

## 15MN32 Mining Geology-I

**Objective:** Learn about Importance of Mining Geology, Types of Rocks, Structures, Geological Disturbances in Rocks and their Effects on rock Structures.

<b>Sub Code : 15MN32</b>	<b>IA Marks : 20</b>
<b>Hrs/week : 04</b>	<b>Exam Hours : 03</b>
<b>Total Hrs : 50</b>	<b>Exam Marks : 80</b>

### MODULE-1: Physical Geology

Geology and its role in Mining, Earth as a planet- internal structure and composition of the earth. Geological work of Wind, Rivers, Lakes, Glaciers, Seas, Oceans and ground water, influences of these process on Mining Engineering Sectors. Earthquakes and seismic hazards and their relation with volcanoes. Engineering protection against earthquakes. **10 Hours.**

### MODULE-2: Mineralogy & Petrology

**Mineralogy :** Definitions, Physical properties of minerals, chemical composition, occurrence and uses of Quartz and its varieties, Felspar, Carbonates Mica, Garnet, Olivine, Pyroxenes and Amphiboles.

**Petrology:** Broad classification of rocks into Igneous, Sedimentary and Metamorphic rocks with examples. Structures, classification of Igneous rocks, classification of sedimentary rocks depending upon the grain size, Metamorphic agents and kinds. **10 Hours**

### MODULE-3: Texture, Structure and Mineralogy of rocks

**Igneous Rocks:** Granite, Diorite, Gabbro, Dunite, Pegmatite, Porphyries, Dolerite, Basalt, Rhyolite & Obsidian

**Sedimentary Rocks:** Conglomerate, Breccia, Sandstone, Limestone & Shale.

**Metamorphic Rocks:** Gneiss, Schist, Quartzite Marble & Slate. **10 Hours**

### MODULE-4: Geological Time Scale & Indian Stratigraphy

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

**Indian Stratigraphy:** Physio-geographic divisions of India with special reference to Dharwar, Cuddapah, vindhyans, gondwanas and tertiary system with their economic importances. **10 Hours.**

### MODULE-5: Structural Geology

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

Structural features of rocks, interpretation of topographic maps. Classification of folds, faults, joints and unconformities, their recognition in the field and importance in mining operations. **10 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(MODULE-I-V)

## **REFERENCE BOOKS:**

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

## **15MN33 ELEMENTS OF MINING ENGINEERING**

**Objectives:** Learn the Basics of Mining, Importance of Underground and Surface Mining, Method of Opening a Deposit with various Means of Entry, Special and various Conditions to be overcome in Shaft Sinking and their Accessories.

<b>Sub Code</b>	<b>: 15MN33</b>	<b>IA Marks</b>	<b>: 20</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>

### **MODULE-1: Introduction to mining engineering and Opening up of deposits**

**Introduction to mining engineering:** Significance to mining industry in national economy and infrastructure building, basic mining terminologies, geo-technical investigations, classification of mining methods, selection criteria for underground or opencast mining methods.

**Opening up of deposits:** Types, size and location of entries into underground coal and other minerals.

**10 Hours**

### **MODULE-2: Shaft sinking operation, Special and mechanized methods of shaft sinking**

**Shaft sinking operation:** Preliminary geo-technical investigations for a shaft sinking, surface arrangements for sinking shafts and equipment. unit-operations of drilling, blasting, mucking; Temporary and permanent lining. Construction of insets and shaft stations.

**Special and mechanized methods of shaft sinking:** Methods of sinking shaft in water-logged, pressurized strata in loose and running soils. Mechanized sinking, shaft borers, drop raise method. Need for widening and deepening of operating shafts. Different methods for widening and deepening shafts- cycles of operation, equipment and manpower needed.

**10 Hours**

### **MODULE-3: Development of workings**

**Development of workings:** Drivage of cross cuts, drifts, inclines and raises by conventional and mechanized methods. Arrangements for ventilation, supports, lighting, transportation and drainage; Drilling patterns for underground coal mines and hard rock mines.

