

# TEACHING & EVALUATION SCHEME

DISCIPLINE : Mining Engineering

SEMESTER : III

Sl. No	Subject	Teaching Scheme (Hours/week)			Evaluation Scheme					Total mark
					Theory			Practical		
		L	T	P	End Exam	Internal Assessment Class Test	Assignment	End Exam	Sessional	
1	Mine Development	4	-	-	80	15	5	-	-	100
2	General Mechanical Engg.	4	-	-	80	15	5	-	-	100
3	Mining Survey-I	3	-	-	80	15	5	-	-	100
4	Geology	4	-	-	80	15	5	-	-	100
5	Mine method (Open Cast)	4	-	-	80	15	5	-	-	100

## Practical

1	General Mechanical Engg Lab.	-	-	4	-	-	-	25	25	50
2	Mine Survey-I Lab.	-	-	6	-	-	-	50	50	100
3	Geology Lab.	-	-	6	-	-	-	25	25	50
4	Training Report & Seminar	-	-	2	-	-	-	25	25	50
5	Library Study	-	-	2	-	-	-	-	-	-
Total :		19	-	20	400	75	25	125	125	750

NOTE : Evaluation for I.A (Theory) & Sessional Practical to be made as per guidelines of SCTE & VT.

# MINE DEVELOPMENT

**Periods per week: 4**

**Scheme**

**Total Periods: 44 Hrs.**

**Total Marks: 100**

**Evaluation**

**Theory: 3 Hrs**

**End Term Exam : 80**

**I.A.: 20 ( 15+5)**

-----

**Total 100 Marks**

## TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topic	Periods:	L
1.	Introduction to Mining		04
2.	Explosive and blasting accessories		15
3.	Blasting practices in Mines		09
4.	Alternative to Explosives		01
5.	Magazine		01
6.	Shaft Sinking		10
7.	Stone Drifting		04

## RATIONALE

As Mining Engineer, one has to develop the basic concept and principles of winning and working in mines. Further, he should have basic knowledge of explosives, shaft sinking and stone drifting for development of mines.

## OBJECTIVES

On completion of the subject, students will be able to :

1. Generalize the elementary idea of various types of winning methods and mode of entries of to mines.
2. Explain various composition, properties and uses of explosives.
3. Explain blasting practice in Mines.
4. Identify basic constructional features and safety provisions of magazines.
5. Identify alternatives to explosives.
6. Identify methods of shaft sinking.
7. Illustrate various methods of stone drifting.

## COURSE CONTENTS (Based on specific objectives)

### 1.0 Introduction to Mining

- 1.1 Define a Mine, classify mining methods.
- 1.2 Classify modes of entries- adits, inclines and shafts, applicability of entries.

### 2.0 Explosive and blasting accessories

- 2.1 Define explosive, state constituent of explosives and properties of explosives.
  - 2.1.1 Determine strength of explosive and velocity of detonation.
- 2.2 Classify explosives, state composition, properties and uses of explosives.
- 2.3 Explain PMS and SMS.

- 2.4 Define permitted explosive and classify permitted explosive.
    - 2.4.1 Explain sheathed, equivalent sheathed and ultra safe explosive. State properties of permitted explosives.
  - 2.5 State composition, constructional features and use of safety fuse, detonating fuse, detonating relay, igniter cord, nonel and ray date.
    - 2.5.1 Describe different types of detonators and uses, state advantages of delay detonators.
  - 2.6 State different types of exploder, its construction and safety features, circuit tester.
  - 2.7 Describe stemming rod, crack detector knife, crimpier.
- 3.0 Blasting practices in Mines.**
- 3.1 Describe preparation of charge.
  - 3.2 State procedure of firing shots, direct and inverse initiation, stemming materials, water ampoules, cushion firing.
  - 3.3 Determine blasting efficiency.
  - 3.4 Solid Blasting.
    - 3.4.1 Define blasting of solid, state advantages and disadvantages of B.O.S. State precautions, restrictions of B.O.S. Describe different patterns of shot holes.
- 4.0 Alternative to explosives.**
- 4.1 State cardox, Hydraulic Coal Burster . Their advantages and disadvantages.
- 5.0 Magazines**
- 5.1 Describe layout and arrangement of different types of magazines, state their safety features.
- 6.0 Shaft Sinking**
- 6.1 Describe vertical shaft and inclined shaft, determine shape and size of shaft, location of shaft. Describe sinking through normal ground. State shaft plumbing.
  - 6.2 Describe sinking through difficult ground, cementation, freezing, mechanized shaft sinking, sinking upward, widening and deepening of shafts.
- 7.0 Stone Drifting**
- 7.1 Describe conventional methods of drifting, find out direction and gradient of drift, describe drilling and blasting, support transportation, drainage, ventilation and lighting arrangements, organisation and supervision, mechanized method of drifting.

