the missing point between two known points by assumed bearing method.
12. To conduct correlation survey by assumed bearing method.

**Scheme of Examination:** Students should be asked to conduct two experiments in the examination.

Experiment 1	20 Marks
Experiment 2	20 Marks
Viva Voice	10 Marks
Total	50 Marks

## SURFACE MINING

<b>Sub Code</b> : 10MN 61	<b>IA Marks</b> : 25
<b>Hrs/ Week</b> : 04	<b>Exam Hours</b> : 03
<b>Total Hrs.</b> : 52	<b>Exam Marks</b> : 100

### PART-A

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.  
**06 Hrs**
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.  
**08 Hrs**
3. **Drilling and Blasting:** Drillability, mechanics of drilling, major types of drilling machines, basics of mechanics of blasting, principles of fragmentation.  
**06 Hrs**
4. **Design of blasting:** with special reference to heavy blasting, air blasting, ground vibration, fly rocks novel methods of drilling, smooth blasting and pre-splitting.  
**06 Hrs**

## PART-B

5.           **Surface Mining Methods:** Casting, strip, quarrying and Placer Mining.  
**06 Hrs**
  
6.           **Excavation and loading:** Shovels, Dragline, Front-end loader, Stackers, Graders.  
**06 Hrs**
  
7.           **Non-Cyclic Surface Mining:** Bucket Wheel Excavators and Continuous surface miners.  
**06 Hrs**
  
8.           **Transport Equipments:** Dumpers, Aerial ropeways-monocable and bicalc types and their constructional details. Shovel – dumper combination, high angle conveyor and in-pit crusher. Selection of equipments.  
**08 Hrs**

### **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, 6<sup>th</sup> 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
7.           Petroleum Engineers In. 1968.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

## MINERAL PROCESSING

Sub Code : 10MN 62  
Hrs/ Week : 04  
Total Hrs. : 52

IA Marks : 25  
Exam Hours : 03  
Exam Marks : 100

### Part- A

- 1. Introduction:** Definition, objectives, scope. Pretreatment and Sorting of Ores, objective of pre treatment, different types of pre treatment. Sorting process, different methods of sorting such as manual, mechanical sorting, Numericals on pre treatment.  
**06 Hrs**
- 2. Metallurgical Accounting:** Sampling, Definition, objectives, different types of sampling methods. Hand sampling, mechanical and electrical sampling. Mass balancing methods. Numericals on sampling and mass balancing methods.  
**07 Hrs**
- 3. Communion and Liberation:** Definition, objectives of communion, principles of communion, theories of communion, stages of communion, Liberation and its concepts.  
**06 Hrs**
- 4. Crushing:** Principles of crushing, primary crushing and secondary crushing, construction and operation of various crushing machines such as primary and secondary crushers. **Grinding:** Theory of grinding, critical speed, types of grinding mills, such as ball mills, rod mill, autogenous mills, close circuit and open circuit grinding.  
**07 Hrs**

### Part-B

- 5. Laboratory Sizing and Industrial Screening:** Definition, Importance of sizing, laboratory sizing and interpretation of data, screening and factors affecting the screening Industrial screening and types of Industrial screens. Movement of solids in fluids, Laws of settling of solids in fluids, Stokes Law, Newtonian law, equal settling particles, classification of different types of classifiers, free settling, Hindered settling, laminar flow and turbulent flow.  
**07 Hrs**

6. **Concentration Process:** Principles of gravity concentration: Jigging, Flowing film concentration and equipments. Principles of magnetic and high tension Separation, different types of magnetic separators, their construction and operation.  
**07 Hrs**
7. **Flotation:** Physio-chemical Principles of flotation. Flotation reagents and machines.  
**06 Hrs**
8. **Dewatering:** Principles and techniques: thickening, filtration, and drying techniques. **Plant Practice:** Study of flow sheets for typical ores of copper, lead, iron, chromite, uranium.  
**06 Hrs**

**TEXT BOOKS:**

1. Mineral Processing Technology, B.A.Wills, 5<sup>th</sup> Edition, Pergamon Press.
2. Ore Processing, S.K.Jain, 2<sup>nd</sup> Edition, Oxford IBH, 1990.

**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.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

## UNDERGROUND METAL MINING

<b>Sub Code</b>	<b>: 10MN 63</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hrs/Week</b>	<b>: 04</b>	<b>Exam Hours</b>	<b>: 03</b>
<b>Total Hrs.</b>	<b>: 52</b>	<b>Exam Marks</b>	<b>:100</b>

### Part-A

**1. Introduction To Metal Mining:** Peculiarities of Metaliferous deposits, scope and limitations of u/g metal mining.

**05 Hrs**

**2. Mine Developments:** Methods of developments, factors affecting the choice of level interval, Block size, shaft station, ore bin and ore pass. Shape and size of drive, cross cut, raise, winze and their position in relation ore body.

**08 Hrs**

**3. Stopping:** Classification of stopping methods, factors affecting choice of stopping methods like depth, dip,width, grade of the ore, physio mechanical characteristics of ore and wall rocks.

**06 hrs**

**4. Stopping methods:** Open stopping, Overhand, Underhand, Breast stopping. Stopping with supports; Shrinkage stopping, Cut and fill method of stopping, square set stopping. Caving methods:Top slicing, sub level caving and block caving.

**07 Hrs**

### Part-B

**5. Trends of new methods:** Sub level stopping, long hole stopping, blast hole stopping, V.C.R. stopping, in-situ leaching, biomineral engineering, hydraulic mining.

**07 Hrs**

**6. Special methods:** Extraction of remnant pillars, Shaft pillars and contiguous reefs, their supporting system and special precaution during extraction.

**07 Hrs**

**7. Deep mining:** Introduction to deep mining problems and stopping method in deep mining,

**06 Hrs**

**8. Applications:** Tunnel and Shaft boring machines and their applications.

**06 Hrs**

**TEXT BOOKS:**

1. Introductory Mining Engineering-Hartman. John Wiley and Sons Inc.1987.
2. Elements of Mining Engineering.-D.J.Deshmukh, Central techno publishers,

**REFERENCE BOOKS:**

1. Deep Mining-Jack Spalding, Mining publication Ltd.Inc.1949.
2. SME Mining Engineering Hand Book-Hartman, Society for Mining, Metallurgy and exploration.Inc.1992.
3. U/G Mining Method-Hustrulid, Society for Mining, Metallurgy & Exploration.Inc.1982.

**Question Paper pattern:**

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

**MINE ENVIRONMENTAL ENGINEERING – II**

**Sub Code : 10MN 64**  
**Hrs/ Week : 04**  
**Total Hrs. : 52**

**IA Marks : 25**  
**Exam Hours : 03**  
**Exam Marks : 100**

**Part-A**

1. **Mine Fires:** Classification, surface and underground fires, prevention and control of underground fires, fire fighting, study of atmosphere behind sealed off area, re-opening of sealed off area.  
**07 Hrs**
2. **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 on Graham's Index.  
**06 Hrs**

3. **Explosives:** Types, 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.

**07 Hrs**

4. **Inundation:** Causes, measures against inundations. Dams: types, design, construction of water dams. Dewatering water logged workings, precautions to be taken when approaching old water logged workings, safety boring apparatus.

**06 Hrs**

**Part-B**

5. **Mine Illumination:** Technical terms in lighting and photometry, Underground lighting, Electric safety lamp, different types of portable lamps, Methods of illumination in underground mines- fixed system, mobile system.

**07Hrs**

6. **Mine Lighting in Opencast mines: Lighting** in opencast mines, standards for mine lighting, Illumination survey, Luminance calculations, and luminance calculations.

**07 Hrs**

7. **Mine Rescue:** Mine Rescue and equipment, short distance apparatus, self contained breathing apparatus, self rescuers, organization of rescue

**06 Hrs**

8. **Mine Recovery:** recovery work in connection with fires, explosions and inundations.