**10 Hours**

### **MODULE-4: Mine supports**

**Mine supports:** Types of support: timber, prop, chock/cog, cross bar, concrete, steel and hydraulic supports. Yielding and rigid supports. Fore poling, roof stitching, roof bolting, applicability, advantages and limitations of various supports.

**10 Hours**

### **MODULE-5: Tunneling methods**

**Conventional method:** drilling and blasting method, types of drill patterns, blasting and transportation of muck.

**Mechanized method:** construction and working principle of tunnel boring machine, applicability, advantages and limitations of tunnel boring machine.

**Shield tunneling method:** construction and working principle, applicability, advantages and limitations.  
**10 Hours**

**TEXT BOOKS:**

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

**REFERENCE BOOKS:**

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

**15MN34 DRILLING AND BLASTING ENGINEERING**

**Objectives:** Learn the Basics of Drilling and Blasting, Various Accessories used, Theory of Drilling and Blasting, Powder Factor, Charge Factor and their Importance, Drilling and Blasting at Various Conditions

	<b>Sub Code : 15MN34</b>	<b>IA Marks :20</b>
	<b>Hrs/week : 04</b>	<b>Exam Hours : 03</b>
	<b>Total/week : 50</b>	<b>Exam Marks : 80</b>

**MODULE- 1: Principles of Drilling & Drill Bits**

**Principles of drilling:** Principles of rock drilling, drillability, drillability index, factors affecting the drillability. Mechanics of drilling. Selection of drills, care of drills. Energy correlation of drills.

**Drill Bits:** Various types of drill bits and their design aspects. Study of bit life, factors affecting the bit life. Thrust feed and rotation, alignment and deviation in drilling.  
**11 Hours**

**MODULE- 2: Explosive**

**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.  
**10 Hours**

**MODULE- 3: Firing of Explosives & Blasting Methods**

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

**Blasting Methods:** Preparation of charge, stemming and shot firing. Choice and economical use of explosives,

Misfires, blown out shots, incomplete detonation, their causes, Prevention and remedies.

**10 Hours**

#### **MODULE- 4: Handling of Explosives**

**Handling of Explosives:** Surface and underground transport of explosives, bulk transport in quarries. Storage and handling of Explosives. Magazines, Accidents due to explosives. Precautions and safety measures during transportation. Substitutes for explosives and their applications-hydrox, Cardox, Hydraulic coal burster, airbox, pulsed infusion shot firing.

**11 Hours**

#### **MODULE- 5: Mechanics of Blasting & Effects of Vibration**

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

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

**10 Hours**

#### **TEXT BOOKS:**

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

#### **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

#### **15MN35 COMPUTER AIDED MACHINE DRAWING\***

**\* NOTE: To be checked with the Mechanical syllabus**

<b>Sub Code : 15MN35</b>	<b>IA Marks : 20</b>
<b>Hrs/week :04</b>	<b>Exam Hours : 03</b>
<b>Total Hrs. : 50</b>	<b>Exam Marks : 80</b>

#### **MODULE-1:**

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.**

**Section of Solids:** Section of Pyramids, Prisms resting only on their bases (No Problems on axis inclinations, spheres and hollow solids), True shape of sections.

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

**10 Hours**

## **MODULE-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.

**10 Hours**

## **MODULE-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.

**10 Hours**

## **MODULE-4:**

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

**10 Hours**

## **MODULE-5:**

### **Assembly Drawings**

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. I.C. Engine connecting rod
4. Machine vice
5. Rams bottom safety valve
6. Plummer block (Pedestal Bearing)
7. Tool Head of shaper

**10 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.
4. “Machine Drawing”, by R.K.Swamy.
5. “A Text Book of Computer Aided Machine Drawing”, by K.R.GopalKrishna.
6. “Machine Drawing”, by K.L.Narayana.