### **RECOMMENDED BOOKS**

1. Blasting Manuals- Sandhu & Pradhan
2. Blasting Pracice in Mines- S.K. Das
3. EMT Vol-I – D.J. Desmukh
4. Coal Mining Practice- Stathum
5. Surface Mining- G.B.Mishra
6. S.M.E. Hand Book

# GENERAL MECHANICAL ENGINEERING (THEORY)

Periods per week: 4 Hrs  
Total periods: 44

Total Marks: 100

Evaluation Scheme  
Theory: 3 Hrs.  
End Term Exam: 80  
I.A.: 20 (15+5)

-----  
Total: 100 Marks

## TOPIC WISE DISTRIBUTION OF PERIODS (Theory)

Sl.No.	Topic	Periods	L
1.	Strength of Materials & Power transmission		16
2.	Elements of Hydraulics		13
3.	Compressed Air		09
4.	Internal Combustion Engines		06

## RATIONALE

As Mining Engineer it is essential to have the fundamental concept of mechanical engineering specially related to working of machines, which are used in mines.

## OBJECTIVES

On completion of the subject, students will be able to:

1. Describe the concept of stress, strain, bending moment and shear force, torsion with power transmission.
2. Explain Fluid static's and dynamics with solution of problems.
3. Explain the use of compressed air and different types of air compressor.
4. Explain the concept of Internal Combustion engines.

## COURSE CONTENTS (Based on Specific Objectives)

### 1.0 Strength of Materials and Power Transmission.

- 1.1 Define
  - 1.1.1 Elasticity
  - 1.1.2 Hook's Law
  - 1.1.3 Limit of Proportionality.
  - 1.1.4 Young's Modulus
  - 1.1.5 Factor of safety. Lateral strain and Poisson's ratio.
- 1.2 Explain stress-strain curve for ductile materials.
- 1.3 Explain the effect of axial load on bar of
  - 1.3.1 Uniform section
  - 1.3.2 Variable section
- 1.4 Solve numerical problems on above
- 1.5 Define bending moment and shear force.
- 1.6 State types of beam and types of loading.
- 1.7 Explain shear force diagram and bending moment diagram for
  - 1.7.1 Cantilever with concentrated loading.
  - 1.7.2 Cantilever with U.D.I. over whole span.
  - 1.7.3 Simply supported beam with concentration loading.
  - 1.7.4 Simply supported beam with U.D.I. over whole span.

- 1.8 State bending formula.
- 1.9 Define section modules.
  - 1.9.1 Find out section modules for beam section of simple cases.
- 1.10 Define torsion and state its effects.
- 1.11 State application of torsion formula.
- 1.12 Explain working of
  - 1.12.1 Shaft couplings such as hydraulic and magnetic couplings.
  - 1.12.2 Belt, chain and rope Drive.
  - 1.12.3 Simple and compound gear train.
  - 1.12.4 Torque converters.
- 1.13 State function of flywheel and governors.
- 1.14 Explain working of watt, purler and proel governors.

## **2.0 Elements of Hydraulics.**

- 2.1 State various fluid properties.
- 2.2 Define pressure of fluid and pressure head.
- 2.3 State and explain working principle of various pressure measuring devices such as:
  - 2.3.1 Pieccometer tube.
- 2.4 State and explain continuity equation.
- 2.5 State and explain Bernoulli's theorem.
- 2.6 Explain working of venturimeter.
- 2.7 Solve numerical problems on above.
- 2.8 Define and classify orifices.
- 2.9 State the formula and discharge for rectangular orifices and solve problems.
- 2.10 Define and differentiate between orifice and notch.
- 2.11 Classify notches.
- 2.12 State formula for discharge through notches & solve problem on above.
- 2.13 State and explain laws of fluid friction.
- 2.14 State and explain loss of head due to friction (Darcy weisbach formula)
- 2.15 Explain hydraulic gradient and energy gradient.
- 2.16 Solve numerical problems as above.