**06 Hrs**

**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<sup>th</sup> Edition, Central Techno Publications, Nagpur.

**REFERENCE BOOKS:**

1. Fires in Coal Mines L.C. Kaku, 2<sup>nd</sup> 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.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

## **ROCK MECHANICS**

**Sub Code : 10MN 65**  
**Hrs/ Week : 04**  
**Total Hrs. : 52**

**IA Marks : 25**  
**Exam Hours : 03**  
**Exam Marks : 100**

### **PART-A**

1. **Introduction to Rock Mechanics:** Definition, Scope and importance, development, application in mining, Discontinuities; Description of discontinuities, Introduction to mapping and hemispherical projection of discontinuities, Barton's shear strength of joints.  

**07 Hrs**
2. **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.  

**06 Hrs**
3. **Analysis of Strain:** Introduction, Definition and basic concepts, strain in a plane, (two dimensional stress), Mohr's Circle of strain, equations of compatibility, stress-strain relationship, basic equations in elastic theory, plain strain equations, elasto plastic behaviour of rocks. Stress – strain curves of various rocks.  

**07 Hrs**
4. **Physical Properties:** Definition and determination of Density, hardness, porosity, permeability, moisture content, degree of saturation. Electrical and thermal properties of rocks.  

**06 Hrs**

### **PART-B**

5.           **Mechanical Properties:** Definition and determination of Compressive Strength, tensile strength, shear strength, triaxial testing. Time dependent properties. Scaling of laboratory data to in-situ values. Rock Indices: protodyakanov strength index, point load strength index, RQD.  
**07 Hrs**
  
6.           **In-situ Strength Properties of Rocks:** Necessity and requirement, methods of in-situ stress measurements. Plate load test, cable jack test, bore hole test, dilatometer test, flatjack test, hydraulic fracture and velocity propagation.  
**07 Hrs**
  
7.           **Rheological Models:** Relationship and rate of change of stress-strain for idealizing materials – Models representing elastic, plastic, viscous, elasto plastic, non-elastic and brittle rock properties.  
**06 Hrs**
  
8.           **Static and Dynamic Elastic Constants Of Rocks:** Static: Introduction, definition, instrument, measurement of deformation: mechanical, optical, electrical gauges, LVDT, calculation of elastic constants of rocks. Dynamic: Introduction, elastic wave, calculation of modulus of elasticity.  
**06 Hrs**

**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 Csaba Asszonyi, 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, 2<sup>nd</sup> edition, Brady and Brown, Kluwer Academic Publishers, 1993.
5.           Ground Mechanics in Hard rock Mining, M.L. Jeremic, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.

6. Rock Mechanics and Design of Structures in Rock – L. Obert & W.I. Duvall, John Wiley and Sons, 1966.
7. Rock Mechanics for Engineers, B.P. Verma, 2<sup>nd</sup> edition, Khanna Publishers, 1989.
8. Introduction to Rock Mechanics – r.e. Goodman, 2<sup>nd</sup> edition, John Wiley and Sons, 1989.
9. The elements of Mechanics of Mining Ground B.S. Verma Vol. I. Julin & Co. Lucknow 1981.
10. Engineering Rock Mechanics, An Introduction to the Principles, John A. Hudson and John. P. Harrison Pergamon Press 1997.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

### FUEL TECHNOLOGY AND COAL PREPARATION

<b>Sub Code : 10MN 661</b>	<b>IA Marks : 25</b>
<b>Hrs/ Week : 04</b>	<b>Exam Hours : 03</b>
<b>Total Hrs. : 52</b>	<b>Exam Marks : 100</b>

#### Part- A

1. **Sources of Energy:** Introduction to sources of energy: fuels, solar energy, nuclear power, wind power, tidal power, geo thermal energy. Classification of fuels: Solid, Liquid and Gaseous fuels. Introduction to liquefaction and gasification of solid fuels.  
**06 Hrs**
2. **Solid Fuels:** Classification of coal by rank and grade, properties of coals such as ultimate analysis, proximate analysis, Calorific Value, Physical, Mechanical and Thermal Properties. Properties of Coking and Non coking coal.  
**07 Hrs**
3. **Combustion of Coal:** Mechanism of coal combustion, combustion systems, carbonization of coal: Low temperature carbonization, high temperature carbonization, Physico chemical aspects, coal tar processing.  
**07 Hrs**
4. **Liquid and Gaseous Fuels:** Composition of petroleum, Classification of petroleum, Petroleum Processing, Properties and testing

petroleum and petroleum products. Gaseous Fuels: Types of gaseous fuels, Natural gas, Methane from coal mines, producer gas, water gas, coal gas, blast furnace gas, liquefied petroleum gas, Oil gasification, cleaning and purification of gaseous fuels.

**06 Hrs**

**Part- B**

5. **Coal Preparation:** Introduction, Need for coal preparation, Scope for coal beneficiation in India. Objectives of coal beneficiation, coal beneficiation methods, Essential operation in coal beneficiation plants.  
**07 Hrs**

6. **Float & Sink test:** Float and sink test, procedure for float and sink test, construction of washability curves,  
**06 hrs**

7. **Construction of tramp curve:** interpretation of tramp curve, near gravity material, Yield reduction factor, washability index, optimum degree of washability, washability number.

**06 Hrs**

8. **Coal Washing Equipments and Process:** Introduction to the coal beneficiation processes and equipments. **Study of Flow Charts:** Working Principles of major coal washing systems and study of flow sheets  
**07 Hrs**

**TEXT BOOKS:**

1. Fuels and Combustion, Dr. Samir Sarkar, Published by Orient Longman Ltd., 1990.
2. Coal Its Beneficiation, D.V. Subba Rao, M.K. Publications, 2003.

**REFERENCE BOOKS:**

1. Coal Conversion Technology, Edited by C.Y.Wen, Addison Wesley Publishing Company, 1979.
2. Coal Carbonisation, T.K.Basu et al., Allied Publishers, 1996.
3. The Chemistry and Technology of coal, James G. Speight, Merce Dekker, Inc. 1994.
4. Text Book of Metallurgical Analysis, B.G.Agarwal and S.P.Jain, Khanna Publications, New Delhi, 1984.
5. Coal Preparation Practice, G.G.Sarkar, Oxford and IBH Publishing Co. 1986.
6. Coal Mining Practice – I.C.F. Statham Vol. IV, the Caxton Publishing company Ltd. Inc. 1958.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

### ENGINEERING ECONOMICS

**Sub Code : 10MN 662**  
**Hrs/ Week : 04**  
**Total Hrs. : 52**

**IA Marks : 25**  
**Exam Hours : 03**  
**Exam Marks : 100**

#### Part-A

- 1. Introduction:** Engineering Decision-Makers, Engineering and Economics, Problem solving and Decision-making, Intuition and Analysis, Tactics and Strategy. Engineering Economic Decision Maze. Law of demand and supply. Law of returns.  
**07 Hrs**
- 2. Interest and Interest factors:** Interest rate, Simple interest, Compound Interest, Cash-flow diagrams, Exercises and Discussion.  
**06 Hrs**
- 3. Present worth Comparisons:** Conditions for present worth comparisons. Basic present worth comparisons, present worth equivalence, net present worth, Assets with unequal lives, infinite lives. Future worth comparison, pay-back comparison, Exercises, Discussions and problems.  
**06 Hrs**
- 4. Equivalent Annual Worth Comparisons:** Equivalent Annual Worth Comparison methods, Situations for equivalent Annual Worth Comparisons, Consideration of asset life, Comparison of assets with equal and unequal lives, Use of shrinking fund method, Annuity contract for guaranteed income, Exercises, Problems. **Rate of Return Calculations:** Rate of Return, Minimum acceptable rate of return, IRR, IRR misconceptions, Cost of capital concepts.  
**07 Hrs**  
Part-B

5. **Brief Discussion on Depreciation and Tax Considerations:** Causes of Depreciation, Basic methods of computing depreciation charges, Tax concepts, Corporate income tax. **Estimating and Costing:** components of costs such as Direct Material Costs, Direct Labor Costs, Fixed Over-Heads, Factory cost, Administrative Over-Heads, First cost, Marginal Cost, Selling price, Estimation for simple components.