### **15MNL38 MINING ELECTRICAL ENGINEERING LABORATORY**

**Objective:** Learn to calculate Resistance / Inductance / power / Efficiency / Power Factor.

To study the speed / Torque characteristics of AC and DC machines and to calculate losses and find their Efficiency,

To calculate losses in a transformer and to plot the efficiency curves

<b>Sub Code : 15MNL38</b>	<b>IA Marks : 20</b>
<b>Labs/Instructions</b> <b>Hrs/week : 03(02 Hrs Lab + 01 Hr Tutorial)</b>	<b>Exam Hours : 03</b>
<b>Total Number of Lecture Hrs : 48</b>	<b>Exam Marks : 80</b>
<b>Credits = 02</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**

**Part – C : Viva voce 10 Marks**

## 15MN361 MINING ELECTRICAL ENGINEERING

**Objectives:** Learn the Importance of Electrical and Electrical Usage in Mining Industry and their Applications for Various Mining Machineries used.

<b>Sub Code: 15MN361</b>	<b>IA Marks :20</b>
<b>Hrs/week: 04</b>	<b>Exam Hours : 03</b>
<b>Total Hrs: 50</b>	<b>Exam Marks : 80</b>

### MODULE-I: Introduction

**Introduction:** Scope and importance of electrical engineering in Mining, Qualification, roles and responsibilities of electrical inspectors, Indian Electricity rules applicable to Mining.

**Introduction to Electrical Drives and its application in Mining:** Electrical Drives, Advantages, parts, Choice of Electrical Drives, status of AC and DC Drives, precautions in coal mines, methods of neutral grounding, types of electric drives for control of winders, shearers and conveyors, electric drives for mine hoists.

**10 Hours**

### MODULE-2: DC Machines

**DC machines:** Types and characteristics of DC Motors, voltage and torque equation of dc motors, regulation, speed control of shunt motors – Armature, Flux and Voltage control, problems on shunt motors. Electric braking of shunt motors – Dynamic, plugging and regenerative, Characteristics of dc shunt generator.

**10 Hours**

### MODULE-3: AC Machines

**AC Machines:** Types and working principle of 3 phase Induction motors, working principle of synchronous motor, problems on synchronous motors, speed control of induction motors, plugging of an induction motor, working principle of an alternator.

**10 Hours**

### MODULE-4: Protective devices & Power Distribution in Mines

**Protective Devices:** Fuses - Types, Air break switches, Air circuit breakers, Oil Circuit breakers, principle of underground signaling in mines, types of motor enclosures in mines

**Power Distribution in mines:** Single line diagram of power distribution on surface and in underground mines, Cables – Various types for surface and underground mines, Flameproof apparatus, Intrinsically safe apparatus, Standard voltage levels for mining as per IER 1956.

**10 Hours**

## **MODULE-5: Mine Illumination**

**Mine Illumination:** Definition, laws of illumination, types of lighting sources, comparison of conventional and solid state lighting, general lighting in underground and surface mines, standards of mine lighting, LED lighting – working, types used in underground and surface mines. **10 Hours**

### **TEXT BOOK:**

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

### **REFERENCE BOOKS:**

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

## 15MN42 MINING GEOLOGY – II

**Objectives:** Learn about Importance of Mining Geology, Types of Rocks, Structures, Geological Disturbances in Rocks and their Effects on rock Structures

<b>Sub Code: 15MN42</b>	<b>IA Marks:20</b>
<b>Hrs/week:04</b>	<b>Exam Hours:03</b>
<b>Total Hrs.:50</b>	<b>Exam Marks:80</b>

### MODULE- 1: Application of geology in Mining Engineering

**Application of geology in Mining Engineering:** Classification of Geology- Pure & Applied Geology, Mining Geology, Delineation of deposits, Limits of Economic Mining, Role of Mine Geologist, Geological Work in Operating Mine. **08 Hours**

### MODULE- 2: Economic Geology & Mineral Deposits

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

**Mineral Deposits:** Study of Various processes of formation of mineral deposits- Magmatic, Hydrothermal, Weathering, Sedimentation, Sublimation, Evaporation, Oxidation and Supergene enrichment and Metamorphic deposits. **10 Hours**

### MODULE- 3: Occurrence & Distribution of Minerals in India

**Occurrence & Distribution of Minerals in India:** Iron, Copper, Lead, Zinc, Chromite, Gold, Manganese, Beach sand, Diamond, Radio-active minerals- Uranium, Radium, Rubidium, Strontium, Refractory minerals, Ceramic minerals and Building stones. **10 Hours**

### MODULE- 4: Coal, Petroleum and Natural Gas

**Coal:** Definitions, physical and chemical properties, variations and ranks of coal. Important constituents of coal, origin of coal, structural features of coal seams, Chief characteristics of Indian coals. Important Coal fields of India.