## **3.0 Compressed Air**

- 3.1 Explain introduction of compressed air as a power.
- 3.2 Classify compressors.
- 3.3 Find out work done and HP required for compression with respect to quantity of air required.
- 3.4 State the effects of clearance volume.
- 3.5 Explain the consent of multistage compression with use of inter cooler and after cooler.
- 3.6 State the various methods of transmission and storage of compressed air.
- 3.7 State and explain the advantages of use of compressed air in mines.
- 3.8 Explain the working principle of pneumatic machines.

## **4.0 Internal Combustion Engines**

- 4.1 Explain various air cycles utilized in I/C Engines such as:
  - 4.1.1 OTTO Cycle.
  - 4.1.2 Diesel Cycle.
- 4.2 Derive air standard thermal efficiency of above cycles.
- 4.3 Explain working principle of 2 stroke and 4 stroke petrol and diesel engines.
- 4.4 Explain the concept of I/C Engine testing.
- 4.5 Define I.H.P., B.H.P. & Mechanical efficiency of I/C Engine.
- 4.6 Solve simple numerical problems on above.
- 4.7 State various applications of I/C Engines in Mining field.

## RECOMMENDED BOOKS

1. Strength of materials – Ramrutham.
2. Applied Mechanics – Khurmi & Gupta.
3. Fluid Mechanics – Ramrutham.
4. Thermal Engineering – Rav Saro.

## MINE SURVEY – I

**Periods per week: 3 Hrs**  
**Total periods: 33**

**Total Marks: 100**

**Evaluation Scheme**  
**Theory: 3 Hrs.**  
**End Term Exam: 80**  
**I.A.: 20 (15+5)**  
-----  
**Total: 100 Marks**

### TOPIC WISE DISTRIBUTION OF PERIODS (Theory)

Sl.No.	Topic	Periods	L
1.	Scales		02
2.	Chain Survey		05
3.	Compass Survey		06
4.	Plane Table Survey		07
5.	Computation of areas		04
6.	Computation of Volumes		05
7.	Estimation of quantity and Cost of construction.		04

### RATIONALE

Before starting the actual mining operation, it is essential for mining engineer to first survey the piece of land where mining operation is contemplated. This is not possible without the knowledge of mine surveying.

### OBJECTIVES

On completion of the subject, students will be able to :

1. Describe different scales and determine least count of each.
2. Explain different chains and their use in the field.
3. Explain prismatic compass and surveyor's compass and determine magnetic meridian. Explain local attraction and make necessary correction.
4. Outline knowledge regarding plane table survey in the field.
5. Describe general methods of determining areas.
6. Explain different procedures for calculating volume by application of different formulae.

### COURSE CONTENTS (Based on specific objectives)

#### 1.0 Scales

- 1.1 Describe construction and use of simple scale.
- 1.2 Describe construction and use of diagonal scale.
- 1.3 Describe construction and use of venire scale.

## **2.0 Chain Survey**

- 2.1 Give survey conventional signs, abbreviation used.
- 2.2 Give standards of lining, inking and coloring.
- 2.3 Describe selection of scales used.
- 2.4 Explain principle of chain surveying.
- 2.5 Describe instruments used and checking their correctness.
- 2.6 Explain ranging and chaining of a line.
- 2.7 Calculate errors in chaining.
- 2.8 Explain obstruction while chaining.
- 2.9 Describe chaining along a shopping ground.
- 2.10 Describe use of optional square and line range and checking optical square for correctness.
- 2.11 Describe offsets and their measurements.
- 2.12 Give reference sketches of stations.
- 2.13 Give procedure of chain surveying.
- 2.14 Explain field booking and plotting of chain survey.

## **3.0 Compass Survey**

- 3.1 Describe prismatic compass, its adjustments and use.
- 3.2 Explain true meridians, magnetic meridian, grid line meridian and arbitrary meridian.
- 3.3 Explain W.C.B. and Q.B. and conversion from one to other
  - 3.3.1 Find out fore and back bearing and their conversion.
  - 3.3.2 Compute angles from bearing and bearing angles
- 3.4 Define local alteration
  - 3.4.1 Determine local alteration and necessary correction to the bearing.
- 3.5 Explain closed and open compass surveying and its plotting.
- 3.6 Give procedure of field booking in compass and chain traverses.
- 3.7 Explain adjustment of closing error in compass traversing.

## **4.0 Plane Table Survey**

- 4.1 Define plane table and its accessories.
- 4.2 Describe orientation by back sighting and diamagnetic needle.
- 4.3 Describe various methods of plane table survey.
  - 4.3.1 Radiation method.
  - 4.3.2 Intersection or triangular method.
  - 4.3.3 Traversing method.
  - 4.3.4 Resection method.
- 4.4 Explain two point problems.
- 4.5 Explain three point problems and its solution by tracing paper method.
- 4.6 Describe advantages and disadvantages of plane table.