**08 Hrs**

6. **Introduction, Scope of Finance, Finance Functions:** Statements of Financial Information: Introduction, Source of financial information, Financial statements, Balance sheet, Profit and Loss account, relation between Balance sheet and Profit and Loss account.

**06 Hrs**

7. **Financial Ratio Analysis:** Introduction, Nature of ratio analysis, Liquidity ratios, Leverage ratios, Activity ratios, Profitability ratios, Evaluation of a firm's earning power. Comparative statements analysis.

**06 Hrs**

8. **Financial and Profit Planning:** Introduction, Financial planning, Profit planning, Objectives of profit planning, Essentials of profit planning, Budget administration, type of budgets, preparation of budgets, advantages, problems and dangers of budgeting.

**06 Hrs**

**TEXT BOOKS:**

1. RIGGS J.L., Engineering Economy, Mc. Graw Hill, 2002.
2. THUESEN H.G., Engineering Economy, PHI, 2002.

**REFERENCE BOOKS:**

1. TARACHAND, Engineering Economy.
2. O.P. KHANNA, Industrial Engineering and Management, Dhanpat Rai & Sons.
3. I.M. PANDAY, Financial Management, Vikas Publishing House.
4. PAUL DEOARMO, Engineering Economy, Macmillan Pub. Co., 2001.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

## SMALL SCALE AND MARINE MINING

Sub Code : 10MN663  
Hrs/ Week : 04  
Total Hrs. : 52

IA Marks : 25  
Exam Hours : 03  
Exam Marks : 100

### Part-A

1. **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.  
**07 Hrs**
2. **Environmental Aspects:** Environmental obligations safety health and training, Environmental impacts and protection.  
**06 Hrs**
3. **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.  
**07 Hrs**
4. **Some case studies of mining:** mica, Barites, diamond and gemstones etc.  
**06 Hrs**  
Part-B
5. **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.  
**07 Hrs**
6. **Marine Geology and Resources:** Introduction to marine geology, marine mineral resources mineralogical students of continental slope, continental shelf and deep sea-bed mineral resources.  
**07 Hrs**
7. **Exploitation of Marine Deposits:** Exploitation systems of dissolved an undissolved mineral deposits, shallow water mining upto 200 mts depth direct picks up and transport.  
**06 Hrs**

8. **Deep sea mining:** deep sea mining upto 2000 mts. Mining of manganese nodules, under water vehicle. Crabs, transportation.

**06 Hrs**

**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.  
Graff, W.J. Introduction and offshore Structure, Design, Fabrication and Installation, Gulf Publishing Company, London, 1963.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

**MINERAL PROCESSING LABORATORY**

**Sub Code : 10MNL67**  
**Hrs/ Week : 03**  
**Total Hrs. : 42**

**IA Marks : 25**  
**Exam Hours : 03**  
**Exam Marks : 50**

**Part -A**

1. **Sampling:**
  - a. Coning and quartering
  - b. Riffle Sampling
2. **Sieve Analysis:**
  - a. Wet sieve analysis and interpretation of data
  - b. Dry sieve analysis and interpretation of data
3. Determination of energy consumption as a function of size reduction.
4. Determination of actual capacity of a jaw crusher.
5. Determination of actual capacity of a crusher.
6. Study of effect of the following variables on grinding in a ball mill.
  - i) Pulp density
  - ii) Time of grinding
  - iii) Percentage of critical speed.



**Part-B**

7. Determination of grindability index of the given ore.
8. Determination of free settling velocities of quartz particle and comparison of the results with theoretical results.
9. Determination of the effect of different flocculating agents on the settling rate of the pulp.
10. Separation of heavier from the given feed using mineral jig and calculation of ratio of concentration.
11. Study of the particle movement on the deck of an operating table.
12. Study of the flotation of characteristics of the sulfide ore and calculate the ratio of concentration.
13. Study the flotation of an oxide ore and calculate the ratio of concentration.

**Scheme of Examination:** Students should be asked to conduct two experiments in the examination.

Experiment 1	20 Marks
Experiment 2	20 Marks
<u>Viva Voice</u>	<u>10 Marks</u>
Total	50 Marks

**MINE ENVIRONMENTAL ENGINEERING LABORATORY**

<b>Sub Code</b> : 10MNL68	<b>IA Marks</b> : 25
<b>Hrs/ Week</b> : 03	<b>Exam Hours</b> : 03
<b>Total Hrs.</b> : 42	<b>Exam Marks</b> : 50

**Part- A**

1. Study of flame safety lamp, assess the percentage of gases, electric safety lamps and cap lamp room layout.
2. Study of hygrometer and measurement of relative humidity of moisture content of air, anemometer and measurements. Kata thermometer and determination of cooling efficiency.
3. Study of gas sampling equipment and determination of CO (MSA CO detector and other equipment).
4. Study of different pressure measuring instruments and measurement of pressure difference, study of ventury, evasee and diffuser.
5. Study of different types of fans and their characteristic curves, fans in series and parallel.

Part-B

6. Study of principle construction and operational details of various type sof fire Extinguishers.
7. Study of construction operational details of dust collectors.
8. Study of dust samplers.
9. Study of self contained breathing apparatus and its reducing valve mechanism, reviving apparatus, self rescuers, and short distance apparatus.
10. Study of air-conditioning plants and spot cooler in mines.

**Scheme of Examination:** Students should be asked to conduct two experiments in the examination.

Experiment 1	20 Marks
Experiment 2	20 Marks
<u>Viva Voice</u>	<u>10 Marks</u>
Total	50 Marks

## VII SEMESTER

### MINE PLANNING AND DESIGN

**Sub Code : 10MN 71**  
**Hrs/ Week : 04**  
**Total Hrs. : 52**

**IA Marks : 25**  
**Exam Hours : 03**  
**Exam Marks : 100**

#### Part-A

**Government Role and Influence in Mining:** Social-Legal-Political – Economic impacts, mining law, Health and safety standards. Environmental consequences.

**07 Hrs**

**Mine Development:** Land Acquisition, Plant siting and construction, environmental Protection and Permission, impoundments and dams.

**07 Hrs**

**Planning of Coal Mines:** Principles of mine planning, stages of planning of new mines, selection of mine sites, geological aspects, division of a coal field into mining areas.  
**06Hrs**

Surface layouts, pit bottom layout, transport system. Application of computer to mine planning.

**06 Hrs**

#### Part-B

**Opening Up Coal Deposits:** 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, costs of various mining operations.

**07 Hrs**

**Opening up with-** Adits, Inclines. Opening up with vertical shafts, open up with shafts and cross measure drifts. Choice of method of opening up by various methods.

**07 Hrs**

**Mine Exploitation:** Mining methods, classification systems, computer methods, mine closure, sealing and abandonment.

**06 Hrs**

**Novel and Innovative Mining Methods.** Evaluation of Mining Methods and Systems.  
**Hrs 06**

### TEXT BOOKS:

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

### REFERENCE BOOKS:

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).  
Underground Wining of Coal – T.N. Singh, Oxford IBH, 1992.  
Modern Coal Mining Technology – S.K.Das, Lovely Prakashan, Dhanbad, 1996.  
Principles & Practices of Modern Coal Mining – R.D. Singh, New Age International (P) Ltd. Publishers, 1997, Section 16.  
Mine Planning for Coal S.P.Mathur, MG Consultants Bilaspur, 1993.  
Mining B. Boky Mir Publishers, 1967.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

### GROUND CONTROL

**Sub Code : 10MN 72**  
**Hrs/ Week : 04**  
**Total Hrs. : 52**

**IA Marks : 25**  
**Exam Hours : 03**  
**Exam Marks : 100**

#### PART-A

**Introduction:** Definition, types of underground excavation, excavation design and constraints. Influence of water, time and temperature on stress behavior. Theories of rock failure: Griffith's, Columb Navier, Mohr's, Hoek & Brown.

**06 Hrs**

**Subsidence:** Theories, factors affecting subsidence, prediction, monitoring and determination. Subsidence damage and preventive measures.