**Petroleum & Natural gas:** Meaning, Origin, Composition, Accumulation, Structural features, Migration of petroleum and Natural Gas, Major oil fields of India. **12 Hours**

### MODULE- 5: Prospecting & Exploration Geology

**Prospecting:** Definition, types- Geological, Geophysical and geo-chemical methods. Remote sensing techniques for prospecting.

**Exploration Geology:** Definition, Principles of mineral exploration, stages of mineral Exploration, Factors involved in planning and drilling in detail exploration. Core Drilling and Core recovery. Methods of sampling, assaying and estimation of ore reserves. Guides for location of ore deposits with particular reference to structural and stratigraphical guides. Geological field work, Methods of surface, sub-surface mapping, Interpretation and use of field data. **12 Hours**

**TEXT BOOKS:**

1. **“Mining Geology “**, Unit-I & II, Mckinistry, , Asia Publication. 2<sup>nd</sup> Ed. 2005.
2. **“Economic Mineral Deposits,”** Unit-III, IV & V, Bateman A.M John Wiley and sons, 2<sup>nd</sup> Ed. 1999.

**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.
3. **“A Handbook of Economic Geology”**, A.K.Sen & P.K.Guha,Modern Publishers, Calcutta, 1981.
4. **“Geological Prospecting & Exploration”** by V.M.Kreiter, MIR Publishers, Moscow, 1968.
5. **“Geology of India & Burma”** by M.S.Krishna.
6. **“India’s Mineral Resources”** by S.Krishnaswamy.
7. **“Petroleum Geology”** by Levorson.

## 15MN43 MINE SURVEYING – I

**Objectives:** Learn the Basics of Surveying, Types of Surveying and their Usage in Practical Applications.

<b>Sub Code : 15MN43</b>	<b>IA Marks : 20</b>
<b>Hrs/week : 04</b>	<b>Exam Hours : 03</b>
<b>Total Hrs : 50</b>	<b>Exam Marks :80</b>

### MODULE- 1: Introduction and Linear Measurements

**Introductions :** Definition of surveying, Classifications of surveying, basic principles of surveying, differences between plan and map, Errors - Sources, classification and preventions, accuracy and precision in surveying.

**Linear measurements:** Types of chain and tape, types of linear measurements: chaining, optical, EDM devices; Ranging - direct and indirect. Measurement of distances on surface and in underground mines, error and corrections in chaining with numerical problems.

**10 Hours**

### MODULE- 2: Chain Surveying

**Chain Surveying:** Definition, Purpose and Principles, types of offsets, setting out of right angles, obstacles (theory and problems), working principles and uses of optical square, prism square and cross staff.

Methods of chain survey, booking and plotting, conventional symbols, cross staff survey.

**10 Hours**

### MODULE- 3: Compass Surveying

**Compass Surveying:** Angles, meridian and bearings (theory and problems). Principle, working and use of prismatic and surveyors (Dial) compass. Magnetic Dip and declination (theory and problems). Local attraction-determination and correction (Theory & problems), errors and preventions.

Methods of compass traversing - loose needle method and fast needle method. Advantages and disadvantage of compass survey, errors and its prevention.

**10 Hours**

### MODULE- 4: Leveling

**Leveling:** Principles and basic definition, types of levels - including modern level (Auto, Tilting & Precise level), fundamental axis and parts of dumpy level, temporary adjustments, sensitiveness of bubble tube, curvature and refraction correction (Theory & problems), Methods of leveling - geometrical, trigonometrically and physical method. Classification of leveling - simple and compound leveling, Fly leveling, check leveling, profile leveling, cross sectioning.