## **5.0 Computation of areas**

- 5.1 Explain methods of determining areas.
- 5.2 Find out areas from offset to a base line using
  - 5.2.1 Mid ordinate rule
  - 5.2.2 Average ordinate rule
  - 5.2.3 Trapezoidal rule
  - 5.2.4 Simpson's rule
- 5.3 Compute area by Planimeter and from graph paper.

## **6.0 Computation of Volumes**

- 6.1 Compute volume from cross section.
- 6.2 Find out volume using
  - 6.2.1 Prismoidal formula
  - 6.2.2 Trapezoidal formula

- 6.2.3 Spot levels
- 6.2.4 Contour plan

## 7.0 Estimation of quantity and cost of construction

- 7.1 Describe different building materials such as sand, lime, cement, timber, bricks, aggregates, concrete.
- 7.2 Explain estimation of quantity and costs including construction.

## RECOMMENDED BOOKS

- 1. A Text Book of Surveying – B.C. Purnima Vol-I & II.
- 2. A Text Book of Surveying – T.P. Kanetkar.

# GEOLOGY

**Periods per week: 4 Hrs**  
**Total periods: 44**

**Total Marks: 100**

**Evaluation Scheme**

**Theory: 3 Hrs.**

**End Term Exam: 80**

**I.A.: 20 (15+5)**

-----

**Total: 100 Marks**

**Practical:**

**End Exam: 25 Marks**

**Sessional: 25 Marks.**

## TOPIC WISE DISTRIBUTION OF PERIODS (Theory)

Sl.No.	Topic	Periods	L
1.	Physical Geology		11
2.	Structural Geology		09
3.	Elements of Crystallography		04
4.	Elements of Mineralogy		09
5.	Petrology		11

## RATIONALE

In majority of the cases, materials that need to be mined in order to reach the hidden treasure are rocks and minerals. It is therefore, essential for a mining engineer to have the basic knowledge of geology.

## OBJECTIVES

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

- 1. Explain the dynamic natural agencies that are constantly moulding the landscape of earth. He will be able to visualize the erosional and depositional landforms created by natural agencies.
- 2. Distinguish and identify the various structures that one may encounter in the field.
- 3. Underline the importance of crystal structures in the identification and study of minerals.
- 4. Identify minerals based on their physical properties. They will possess a sound knowledge of silicate structures.
- 5. Identify different rocks in the laboratory.

6. Distinguish between Igneous, Sedimentary and Metamorphic rocks and their texture and structures.

## **COURSE CONTENTS (Based on specific objectives)**

### **1.0 Physical Geology**

- 1.1 Define weathering and erosion.
- 1.2 Explain with suitable sketches the erosional and depositional land forms produced by wind.
- 1.3 Explain with neat sketches the erosional and depositional land forms produced by river.
- 1.4 Differentiate between glacier and iceberg
  - 1.4.1 Describe the erosional and depositional features produced by glacier.
  - 1.4.2 Define moraine. Describe the different type of moraine with sketches.

### **2.0 Structural Geology**

- 2.1 Define Dip. Distinguish between true dip and apparent dip.
- 2.2 Define strike.
- 2.3 Define folds. Classify folds and describe them.
- 2.4 Define faults. Describe the various types of fault.
- 2.5 Define unconformity. Describe the various type of unconformity with neat sketches.
- 2.6 Define joints. Describe various joints.

### **3.0 Element of Crystallography**

- 3.1 Define a crystal.
- 3.2 Explain Miller's indices.
- 3.3 Describe the Symmetry elements and forms present in the normal class of isometric system.

### **4.0 Elements of Mineralogy**

- 4.1 Define a mineral.
- 4.2 Enumerate and describe the physical properties of minerals.
- 4.3 Explain briefly the silicate structures along with diagrams.
- 4.4 Classify minerals.
- 4.5 Describe mineralogy and physical properties of Olivine, Quartz, Feldspar and Pyroxene group of minerals.

### **5.0 Petrology**

- 5.1 Define a Rock. Distinguish between a rock and a mineral.
- 5.2 Define Igneous, Sedimentary and Metamorphic rocks.
- 5.3 Describe the various textures and structures found in Igneous rocks.
- 5.4 Describe some important structures of sedimentary rocks along with neat sketches.
- 5.5 Describe various structure found in metamorphic rocks.