**06 Hrs**

**Stability of Rock Excavations:** Re-inforcement of mine fills, autoconsolidated rock fill, cemented sand fill and rock fill, chemical activators in fill cementation.

**06 Hrs**

**Analysis of Stress around Underground Excavation:** Introduction, Premining and Induced Stresses, stress distribution around single excavation, circular, multiple, pillar and irregular shapes. Analytical approaches: Introduction, numerical models, finite element method (FEM), BEM, DEC, Photoelasticity.

**08 Hrs**

**PART-B**

**Classification of Rock Masses:** Introduction, methods and approaches: Terzaghi, RQD, RSR, RMR, Q, NATM, ISRM, Limitations.

**07 Hrs**

**Types of Supports and their Design:** Conventional and Powered supports, Rock Bolting, Roof Trusses, Shotcreting, Fibre supports, Support layouts, estimation of support resistance, Rock Structure interaction, Timber, steel, concrete and cable bolt supports and design aspects.

**07 Hrs**

**Instrumentation and Monitoring:** Types of stress strain measuring instruments: loadcells, strain gauges, convergence measurement instruments, dilatometers, extensometers, optical gauges, compressometers, methods of monitoring and their limitations.

**06 Hrs**

**Miscellaneous:** Rock burst and coal bumps: Mechanism, causes, occurrence, estimation of damage, prediction and preventive measures. Cavability, goaf control. Design of single and multiple openings.

**06 Hrs**

**TEXT BOOKS:**

Rock Mechanics and the Design of Structures in Rocks, L.Obert and W.I.Duvall, John Wiley and Sons, 1966.

Coal Mine Ground Control, S.Peng, John Wiley and Sons, Inc. 1978.

**REFERENCE BOOKS:**

S.M.E. Mining Engineering Hand Book, Volume I and II, Society for Mining, Metallurgy & Exploration. Inc. 1992.

Underground Mining Methods Hand Book, W.A. Hustralid, Society for Mining, Metallurgy & Exploration Inc. 1982.

Ground Mechanics in Hard Rock Mining, M.L.Jeremic, Oxford & IBH Publishing Co. New Delhi, 1986.

Design of Supports in Mines, C.Biron & E. Arioglu, John Wiley & Sons, New York, 1983.

Underground Mining Methods and Technology, Proceedings of the International Symposium, Nottingham, Elsevier 1986.

Coal Mining Technology Theory and Practice Robert Stefanko SME 1983.

Underground Excavations in rock E. Hoek and E.T. Brown IMM, 1980.

Support of Underground Excavation in Hard Rock E. Hoek et. al., Oxford and IBH 1995.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

### COMPUTER APPLICATION IN MINING

**Sub Code : 10MN73**

**IA Marks : 25**

**Hrs/ Week : 04**

**Exam Hours : 03**

**Total Hrs. : 52**

**Exam Marks : 100**

#### Part-A

**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.

**06 Hrs**

**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.

**07 Hrs**

**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.

**07 Hrs**

**Algorithms-1:** Development of algorithms in Ore Reserve Estimation, Equipment Selection, Material Handling System, Pit Configuration, SARPAC

**06**

**Hrs**

#### Part-B

**Algorithms-II:** Blast Design, Pillar Design, Subsidence Protection, Ventilation Network Analysis, Ground Vibration Prediction from Blasting.

**06 Hrs**

**Data Base Management System:** Introduction: Database Approach versus traditional file processing Approach, DBMS Administrators, Designers users, Developers, and maintenance, uses of DBMS, Datamine 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.

**07 Hrs**

**Relational Data Models and Relational Algebra:** Relational Models concept, the relational Algebra, Additional Relational Operators, Queries in the Relational Algebra.

**06 Hrs**

**SQL - A Relational Database Language:** 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.

**07 Hrs**

**TEXT BOOKS:**

Fundamentals of Database Systems, Elmars and Navathe, 3<sup>rd</sup> edition, Wesley 2000.

CAD/CAM : Computer Aided Design and Manufacturing, Mikell P. Groover, Emory W. Zimmers, Jr. PHI India, 1989.

**REFERENCE BOOKS:**

Mine Ventilation and Air – Conditioning, Hartman, Wiley International, 1961.

Mine Environmental Engineering, V.S. Vutukuri & Lama, Cambridge University Press, 1986.

Database System Concepts, Korth, Mc Graw Hill, 1986.

CAD/CAM Theory and Practice by Zeid, Tat Mc. Graw Hill.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

#### MINE LEGISLATION

<b>Sub Code</b> : 10MN 74	<b>A Marks</b> : 25
<b>Hrs/ Week</b> : 04	<b>Exam Hours</b> : 03
<b>Total Hrs.</b> : 52	<b>Exam Marks</b> : 100

#### Part-A

**Introduction:** Brief historical perspective legislation in Indian Mines. **08 Hrs**

**Mines Act:** Preliminary, Inspectors and Certifying surgeons, committee, mining operations and management of mines. Provisions to health and safety.  
**06Hrs**

**Mines Act :**Hours and limitations of employment, Leave with wages, Regulations and bylaws, penalties and procedures.  
**06Hrs**

**Mines Rules:** 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.  
**06 Hrs**

#### Part-B

**Metaliferrous mines regulation:** 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.  
**07 Hrs**

**Coal mines regulations:** 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.

07

Hrs

**Crèche Rule:** Provision of crèches, standards of crèches, medical arrangement of crèches.

**08 Hrs**

**Maternity Benefit Act in Detail.**

**05Hrs**

**TEXT BOOKS:**

Mines Act 1952, Mines Rules 1955, Universal Law Publishing, Pvt. Ltd., 1999.

Metalliferous Mines Regulations 1961, Universal Law Publishing Pvt. Ltd., 1999.

**REFERENCE BOOKS:**

Legislation in Indian Mines – A critical Appraisal Prasad and Rakesh, 5<sup>th</sup> edition  
Tara Printing Works, varanasi, 1990.

Maternity Benefit Act, & Mines Crèche Rules, Universal Law Publishing Pvt. Ltd., 1999.

Encyclopedia of Mining Law – D.D. Seth. Law Publishers (India) Pvt. Ltd., Allahabad, 1999.

Mine Management Legislation and General Safety, S. Ghatak, Coal Field Publishers, Asansol, 1999.

Coal Mines Regulation 1957, Universal Law Publishing Pvt. Ltd., 1999.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

## ADVANCED SURFACE MINING

Sub Code : 10MN751  
Hrs/ Week : 04  
Total Hrs. : 52

IA Marks : 25  
Exam Hours : 03  
Exam Marks : 100

### PART-A

**Planning:** Land Acquisition, detailed prospecting and delineation of ore bodies, Concept of Cut off grade for the estimation of ore reserves, quality control and conservation, out put and man power planning.

**08 Hrs**

**Pit Layout:** Preparation of the site, selection of site for initial box cut, numbers, length, width, height and direction of benches.

**06 Hrs**

**Layouts Design:** Pit layout plotting for different equipment's combination, calendar planning.

**06 Hrs**

**Introduction to Slope Failure:** Factors affecting the stability of a slope, different types of slope failure-plane, wedge, circular failure and Toppling.

**06 Hrs**

### PART-B

**Analysis of Slope Stability:** Factor of safety calculation for plane failure and wedge failure, analysis of circular failure using circular failure charts.

**06 Hrs**

**Choice, Type and Degree of Mechanization:** Selection of Continuous and Discontinuous Opencast Mining machineries, Selection of drills, selection of size and population of shovel, dumper, dragline, bucket wheel excavators basing on the amount of material to be handled, out put data and cycle time, continuous surface miner and its applicability.

**08 Hrs**

**Safety Aspects:** Safety Aspects in Opencast Mines Regarding height, width and slope of the benches, fly rocks, mine illumination, Ground Vibrations due to Blasting.

**06 Hrs**

**Design of Haul road and Spoil Dump:** Design Aspects of haul roads, selection of site for spoil dumps, design aspects for spoil Dumps, Stability of Spoil dumps.