Reduction of levels - height of instrument method - raises & fall method (Theory & problems), transfer of levels from surface to underground, errors and its precautions.

**11 Hours**

### MODULE- 5: Plane Table Survey and Contouring

**Plane table survey:** Equipments and accessories, advantages, disadvantages and limitations of plane table survey, orientation and method of orientation; Methods of Plane table survey - radiation, intersection and traversing, resection - two-point problem and three point problem (Bessel's graphical method), errors and its precautions.

**Contouring:** Contour, contour interval and characteristics, methods - direct and indirect, interpretation - arithmetic and graphical method, uses of contours

**11 Hours**

**TEXT BOOKS:**

1. **“Surveying Vol I”** B.C.Punmia, Laxmi publications, 1999 (Unit-I to V).
2. **“Mine Surveying Vol I”** Ghatak, Coal Field Publishers, 1998 (Unit-I to V).

**REFERENCE BOOKS:-**

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

## 15ME44 Mechanics of Materials

<b>Subject Code: 15ME44</b>	<b>IA Marks: 20</b>
<b>Hrs/week : 04</b>	<b>Exam Hours:03</b>
<b>Total Hrs : 50</b>	<b>Exam Marks:80</b>

### MODULE-1:

**Stress and Strain:** Definition of Stress, Strain and Stress-strain relations, Mechanical behaviour of materials, Linear elasticity, Young's modulus of elasticity and Poisson's ratio, Stress-Strain curves in tension for Mild steel, Cast iron and non-ferrous metals.

Bars of uniform cross section, varying cross section and discontinuous/stepped cross section, Extension / Shortening under point (axial) load, body force (self weight), temperature change, Compound bars, Composite Sections, Numerical examples.

**10 Hours**

### MODULE-2:

**Compound Stress:** Uniaxial, Biaxial, General 2D stress state, Definition of Plane stress and Plane strain states, Stresses on inclined sections, Principal stresses, Principal planes, Principal axes, Maximum shear stress, Mohr's circle, Numerical examples.

Expression for Volumetric strain, Elastic constants, Numerical examples

**Cylinders:** Determination of deformations, strains and stresses in thin cylinders subjected to internal pressure, Numerical examples.

**10 Hours**

### MODULE-3:

**Bending Moment and Shear Force diagrams:** Types of beams, loads and reactions, Definition of shear force and bending moment, sign conventions, Relationship between shear force, bending moment and rate of loading, Shear force and bending moment diagrams for different beams, Numerical examples involving beams subjected to concentrated loads, uniformly distributed load (UDL), uniformly varying load (UVL) and couple.

**10 Hours**

### MODULE-4:

**Stresses in Beams:** Euler-Bernoulli beam theory, Relationship between bending moment, bending stress, and radius of curvature. Transverse Shear stresses, shear stress across rectangular, circular, symmetrical I- and T-sections only, Numerical examples.

**Deflection of Beams :** Governing differential equation and its solution, Double integration method for cantilever and simply supported beams for point load, UDL, UVL and Couple, Macaulay's method, Numerical examples.

**10 Hours**

### MODULE-5:

**Torsion of shafts with circular cross section:** Derivation of governing equation, Torsional rigidity, Torsional strength, Power transmitted by solid and hollow shafts, Numerical examples

**Elastic stability of Columns:** Euler's theory for axially loaded elastic long columns, Derivation of Euler's load for various end conditions, limitations of Euler's theory, Rankine's formula, Numerical examples.

**10 Hours**

**TEXT BOOKS:**

1. Mechanics of Materials, in SI Units, Ferdinand Beer and Russell Johnston, 5th Ed., TATA McGraw Hill-2003.
2. Mechanics of Materials, R. C. Hibbeler, Prentice Hall. Pearson Edu., 2005
3. Mechanics of Materials, James M. Gere, Thomson, Fifth Edition, 2004.