## **RECOMMENDED BOOKS**

1. A Text Book of Geology – P.K. Mukherjee.
2. Ruttley's Elements of Mineralogy – H.H. Reid.
3. Petrology – G.W. Tyrrel.
4. Structural Geology of Rocks at Regions – George H. Davis, Stephen J Reynolds.
5. Structural Geology – M.P. Billings.

# MINING METHODS ( OPENCAST )

**Periods per week: 4 Hrs**  
**Total periods: 44**

**Total Marks: 100**

**Evaluation Scheme**  
**Theory: 3 Hrs.**  
**End Term Exam: 80**  
**I.A.: 20 (15+5)**  
-----  
**Total: 100 Marks**

## TOPIC WISE DISTRIBUTION OF PERIODS (Theory)

Sl.No.	Topic	Periods	L
1.	Choice of Opencast Mining		05
2.	Benching		03
3.	Application of Machineries in Opencast Mining		07
4.	Drilling		06
5.	Blasting		04
6.	Controlled Blasting Techniques		04
7.	Secondary Blasting		02
8.	Design of Open Pit		04
9.	Drainage in Open Pit		02
10.	Layout of Opencast Mines		05
11.	Quality control in Mines		02

## RATIONALE

As Mining Engineer, one should have the knowledge of the fundamental principles of operation of Open cast mines.

## OBJECTIVES

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

1. Develop the concept of choice of Opencast Mining.
2. Determine bench parameters.
3. Justify the application of different machineries in Opencast Mines.
4. State and explain different drilling methods.
5. Describe blasting techniques.
6. Design open pit.
7. Describe drainage system in open pit.
8. Describe layout of Open cast mines.
9. Classify different methods of quality control in Mines.

## COURSE CONTENTS (Based on specific objectives)

### 1.0 Choice of Opencast Mining

- 1.1 State factors affecting choice of Open casting Mining method.
- 1.2 Define stripping ratio.
- 1.3 Determine overburden/ore ratio.
- 1.4 Find out cut off stripping ratio.
- 1.5 Determine quarriable limit.
- 1.6 State favorable conditions for mechanized Opencast Mines.
- 1.7 State limitations of large open pits.

## **2.0 Benching**

- 2.1 Determine bench parameters- height, width & slope.
- 2.2 Determine length of bench for overburden and ore.

## **3.0 Application of different machineries in Opencast Mining.**

- 3.1 Calculate bucket capacities of Power shovel, Backhoe, Dragline, Bucket wheel excavator, Bucket chain excavator, Wheeled scraper, Bulldozer, Road grader and Ripper.

## **4.0 Drilling**

- 4.1 Explain different methods of exploratory drilling.
- 4.2 State different types of drill used in Opencast mining.
- 4.3 Describe simple constructional features of churn drill, drills master, wagon drill and jack hammer.
- 4.4 State D.H.D.
- 4.5 Describe different types of drill bits used in Opencast drilling.

## **5.0 Blasting**

- 5.1 State spacing, burden & collar length.
- 5.2 Describe charging & stemming of blast holes.
- 5.3 Determine amount of charge of explosive in blast holes.
- 5.4 State & describe deck charging.
- 5.5 Describe single-row and multi-row firing.
- 5.6 Use safety fuse, denoting relay, ordinary & electric detonators (instantaneous and delay)
- 5.7 Narrate various types of explosives used in Opencast Mines-ANFO, LOX, Slurry explosives, emulsion explosives.
- 5.8 Describe mechanized charging of explosives for deep hole blasting.

## **6.0 Controlled Blasting Techniques**

- 6.1 State and describe pre-splitting, cushion blasting, muffled blasting, coyote hole blasting, chambered hole blasting, directional blasting.

## **7.0 Secondary Blasting**

- 7.1 State and describe plaster shooting and pop shooting, toe blasting.

## **8.0 Design of Open Pit**

- 8.1 Determine height, width and slope of a bench.
- 8.2 Calculate explosive charge for a given production.
- 8.3 Design haul road.

## **9.0 Drainage in Open Pit**

- 9.1 State sources of water in Opencast mine. Describe Preventive measure against flooding of mine and control of flow of water into the mines.

## **10.0 Layout of Opencast workings**

- 10.1 Describe the opening up of the deposit-box cut. Describe layout for loop layout, dead end circular, fan, spiral semi-circular switch back, transverse and longitudinal layouts using different loading and transporting machineries.
- 10.2 Describe working of hill side deposits.