**06 Hrs**

### **TEXT BOOKS:**

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

### **REFERENCE BOOKS:**

S.M.E. Mining Engineering hand Book Vol. I and II, Hartman, Society for Mining, Metallurgy and Exploration Inc. 1992.  
Elements of Mining Technology, Vol. I, II and III - D.J. Deshmukh, Central Techno Publication, 1998.  
Method of Mining, Working Coal and Metal Mines, Vol. I, II and III – Wood ruff S.D., Pergoman Press, 1968.  
Proceedings of International Symposium on Thick Seam Mining, Indian School of Mines, Dhanbad, MMGI, 1965.  
Coal Mining Vol. I, II, III and IV – Statham I.C.F., The Coxton Publication Company, 1960.  
Introductory Mining Engineering – Hartman H.L. John Wiley and Sons Inc. 1987.  
Advanced Coal Mining Vol. I, II – Vorobjev B.M. and Deshmukh R.T., Asia Publishing House, Bombay, 1966.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

### **PROJECT MANAGEMENT**

<b>Sub Code</b>	<b>: 10MN752</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hrs/ Week</b>	<b>: 04</b>	<b>Exam Hours</b>	<b>: 03</b>
<b>Total Hrs.</b>	<b>: 52</b>	<b>Exam Marks</b>	<b>: 100</b>

#### **Part-A**

**Concepts of Project Management:** Concepts of a Project, Categories of projects, Phases of project life cycle, Roles and responsibilities of project leader, tools and techniques for project management.

**06 Hrs**

**Project Planning and Estimating:** Feasibility report, phased planning, Project planning steps, Objectives and goals of the project, preparation of cost estimation, evaluation of the project profitability.

**06 Hrs**

**Organizing and Staffing the Project Team:** Skills/ abilities required for project manager, Authorities and responsibilities of project manager. Project organization and types accountability in project execution, controls, tendering and selection of contractors.

**08 Hrs**

**Project Scheduling:** Project implementation scheduling, effective time management, different scheduling techniques, resources allocation methods.

**06 Hrs**

**Part-B**

**Tools and Techniques of Project Management:** Bat (GAMTT) chart, bar chart for combined activities, logic diagrams and networks, Project evaluation and review Techniques (PERT) Planning, Computerized project management.

**08 Hrs**

**Co-ordination and Control:** Project direction communication in a project, MIS project co-ordination, project control requirement for better control of project or role of MIS in project control, performance control, schedule control, cost control.

**06 Hrs**

**Performance Measures in Project Management:** Performance indicators, performance improvement for the CM & DM companies for better project management, Project management and environment.

**06 Hrs**

**Case Studies on Project Management:** Case studies covering project planning, scheduling, use of tools & techniques, performance measurement.

**06 Hrs**

**TEXT BOOKS:**

Project Management a System Approach to Planning Scheduling & Controlling, Harold Kerzner, CBS Publishers and Distributors.  
Chaudhry S., Project Execution Plan: Plan for Project Execution Interaction.

**REFERENCE BOOKS:**

Project Management – Benington Lawrence – Mc. Graw Hill – 1970.  
A Management Guide to PERT and CPM, WEIST & LEVY, Eastern Economy of PHI.  
PERT & CPM – L.S. Srinath, Affiliated East West Press Pvt. Ltd.  
Project Management with PERT and CPM, Moder Josph and Phillips cerel r., 2<sup>nd</sup> edition, New York VAN Nostrand, Reinhold – 1976.

Project Planning analysis Selection Implementation & Review – prasanna Chandra, ISBN0-07-462049-5.

Angus, Planning, Performing and Controlling Projects, 3<sup>rd</sup> End, Pearson Education Pvt. Ltd., ISBN: 812970020.

Project Planning, Scheduling & Control, James P. Lewis, Meo Publishing Company.

Bhavesh M. Patel, Project Management, Vikas Publishing House, ISBN 81-259-0777-7

Jack Gido, James P. Clements, Successful Project Management, Vikas Publishing House, ISBN 981-243-137-3

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

## SOFTWARE ENGINEERING

**Sub Code : 10MN753**

**IA Marks : 25**

**Hrs/ Week : 04**

**Exam Hours : 03**

**Total Hrs. : 52**

**Exam Marks : 100**

### Part-A

**Introduction:** Software and software engineering, phases in software engineering, process model, waterfall model, prototyping etc.

**06 Hrs**

**Software Requirement Specifications:** Role of SRS data flow diagrams – problems, data dictionary, structured analysis, prototyping, other CASE tools. Pseudo codes, HIPO diagrams, software tools of developments facilities.

**07 Hrs**

**Planning a software Project:** Cost estimation, methods, single variable models, COCOMO models-problems.

### 06Hrs

Project scheduling staffing and personnel planning software configuration management team structure. Quality assurance plans. Project monitoring and risk management.

**07 Hrs**

### Part-B

**System Design:** Module level concepts – coupling and cohesion design methodology – problem object oriented approach design specifications.

**07 Hrs**

**Detailed Design and Coding:** Module specifications, data abstractions – problem. Detailed design using process design language (PDL) – problems verification, complexity matrices – problems.

**07 Hrs**

**Programming Practices:** Programming practices in coding top down & bottom up methods. Structured programming information hiding, programming style, verification – problems defensive programming.

**07 Hrs**

**Testing:** Testing fundamentals, functional and structural testing, testing process that plan, test case specifications, metrics – problems top down Vs bottom up testing, debugging techniques, compiler diagram.

**05 Hrs**

**TEXT BOOKS:**

An Integrated Approach to Software Engineering, 2<sup>nd</sup> Edition, Pankaj Jalote, Norosa Publishing House, 1997.

Software Engineering, Rogers S. Pressman, Mc. Graw Hill, 1997.

**REFERENCE BOOKS:**

Software Engineering, Martin, L. Shooman, Mc. Graw Hill, 1993.

Software Engineering Concepts, Richard. E. Fairley, Mc. Graw Hill, 1985.

Software Engineering, Environment Concepts & Technology, Robert N. Charette, Mc Graw Hill, 1988.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

## OPERATIONS RESEARCH

**Sub Code : 10 MN 761**  
**Hrs/ Week : 04**  
**Total Hrs. : 52**

**IA Marks : 25**  
**Exam Hours : 03**  
**Exam Marks : 100**

### Part-A

1. **Introduction:** OR methodology, Definition of OR, Application of OR to engineering and Managerial problems, Features and Limitations of OR. **04 Hrs**
2. **Linear Programming:** Definition, mathematical formulation, standard form, solution space, solution-feasible, basic feasible, optimal, infeasible, multiple, optimal, Redundancy, Degeneracy, Graphical and Simplex methods. **08Hrs**
3. **Variants of Simplex algorithm** – Artificial basis techniques. Duality, Economic interpretation of Dual, Solution of LPP using duality concept, Dual simplex method. **06 Hrs**
4. **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. **08 Hrs**

### Part-B

5. **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. **06 Hrs**
6. **Project Management Using Network Analysis:** Network construction, determination of critical path and duration, floats. PERT – Estimation of project duration, variance. **07Hrs**
7. **CPM** – Elements of crashing, least cost project scheduling. Flow in networks: Determination of shortest route, Determination of Maximum flow

through the networks.

**07 Hrs**

8. **Game Theory:** Formulation of games, Two Person - Zero sum game, games with and without saddle point, Graphical solution (2Xn, mX2 game), dominance property.

**06 Hrs**

**TEXT BOOKS:**

1. Taha H.A. – Operations Research and Introduction, Mc. Millan. ISBN -0-02-418940-5.
2. Philips, Ravindran and Soleberg – Principles of Operations Research – Theory and Practice, PHI.