**REFERENCE BOOKS:**

1. Mechanics of Materials ,K.V. Rao, G.C.Raju, First edition 2007
2. Mechanics of Materials by J.B.K Das.
3. Strength of Materials, Bhavikatti, Vikas publications.2nd Edition,1998.
4. Strength of Materials, S.S.Rattan, Tata McGraw Hill 2009
5. Engineering Mechanics of Solids, Egor.P.Popov,Pearson Edu.India.2nd Edition 2007.
6. Strength of Materials by Vazirani V.N & Ratwani, Vol-II, Kanna Publishers, 1996.

## 15MN45 THERMODYNAMICS AND FLUID MECHANICS

Sub Code : 15MN45	IA Marks : 20
Hrs/week : 04	Exam Hours : 03
Total Hrs : 50	Exam Marks : 80

### MODULE- 1: Basic Concepts of Thermodynamics and Energy

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

**Energy:** classification, stored energy and energy in motion. Work and heat-definition, work done at the moving boundary. Comparison between work and heat. **11 Hours**

### MODULE- 2: Laws of Thermodynamics and Air Compressors

**I and II Laws of thermodynamics:** I and II Laws of thermodynamics: Statements, Cyclic processes, Numerical Problems.

**Air Compressors:** Single stage and multistage reciprocating air compressors on surface and in underground mines. Expression for work done during single stage air compression with and without clearance volume. Volumetric efficiency. Simple numerical problems on single stage compressors only. **11 Hours**

### MODULE- 3: Fluid Mechanics and Fluid Flow Measurements

**Fluid Mechanics:** Definition and properties of Fluids, ideal and real fluid units, systems of measurement. Fluid properties-density, specific weight, specific volume, specific gravity, viscosity, compressibility, surface tension and capillarity, vapour pressure and cavitation,

**Fluid flow measurements:** Venturimeter, Orifice meter. Flow through orifices and notches. Loss of head due to friction in pipes. Discharge measurements in pipes. **10 Hours**

### MODULE- 4: Fluid Statics and Buoyancy

**Fluid Statics:** 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, diaphragm pressure gauge and dead weight pressure gauge. Total pressure and center of pressure on submerged plane surfaces; horizontal, vertical and inclined planes, curved surface submerged in liquid.

**Buoyancy:** definition, center of buoyancy, metacenter and metacentric height, conditions of equilibrium of floating and submerged bodies, determination of metacentric height experimentally and theoretically. **10 Hours**

### MODULE- 5: Fluid Dynamics

**Fluid Dynamics:** Introduction to equation of motion, Euler's equation of motion, Bernoulli's equation from first principles and also from Euler's equation, limitations of Bernoulli's equation, assumptions, hydraulic gradient line and total energy line. Numerical Problems. **10 Hours**

**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,”** R.K.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.
4. **“Thermodynamics & Fluid Mechanics”**, B.E.T, A.Venkatesh, Universities Press.2008
5. **“An Introduction to Thermodynamics”**, Y.V.C.Rao, Wiley Eastern, 1993
6. **“Fluid mechanics”**, by Ramamrutham

## **15MN461 UNDERGROUND MINE MECHANIZATION –I**

**Objectives:** Learn about Various Mining Machineries pertaining to Entry and Exit of Men, Material, Calculation of Power Required for Various Transporting Systems.

<b>Sub Code: 15MN461</b>	<b>IA Marks: 20</b>
<b>Hrs/week: 04</b>	<b>Exam Hours: 03</b>
<b>Total Hrs. : 50</b>	<b>Exam Marks: 80</b>

### **MODULE- 1: Principles, Generation, Distribution & Utilization of Compressed air**

**Compressed Air:** Definition- Air pressure, Laws governing compression & expansion of gases (derivation & simple problems), Specific heat of gas.

**Generation & Distribution of compressed air:** Sources of power for compressors-Rotary & Centrifugal compressors, Transmission and distribution of compressed air in mines, loss of compressed air.

**Utilization of compressed air-** Jack hammer, Rocker shovel, Air turbines & Reciprocating compressed air engine.

**10 Hours**

### **MODULE- 2: Ropes & Rope haulage systems**

**Ropes:** Types and details of construction of different types of ropes and their respective uses in mines, Selection, Care and storage of ropes, Socketing- split, cone & inter locking wedge; rope splicing, Safety factor for ropes used in winding.