**11.0 Describe different methods of quality control of Opencast Mines.**  
(Elementary idea only)

**RECOMMENDED BOOKS**

1. Surface Mining – G.B. Mishra
2. Opencast Mining – S.K.Das
3. Opencast Mining – R.T.Desmukh & D.J.Desmukh
4. Opencast Mining (1) Unit Operation (2) Integrated Mechanized – Rezavisky
5. Blasting Practice in Mines – S.K.Das
6. SME Mining Hand Book

**GENERAL MECH. ENGINEERING LAB**

**Period/Week : 4 (Pr)**  
**Total: 44**

**End Exam.: 25 Marks**  
**Sess. : 25 Marks**

01. Verify Bernoulli's Theorem by Bernoulli's Verification Apparatus.
02. Determine rate of flow through the venturimeter set-up.
03. Conduct tensile test of a mild steel specimen and plot stress-strain curve, show salient points on it.
04. Determine volumetric efficiency of air-compressor.
05. Study of 2-stroke & 4-stroke diesel engines.
06. Conduct I/C engine testing on single cylinder diesel engine & find out I.H.P., B.H.P. & mechanical efficiency.

**MINE SURVEY – I LAB**

**Period/Week : 6.**  
**Total: 66**

**End Exam.: 50 Marks**  
**Sess. : 50 Marks**

01. a. Sketch survey conventional signs, abbreviations and colors used.
02. **Chain Survey**
  - a. Ranging a line more than 100 m in length and measuring its correct length applying corrections.
  - b. Taking offsets of objects on both sides of a line
  - c. Plotting the above details.
  - d. Overcoming obstructions in chaining.
    - i) Vision free, chaining obstructed (Pond, river)
    - ii) Chaining free, vision obstructed (Raising ground)
    - iii) Both vision and chaining obstructed (Building)
  - e. Measuring on sloping ground.
  - f. Chain surveying and plotting of small plot by triangulation.
03. **Compass Survey**
  - a. Finding bearing of line and applying check.
  - b. Closed traversing of a small plot with station (without intermediate filling)
  - c. Open traversing of a small length with few station (without offsets)
  - d. Plotting both the above traverses applying correction.

#### 04. Plane table Survey

- a. Plane table traversing by different methods.
- b. Location of the position of a station on the plain by two point and three point problems.

## GEOLOGY PRACTICAL

**Periods per week: 6**  
**Total periods: 66**

**Total Marks: 50**

**Evaluation Scheme**

**End Exam: 25 Marks**

**Sess.: 25 Marks**

-----

**Total: 50 Marks**

1. Identification of rock forming and ore minerals in hand specimens.
02. Determinations of specific gravity by workers steel yard balance.
03. Analysis of thin sections of minerals and rocks under the microscopes.

## TRAINING REPORT AND SEMINAR

L/wk T/wk P/wk  
**0 0 2**

**Period per Week: 2**  
**Total Period: 22**

**Total Marks: 50**

**Evaluation scheme**  
**practical**

**End Exam.: 25 Marks**

**Sess.: 25 Marks**

### TRAINING REPORT: 25

Students will go to different Mines for practical Training at the end of 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> & 5<sup>th</sup> Semester for a period of 04 weeks/30 days. After returning from training they have to submit training reports touching all aspects of mining & related operations i.e. geology, survey, drilling, blasting methods of work, ventilation, support, transportation and any problem in Mines detected by them. This will be followed as per curriculum. Their report will be evaluated by conducting seminar & viva voce tests. Training report will not be accepted without training certificate from the Mine Manager concerned.

## SURVEY INSTRUMENT TECHNOLOGY – I

Periods/ Week -4  
Total Periods – 40

Theory – 3 Hrs.

End Exam. – 80

Internal Assessment-

20(15+5)

Theory

- a) The telescope :-

Lenses and prisms, Refraction through lenses and prisms, Image of the body, Chromatic aberration-Spherical aberration, Coma, Astigmatism, Curvature of the field- distortion, Internal focusing and External focusing telescope, Diaphragm and Reticule, Ramsden eyepiece, the erecting eyepiece, Huygen eyepiece. The diagonal eyepiece, parallax and its elimination, Testing the telescope for Chromatic aberration for spherical aberration for definition for aperture or illumination for magnification for angle of field for distortion

care of the telescope- Different types of organic solvents and adhesives required for cleaning lenses and prisms.

b) The level tube :

Construction, principle sensitiveness, measurement of sensitiveness. The chambered level tube, the constant level tube - the circular level.

c) The vernier :

Direct vernier, Rectograde vernier, Example of verniers in surveying instruments- special forms of verniers – Reading the vernier.

d) The Magnetic needle :

Construction, Requirements of magnetic needle, sensitiveness of the compass Box.

e) The tripod stand – Wall tripod

f) Chain testing and adjustments – arrows, steel band- line tape- metallic tape- steel tape-Invar tape-Ranging poles-offset rod line ranger- cross staff- optical square- its use, testing and adjustment. The prism square- Box sextant observing with sextant testing.

g) The plane table :

Allidade- Il frame and plumbob test and adjustment, Beaman stadia arc.