**REFERENCE BOOKS:**

1. Hiller and Liberman, Introduction to Operation Research, Mc. Graw Hill Vth Edition.
2. S.D. Sharma – Operations Research, Kedarnath, Ramnath & Co.
3. J.K.Sharma, Operations Research Theory and Application, 2<sup>nd</sup> Edn, ISBN – 0333-92394-4.
4. Kanthi Swarup & Others – Operations Research, Sultanch and Sons.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

**OPERATIONS MANAGEMENT**

**Sub Code : 10MN 762**  
**Hrs/ Week : 04**  
**Total Hrs. : 52**

**IA Marks : 25**  
**Exam Hours : 03**  
**Exam Marks : 100**

**Part-A**

**Operations Management Concepts:** Introduction, Historical Development, the Trend: Information and Non-Manufacturing Systems, Operations Management, Factors affecting Productivity, International Dimensions of Productivity, The Environment of Operations, Production Systems Decisions – a look ahead.

**07 Hrs**

**Operations Decision Making:** Introduction, Management as a Science, characteristics of decisions, Framework for decision making, Decision methodology, Decision supports systems, Economic models, Statistical models.



**Systems Design and Capacity:** Introduction, Manufacturing and Service Systems, Design and Systems Capacity, Capacity Planning. **06 Hrs**  
**Hrs**

**Forecasting:** Forecasting Objectives and Uses, Forecasting Variables, Opinion and Judgemental methods, Time Series methods, Exponential smoothing, Regression and Correlation methods, Application and Control of Forecasts. **07Hrs**

**Part-B**

**Aggregate Planning and Master Scheduling:** Introduction, Planning and Scheduling, Objectives of Aggregate Planning, Aggregate Planning Methods, Master Scheduling Objectives, Master Scheduling Methods. **07 Hrs**

**Material and Capacity Requirements Planning:** Overview: MRP and CRP, MRP: Underlying Concepts, System Parameters, MRP logic, System refinements, Capacity Management, CRP activities. **07 Hrs**

**Scheduling and Controlling Production Activities:** Introduction, PAC objectives and data requirements, Scheduling strategy and guidelines, Scheduling Methodology, Priority Control, Capacity Control.  
**Single Machine Scheduling:** Concept, Measures of Performance, SPT Rule, Weighted SPT Rule, EDD Rule, Minimizing the number of tardy jobs. **06 Hrs**

**Flow Shop Scheduling:** Introduction, Johnson's Rule for 'n' jobs on 2 and 3 machines, CDS Heuristic.

**Job Shop Scheduling:** Types of schedules, Heuristic Procedure, Scheduling 2 jobs on 'm' machines. **06 Hrs**

**TEXT BOOKS:**

Monks, J.G., Operations Management, McGraw Hill International Editions, 1987.  
Pannerselvam R., Production and Operations Management, PHI, 2002.  
Productions & Operations Management by Adam & Ebert.2002.

**REFERENCE BOOKS:**

Buffa, Modern Production / Operations Management, Wiley Eastern Ltd. 2001.  
Chary, S.N., Production and Operations Management, Tata McGraw Hill, 2002.  
Operations Management by James Dilworth, 2000.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

### MAINTENANCE MANAGEMENT IN MINES

<b>Sub Code</b> : 10MN763	<b>IA Marks</b> : 25
<b>Hrs/ Week</b> : 04	<b>Exam Hours</b> : 03
<b>Total Hrs.</b> : 52	<b>Exam Marks</b> : 100

#### Part-A

**Maintenance of Mining Machinery:** Objectives and types, corrective, plant, preventive and predictive maintenance: Reliability centered maintenance: upkeep of maintenance record.  
**06 Hrs**

Elements of down time of machinery. Possible cause for machine delay and production stoppage. Data selection regarding machine delay and their analysis.

**06 Hrs**

**Maintenance Facilities in Mines for Minor and Major Repairs:** Maintenance planning and scheduling; long and short-term maintenance plans, determining the optimal maintenance policy.

**07 Hrs**

**Maintenance Scheduling:** Maintenance scheduling by the application of network technique. Application of queuing theory in maintenance of mining equipment.

**07 Hrs**

#### Part-B

**Definitions of Reliability, Availability and Maintainability:** Possible measures to increase the availability of mining machinery. Maintenance budgeting: estimation of cost of resources required to meet the expected maintenance load.

**07 Hrs**

**Maintenance management System:** Computerized documentation of plant and equipment management.

**07 Hrs**

**Advanced Maintenance Procedures and Techniques:** Online diagnostic maintenance, tribology techniques vibration and temperature monitoring of machinery. **06**

**Hrs**

Illustrative examples of maintenance of an operating underground mine and open cast mine.

**06 Hrs**

**TEXT BOOKS:**

Maintenance Planning and control, Anthony Kelley, Affiliated East West Press, New Delhi 1981.

Reliability Engineering, Govil A.K., Tata Mc. Graw Hill Company, New Delhi, 1983.

**REFERENCE BOOKS:**

Special Issues of Journals of Mines, Metals and Fuels on Mine Mechanization, Vol. 59, 1992.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

**ROCK MECHANICS LABORATORY**

**Sub Code : 10MNL 77**

**Hrs/ Week : 03**

**Total Hrs. : 42**

**IA Marks : 25**

**Exam Hours : 03**

**Exam Marks : 50**

**Part-A**

Preparation of rock specimens for laboratory tests.

Determination of uniaxial compressive strength of rocks.

Determination of compressive strength index of rocks by using point load tester.

Determination of tensile strength of rock by Brazilian test.

Determination of Protodykanov index of the given rock specimen.

Determination of slake durability index of rocks.

**Part-B**

Determination of shear strength.

Determination of punch shear strength.

Tri-axial testing of samples.

Schmidt hammer test.

Plotting of Stereographic Hemispherical projections of Discontinuities.

Determination of Rock Quality Designation of rock.

**Scheme of Examination:** Students should be asked to conduct two experiments in the examination.

Experiment 1	20 Marks
Experiment 2	20 Marks
<u>Viva Voice</u>	<u>10 Marks</u>
Total	50 Marks

### COMPUTER APPLICATION IN MINING LABORATORY

**Sub Code : 10MNL78**  
**Hrs/ Week : 03**  
**Total Hrs. : 42**

**IA Marks : 25**  
**Exam Hours : 03**  
**Exam Marks : 50**

#### Part-A

Learning of the following commands using a CAD package.

Drawing Commands: Line, arc, circle, polygon, Donut, Solid, Spline Pline, Text, M Line, ellipse, dimensioning, object snaps point, Hatch, layers, Units.

Editing Commands: Limits, Erase, Array, Copy, Move, Offset, Stretch, Pedit, change properties, Trim, Extend, Fillet, Chamfer, Break, Mirror, Scale, Rotate, Zoom, Pan.

Enquiry Commands: Id, list, Dist, Area, DB list, Status

Selection sets i.e. window, crossing, fence, W polygon.

Plotting.

#### Part-B

8 exercises (mining drawing) using any of the above commands.

**Scheme of Examination:** Students should be asked to conduct two experiments in the examination.

Experiment 1	20 Marks
Experiment 2	20 Marks
<u>Viva Voice</u>	<u>10 Marks</u>
Total	50 Marks

**VIII SEMESTER  
GENERAL SAFETY**

**Sub Code : 10MN81**  
**Hrs/ Week : 04**  
**Total Hrs. : 52**

**IA Marks : 25**  
**Exam Hours : 03**  
**Exam Marks : 100**

**Part-A**

**Introduction:** Safety conference and their impact, Safety Education and training Pit Safety committee, Management Safety Audit system. **06 Hrs**

Internal Safety Organization, Safety Policy, health and safety program, Feed back of safety method.

**06 Hrs**

**Occupational Health:** Safety and occupational health survey, notified and general miners diseases and their preventive measures. Permissible standard of dustiness.

**07 Hrs**

**Vocational Training:** V.T. Rules in detail, Indian Electricity Rules applicable to mines, rescue rules in detail.

**07 Hrs**

Part-B

**Safety Rules and Regulations:** Standing order in event fire, inundation and failure of main mechanical ventilator.

**06 Hrs**

**Bye-Laws:** ANFO Explosive, A.C. mains firing, Bulk transportation of explosives, Diesel Locomotives.

**06 Hrs**

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

**07 Hrs**

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

**07 Hrs**

**TEXT BOOKS:**

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

**REFERENCE BOOKS:**

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

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

**MINE MANAGEMENT**

<b>Sub Code</b>	<b>: 10MN 82</b>	<b>IA Marks</b>	<b>: 25</b>
<b>Hrs/ Week</b>	<b>: 04</b>	<b>Exam Hours</b>	<b>: 03</b>
<b>Total Hrs.</b>	<b>: 52</b>	<b>Exam Marks</b>	<b>: 100</b>

**PART-A**

**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.

**06 Hrs**

**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 under ground 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.