**Rope haulage systems:** Elements of Mine haulage system and classification, Techno economic indices of Mine haulage system, Rope haulage: Different types- direct, endless, main & tail, gravity, Limitations, applications merits & demerits of different haulages, numerical problems.

**12 Hours**

### **MODULE- 3: Mine transportation**

**Conveyors:** Types of conveyors-belt, scraper chain, shaker, high angle conveyor, cable belt, rope belt and steel plate, its limitations and their applications, problems on calculation of power requirement and capacity of conveyors.

**Locomotives:** Types-Diesel, Electric battery, Trolley wire, its limitations and their applications. **10 Hours**

### **MODULE- 4: Winding systems in Mines**

**Winding systems in Mines:** Elements of winding system, Types- drum, friction, electric, Compressed air, Koepe winding and Multirope winders, Method of balancing the loads, Duty cycle, Numerical problems.

**Breaking system of winders:** Mechanical, Electrical and automatic breaking system of winders, Safety devices on winders.

**10 Hours**

### **MODULE- 5: Study of layouts for Mine transportation**

**Study of Layouts for Mine transportation:** Study of respective layouts for all the systems of transportation. Study of pit top and pit bottom layouts. Skip and cage winding. Winding from different levels in a shaft.

**10 Hours**

**TEXT BOOKS:**

1. “Elements of mining technology Vol III” , , D.J.Deshmukh, Vidyasewaparakashan, Nagpur, 7th Ed. 2000 Unit-I to V.
2. “Mine pumps haulage & winding”, S. Ghatak, Coalfield Publishers, Asansol, 1<sup>st</sup> Ed. 1995. Unit-II to V.

**REFERENCE BOOKS:**

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

## 15MNL47 MINING GEOLOGY LABORATORY – II

**Objectives:** Learn about Importance of Mining Geology, Types of Rocks, Structures, Geological Disturbances in Rocks and their Effects on rock Structures in laboratory.

Sub Code : 15MNL47	IA Marks : 20
Hrs/week : 03	Exam Hours : 03
Total Hrs : 42	Exam Marks : 50

### Part-A (Any one question 20 marks)

- I. **Microscopic studies of Rock Forming Minerals**  
**Experiment No. 01:** Study of optical properties, Texture, Alteration and Identification of Rock forming Minerals.
- II. **Megascopic Studies of Ore Minerals**  
**Experiment No.02:** Physical properties, Chemical composition, Mode of occurrence, distribution and uses of Iron, Manganese, Copper, Lead, Chromium, Aluminum etc.
- III. **Determinations of Dip & Strike**  
**Experiment No. 03:** To determine the true dip, when two apparent dips are known.  
**Experiment No. 04:** To determine the amount of apparent dip, when true dip and the direction of apparent dips are given.  
**Experiment No. 05:** To determine the direction of apparent dip, when true dip and amount of apparent dips are known.

### Part-B (Any one question 20 marks)

- IV. **Thickness based Calculations**  
**Experiment No. 06:** On Horizontal Ground  
**Experiment No. 07:** On Slope Ground  
**Experiment No. 08:** Slope against the direction of dip.
- V. **Geophysics & Bore hole based Problems (3 points problem)**  
**Experiment No. 09:** Electrical resistivity survey  
**Experiment N0.10:** On Ground Level
- VI. **Estimation of ore reserves:**  
**Experiment No. 11:** Bedded deposits, Vein deposits and load deposits

### Part-C Viva Voce 10 marks

**15MNL48 MINE SURVEYING LABORATORY-I**

**Objectives:** Learn the Basics of Surveying, Types of Surveying and their Usage in Practical Applications in Laboratory.

<b>Sub Code : 15MNL48</b>	<b>IA Marks : 20</b>
<b>Hrs/week : 03</b>	<b>Exam Hours : 03</b>
<b>Total Hrs : 42</b>	<b>Exam Marks : 50</b>

**Part-A (Any one question 20 marks)**

- 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 (Any one question 20 marks)**

- 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

**Part-C Viva Voce 10 marks**