#### Books Recommended

1. Plane and Geodetic Survey : By D. Clark Vol - I & II

## TEACHING & EVALUATION SCHEME

DISCIPLINE : Mining Engineering

SEMESTER : IV

Sl. No	Subject	Teaching Scheme (Hours/week)			Evaluation Scheme					Total mark
					Theory			Practical		
		L	T	P	End Exam	Internal Assessment		End Exam	Sessional	
<b>Theory</b>						Class Test	Assignment			
1	Mining method (Underground Coal)	4	1	-	80	15	5	-	-	100
2	Mine Survey-II	4	-	-	80	15	5	-	-	100
3	Mine Ventilation	4	-	-	80	15	5	-	-	100
4	General Electrical Engineering	4	-	-	80	15	5	-	-	100
5	Mine Legislation & General Safety	4	-	-	80	15	5	-	-	100

### Practical

1	Mine Survey-II Lab.	-	-	6	-	-	-	50	50	100
2	Mine Ventilation Lab.	-	-	4	-	-	-	25	25	50
3	General Electrical Engineering Lab.	-	-	4	-	-	-	25	25	50
4	Training Report & Seminar	-	-	2	-	-	-	-	50	50
5	Library Study	-	-	2	-	-	-	-	-	-
<b>Total :</b>		20	1	18	400	75	25	100	150	750

NOTE : Evaluation for I.A (Theory) & Sessional Practical to be made as per guidelines of SCTE & VT.

# MINING METHODS ( UNDERGROUND COAL)

L/wk T/wk P/wk  
4 1 0

**Period per Week: 5**  
**Total Periods:**  
**Lecture: 44**  
**Tutorial: 11**

**Total Marks: 100**

**Evaluation Scheme**  
**Theory:**  
**End Term Exam.: 80**  
**I.A.: 20 (15+5)**

## TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topic	Periods:	L	T
1.	Introduction to Method of working		02	00
2.	Bord & Pillar method		11	03
3.	Long wall Mining Method		06	01
4.	Thick seam Mining Method		06	01
5.	Horizon Mining Method		04	01
6.	Hydraulic & Pneumatic Stowing		03	01
7.	Support system and roof control		08	03
8.	Subsidence due to Mining		04	01

## RATIONALE

As a Mining Engineer, one should have the knowledge of fundamental principles of operation in underground coal mines.

## OBJECTIVES

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

1. Explain different mining methods and their selection.
2. Describe details working of B.P. method and its development & depillaring, precautions against fire and water and B.P. layout.
3. Explain long wall working.
4. Describe elementary idea about thick seam mining.
5. Describe horizon mining.
6. Explain various practices of filling of goaf and their layout.
7. Describe roof behaviors and support required in Mines.
8. Identify causes of subsidence and its prevention.
- 9.

## COURSE CONTENTS (Based on specific objectives)

### 1.0 Introduction to Underground Coal Mining

- 1.1 Classify Underground Coal Mining Methods.

### 2.0 Bord and Pillar Method

- 2.1 Describe the various application of Bord & Pillar method.
- 2.2 Describe various layouts of Bord & Pillar method.
- 2.3 Describe depillaring method with stowing and caving.

State precautions against fire and water during and after depillaring.

State and describe various machineries used in working face.

Define contiguous seam.

Describe working of contiguous seams.

Describe working of seams above and below goaved out area.

State advantages and disadvantages of Bord & Pillar method.

### 3.0 Longwall Method

- 3.1 Describe Longwall advancing and retreating methods.