**08 Hrs**

**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.

**06 Hrs**

**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.

**06 Hrs**

### **PART-B**

**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.

**08 Hrs**

**Work Study:** Definition, productivity and work study, position 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.

**06 Hrs**

**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.

**06 Hrs**

**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.

**06 Hrs**

### **TEXT BOOKS:**

Mine Management, Legislation and General Safety, S. Ghatak, Coal Field Publishers, Asansol, 1999.

Management by Harold Koontz and Heinz Wehrich, Mc Graw Hill Company, 1990.

#### REFERENCE BOOKS:

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

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

#### MINE TRANSPORT SYSTEM

Sub Code	: 10MN831	IA Marks	: 25
Hrs/ Week	: 04	Exam Hours	: 03
Total Hrs.	: 52	Exam Marks	: 100

##### Part-A

**Classification of Mine Transport Systems and Layouts:** Techno – economics Indices, Transport by gravity. Underground conveyor transport. **08 Hrs**

scraper chain conveyor, belt conveyor, special belt conveyor (cable belt) shaker and vibrating conveyors. Scrapper haulage. **06 Hrs**

**Rail Track:** Construction of rail track, mines car, choice of car, resistant to motion of car, motion of car under gravity, man-riding cars. **06 Hrs**

**Rope Haulage:** Equipment of rope of haulage, rope haulage calculations, scope of application of a rope haulage. **06 Hrs**

##### Part-B

**Locomotive Haulage:** Types of mine locomotives. Load Haul Dumpers. Trackless mining concepts, shuttle cars, mine trucks and their application. **06 Hrs**



**Underground Hydraulics:** Hydraulic breaking, theory of transportation, hydraulic transportation by gravity and by pumps, equipment. Stowing material, transport.

**07 Hrs**

**Aerial Ropeway:** construction of aerial ropeway, Principle of rope way, calculation plan and profile of ropeways.

**07 Hrs**

**Mining Machinery Maintenance:** Maintenance management and safety, CAD, remote monitoring and control in mines and automation.

**06 Hrs**

**TEXT BOOKS:**

1. Mine Transport 1966- N.T. Karelin, Orient Longmans, 1967.
2. Mine Hoisting – M.A. Ramlu, Oxford IBH, 1996.

**REFERENCE BOOKS:**

1. Underground Mining Method – W.A. Hastrulid, Society for Mining, Metallurgy & Exploration Inc. 1992.
2. Modern Coal Mining technology, S.K. Das, Lovely Prakashan, Dhanbad, 1996.
3. Design of Supports in Mining, C.Biron & E. Arioglu, John Wiley & Sons, 1983.
4. Mine Pumps and Haulages, S. Ghatak, 1990.
5. Coal Mining Practice, Vol. I to III, I.C.F. Statham, The Coxtan Pub. Co. Ltd. 1960.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

**MINING GEOSTATISTICS**

**Sub Code : 10MN 832**  
**Hrs/ Week : 04**  
**Total Hrs. : 52**

**IA Marks : 25**  
**Exam Hours : 03**  
**Exam Marks : 100**

**Part-A**

**Introduction to Geostatistics:** Definition, Schools of geostatistics. Estimation models for mine evaluation – average method, polygonal or triangular method.

**06 Hrs**

**Deterministic Mathematical Model:** Independent random model, trend with random noise, correlated random model and trend with correlated random

residuals.

**08 Hrs**

**Correlated Random Theory-1: Semi Variogram:** Definition of semi-variogram, mathematical models of semi-variogram.

**06Hrs**

**Practical problems** – Isotropy and anisotropy, stationarity, regularization, nugget effect.

**05 Hrs**

Part-B

**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.

**08 Hrs**

**Correlated Random Theory – 3: Kriging:** Kriging and optimal valuation, kriging equations in general cases.

**06 Hrs**

**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.

**07 Hrs**

**Example to calculate** planning cut-off grade. Optimization of drilling programme. Misclassified tonnages – actual Vs estimated. Grade control.

**05 Hrs**

**TEXT BOOKS:**

1. An Introduction to Applied Geostatistics, Issaks and Srivastava, Oxford, IBH, 1990.
2. Mining Geostatistics, Journel, 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.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

**TOTAL QUALITY MANAGEMENT**

**Sub Code : 10MN 833**

**IA Marks : 25**

**Hrs/ Week : 04**

**Exam Hours : 03**

**Total Hrs. : 52**

**Exam Marks : 100**

**Part-A**

1. **Overview of Total Quality Management:** Introduction – Definition, Basic Approach, Contribution of Gurus – Total Quality Management, TQM framework, Historical Review, Benefits of TQM, TQM organization.

**05 Hrs**

2. **Leadership:** Characteristics of quality leaders, Deming's philosophy, Role of TQM leaderships – Customers' satisfaction, Customers' perception, Handling customers' complaints, Feedback, Employee involvement, role of Motivation, Suggestion system, Performance appraisal Continuation Process Improvement – Juran's Trilogy, PDSA cycle, Problem Solving methods, Imai's Kaizen, Reengineering, 6 sigma.

**08 Hrs**

3. **Tool & techniques of TQM:** Bench marking, Definition, Process of bench marking, quality Management Systems, ISO – 9000 series of standards, Implementation and documentation of ISO – 9000, Introduction to QFD and QFD process, Quality by design, rationale for implementation of quality by design, TQM exemplary organization, FMEA (Failure Mode and Effect Analysis), Design FMEA and Process FMEA studies.

**07 Hrs**

4. **Statistical Process Control:** 7 Basic tools of quality control, Control charts for variables, Construction, interpretation, Analysis using X-R

control charts, process capability estimation, process capability indices, process improvement through problem analysis (Intensive coverage with numerical problems)

**06 Hrs**

**Part-B**

5. **Control Charts for Attributes:** Construction interpretation and analysis of P- Charts, NP- Chart, C- chart, U-Chart, Process improvement through problem analysis (Intensive coverage with numerical problems).

**08 Hrs**

6. **Product Acceptance Control:** Design of Single sampling, Double sampling and Multiple sampling plans, Analysis of the characteristics of the above sampling plans, Selection of sampling plans for Product Acceptance Control through IS 2500 Part 1 and Part 2.

**06 Hrs**

7. **Reliability and Life Testing:** (Basic treatment only): reliability analysis of components, standard configuration systems like series, parallel redundancy and principles of design for reliability, Procedure for life testing.

**06 Hrs**

8. **Experimental Design:** One factor designs, two factor designs, Orthogonal Design, Full factorial and fractional factorial design, Taguchi's philosophy of quality engineering, Loss function, Orthogonal array, signal noise ratio, parameter design, Tolerance design (Basic Conceptual treatment only)

**06 Hrs**

**TEXT BOOKS:**

1. Total quality Management by Dale H. Besterfield (Etal), Pearson Education III, Edition – I, Indian Reprint, 2004.
2. Statistical quality control by Grant Levenworth.

**REFERENCE BOOKS:**

1. Statistical Quality Control by Douglas C. Mantego Mary
2. Total Quality Management Texts Cases by K. Shridhara Bhat, Himalaya Publishing House, Edition I, 2002.
3. quality Control and Total Quality Management – P.L. Jain, Tata Mc. Graw Hill Publishing Co. Ltd., New Delhi.
4. A New American TQM – Four Practical Revolutions in Management, Shoji Shiba, Alan Graham & David Walden, Productivity Press, Portland (USA).

5. Managing for total Quality, N. Loothetis, Prentice Hall of India, New Delhi, 2002.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

### DEEP MINING

Sub Code : 10MN841                      IA Marks : 25  
Hrs/ Week : 04                              Exam Hours : 03  
Total Hrs. : 52                              Exam Marks : 100

#### Part-A

1. **Rock Pressure:** Rock pressure in development, rock pressure in stoping, rock burst in stoping and development.  
**07 Hrs**
2. **Ground Control:** Supports: rigid, yielding, temporary and permanent. Supports for development headings, stopes, shafts, winzes, crosscuts, stowing practices, pack wallings, concreting and self-supporting strata.  
**07 Hrs**
3. **Mining:** Stope planning, stoping sequence, minimization of rock bursts and their effects, reclamation of collapsed working.  
**06 Hrs**
4. Development in highly stressed ground, special mining methods.  
**06 Hrs**

#### Part-B

5. **Ventilation:** Effect of temperature, humidity and barometric pressure in deep mines, sources of heat in deep mines, methods to reduce humidity. Spot coolers air conditioning plant surface and underground. Gases in deep mines, ventilation standards, fire zones, fire seals, key points, precautions against fire.  
**06 Hrs**
6. **Deep winding:** Layouts, cage versus skip hoisting, shaft equipment and multilevel winding.  
**06 Hrs**

7. **Pumping:** Layouts, drainage, position of pump chambers, special pumps, delivery lines, capacity of pumps and pump chambers.

**06 Hrs**

8. **Personal:** Importance, experience in deep mining, welfare measures etc.,

**08 Hrs**

**TEXT BOOKS:**

1. Deep Mining Jackspalding, Mining Publication Limited Inc. 1949.
2. Mine Ventilation and Air Conditioning by H.L. Hartman, Wiley International, 1976.

**REFERENCE BOOKS:**

1. Mine Ventilation by G.B. Mishra, Oxford University Press, 1996.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

**MINE ENVIRONMENT AND ECOLOGY**

**Sub Code : 10MN 842**  
**Hrs/ Week : 04**  
**Total Hrs. : 52**

**IA Marks : 25**  
**Exam Hours : 03**  
**Exam Marks : 100**

**Part-A**

1. **Introduction:** Definition of Environment and Ecology, Subdivision of ecology ecosystem – classification of ecosystem, structural and functional components of ecosystem, energy flow in the ecosystem. Tropic structure, ecological pyramids.

**Bio-Geo-Chemical Cycles:** Types, sulphur cycle, Phosphorous cycle, Nitrogen cycle, Carbon cycle, Hydrological cycle. Impact of human on environment. Development and preservation of ecosystem, soil conservation, soil erosion, afforestation.

**07 Hrs**

2. **Mining and the Environment:** Mineral Production, History of environmental problems. Range and importance of environmental problems: Nature of problems factors influencing the nature and extent of environmental impact. Visual Impact; landscape analysis, sources of visual impact, landscape planning.

**06 Hrs**

3. **Air Pollution:** Nature and effect of the main pollution's: Gaseous pollutants like point source, Non point sources, Dust formation and movement, Measurement and monitoring, ambient measurement, source measurement, monitoring program, effect of air pollution such as greenhouse effect, depletion of ozone layer and its effects.

**07 Hrs**

4. **Water pollution:** Introduction of various types of water in the mineral industries, Individual Pollutants: Specific pollution problems, such as acid mine drainage, heavy metal pollution, eutrophication, De-oxygenation.

**06 Hrs**

**Part-B**

5. **Control of Air & Water Pollution:** air pollution control, control of particulate of point source and non-point sources, control of gases-point and non-point sources and disposal of collected pollutants. Control of water Pollution: Monitoring sampling procedures, water control, handling of polluted water, water treatment water quality standards.

**07 Hrs**

6. **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.

**07**

**Hrs**

7. **Air Blast:** causes of air blast, effects of air blast, remedial measures.

**06 Hrs**

8. **Tailing Dams:** construction of upstream & down stream tailing dams, construction of centerline methods & their advantages & disadvantages. Problems associated with tailing dams. Reclamation planning. Land use analysis, reclamation techniques, problems, revegetation process.

**E.I.A. & E.M.P.:** Base line studies, importance of environmental impact assessment, Environmental impact assessment, environmental management plan.

**06 Hrs**

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

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

**ROCK EXCAVATION ENGINEERING**

**Sub Code : 10MN843**  
**Hrs/ Week : 04**  
**Total Hrs. : 52**

**IA Marks : 25**  
**Exam Hours : 03**  
**Exam Marks : 100**

**Part-A**

1. **Introduction:** Concepts and historical developments in rock excavation, factors affecting rock fragmentation, mechanism of rock breakage and fractures. **06 Hrs**
2. **Rock Fragmentation:** Method of rock fragmentation – explosive action, cutting, ripping and impacts. **06 Hrs**
3. **Properties of Rocks for Machine Process:** Application of compression, tensile and multi – axial strength, index test and abrasivity, anisotropy, elasticity, porosity, lamination, bedding joints in rock fragmentation process. **07 Hrs**
4. **Principles of Rock Cutting Technology:** Drilling and its various types i.e., rotary, percussive, rotary – percussive mechanism of rock



percussion, theory of single tool rock cutting, crack initiation and propagation, breakage pattern.

**07 Hrs**

**Part-B**

5. Rock cutting pricks, discs and rolls cutter. Water jet cutting. Method of assessing drillability and cuttability of rock.

**06 Hrs**

6. **Principles of Excavation Machines:** Roadheaders, TEMs' coalface cutters loaders, Bucket Wheel Excavators and Continuous Miners both surface and underground.

**08 Hrs**

7. **Rock Cutting Tools:** Cutting tool material – different types relative application and their choice, tool shape and size, specific energy consumption, tool wear,

**06Hrs**

8. Effect of operational parameters on tool performance, maintenance and replacement of cutting tools of excavating machines.

**06 Hrs**

**TEXT BOOKS:**

1. Principles of Rock Fragmentation, G.B. Clark, John Wiley and Sons, New York, 1987.
2. Rock Mechanics and Design of Structures, Obert & Duvall, John wiley and Sons, New York, 1962.

**REFERENCE BOOKS:**

1. S.M.E. Mining Engineering Hand Book, Hartman, Society for Mining, Metallurgy and Exploration Inc. 1982.
2. Introductory Mining Engineering, Hartman, John Wiley International, 1976.
3. Diamond Drilling, C.P. Chughra, Oxford IBH, 1986.

**Scheme of Exam:** Total **EIGHT** questions are to be asked, **FOUR** from each part. The student has to answer any **FIVE** full questions selecting at least **TWO** from each part.

## MINING PROJECT

**Sub Code : 10MN 85**  
**Hrs/ Week : 03**  
**Total Hrs. : 52**

**IA Marks : 25**  
**Exam Hours : 03**  
**Exam Marks : 100**

### **Objectives:**

1. To encourage the students to work in a group so that they will develop team and leadership qualities.
2. To make the students to learn the preparation of a detailed project proposal, execution of the project and preparation and presentation of a final project report.
3. To develop in the students multi skills.
4. To develop in the students communication skills.

### **Guide Lines for Project Work:**

1. Project can be undertaken in-house or in a industry or in a research / service organization.
2. Generally a Project batch consists of a minimum of 2 students and a maximum of 4 students.
3. The Project Synopsis should be approved within a period of 15 days by a committee consisting of Head of the concerned department as a Chairman and two senior teachers of the department of which one may be the internal guide.
4. The topic of the project may be in the same branch in which the student is studying, or it may be multidisciplinary. It may involve investigation/ analytical study / experimental work / fabrication / Statistical study / simulation etc. it may also be field oriented. The project should be preferably be taken in the latest trends in Engineering and Technology.
5. There should be a project monitoring committee in each department consisting of Head of the Department and two senior teachers of the Department.
6. Attendance for Project Work will be treated on par with any other practical / practical course.
7. Laboratory slot of 4 hours / week as indicated in the scheme is to be provided by the department.
8. The staff members will be shown a load of 3 hours (1 ½ units) for guiding, generally 4 batches of students.