- 3.2 Define single unit and double unit face.
- 3.3 Describe cyclic and non-cyclic L/W layouts.
- 3.4 Describe mechanized longwall working with armoured flexible conveyor, shield support and shearer loader.
- 4.0 Thick seam Mining**
  - 1.1 Define Thick seams.
  - 1.2 Classify Thick seam Mining.
  - 1.3 Describe layouts of horizontal slicing, incline slicing, blasting gallery and sublevel caving.
- 5.0 Horizon Mining**
  - 1.1 State conditions, advantages, disadvantages and limitations of Horizon Mining.
  - 1.2 Describe the layout of Horizon Mining.
- 6.0 Hydraulic and Pneumatic stowing**
  - 1.1 Describe hydraulic stowing.
  - 1.2 Describe Pneumatic stowing.
- 7.0 Support and roof control in Mines**
  - 1.1 State properties of various types of roof & roof behavior, Pressure arch theory in B&P and longwall working.
  - 1.2 Describe testing of roof.
  - 1.3 Classify support system in Mines construction, principle of operation application and load bearing capacity assessment.
- 8.0 Subsidence due to Mining**
  - Define angle of draw
  - State factors of subsidence, critical area of extraction
  - Describe the factors affecting subsidence
  - State & describe precautionary measures against damage due to subsidence
  - Define shaft pillar
  - Determine size of shaft pillars

## RECOMMENDED BOOKS

1. Winning & Working – R.T.Desmukh & D.J.Desmukh
2. EMT. Vol I, III - D.J.Desmukh
3. Modern Coal Mining – S.K.Das
4. Advance Coal Mining - R.T.Desmukh & B. Borovjev.
5. UMS
6. Coal Mine Ground Control – S.S.Peng
7. SME Mining Engg. Hand Book
8. Strata Control – Jermic

## MINE SURVEY – II

L/wk T/wk P/wk  
**4 0 6**

**Period per Week: 4**  
**Total Periods:**  
**Lecture: 44**

**Total Marks: 200**

Subject Ref.No.: Mg402

**Evaluation Scheme**

**Theory:**

**End Term Exam.: 80**

**I.A.: 20 (15+5)**

**Practical**

**End Term Exam.: 50**

**Sess.: 50**

## TOPIC WISE DISTRIBUTION OF PERIODS (Theory)

Sl.No.	Topic	Periods:	L
1.	Miner's Dial		02
2.	Levelling		15
3.	Contouring		06
4.	Calculation of ore reserves		04
5.	Theodolite		08
6.	G.P.S. & Total station		05
7.	Subsidence survey, subsidence Plans & Sections		04

## RATIONALE

Before starting the actual mining operation, it is essential for mining engineer to first survey the piece of land where mining operation is contemplated. This is not possible without the knowledge of mine surveying.

## OBJECTIVES

On completion of the subject, students will be able to :

1. Describe a miner's dial
2. Describe various leveling methods.
3. Calculate cutting of filling from level sections.
4. Define contouring, contour lines, contour gradient, use of contour plan, stratum contour, isopachs and their uses.
5. Describe write different methods of calculating ore reserves by materials balance and decline curve methods.
6. Describe the application of theodolites in surveying, micro-optic and seconds theodolite.
7. Explain the basic principle of global positioning systems & total station.

## COURSE CONTENTS (Based on specific objectives)

### 1.0 Mine's Dial

- 1.1 Define Dip, Declination, Variation.
- 1.2 Explain loose needle method of survey & calculate bearings

### 2.0 Levelling

- 2.1 Define benchmark M.S.L. Dumpy level.
- 2.2 Adjust dumpy level, modern levels, precise staff.
- 2.3 Describe methods of leveling- Rise & Fall method, height of instrument.
- 2.4 Plot level section, errors in ordinary leveling, underground leveling in an incline by straight edge & spirit level.
- 2.5 Explain reciprocal leveling, subsidence leveling, setting out gradient, trigonometric leveling, geometrical leveling, physical leveling.
- 2.6 Calculate or evaluate coal & mineral stack pile , cutting & filling from level sections.

### 3.0 Contouring

- 3.1 Explain different methods of contouring, contour lines.
- 3.2 Describe various characteristics of contours.
- 3.3 Evaluate contour gradient.
- 3.4 Describe the use of contour plan.
- 3.5 Define stratum contour, isopachs.

### 4.0 Calculation of Ore Reserves

- 1.1 Classify reserves.
- 1.2 Evaluate reserves by exploratory mining.

- 1.3 Calculate primary ore reserve by material balance method & decline curve method.
- 5.0 Theodolite**
- 5.1 Describe temporary and permanent adjustment of Theodolite.
- 5.2 Describe the principles of operation & describe different parts.
- 5.3 Measure Horizontal & Vertical angles.
- 5.4 Describe setting of the instrument.
- 5.5 Explain Traversing with Theodolite.
- 6.0 G.P.S. & Total Station**
- 6.1 Explain the basic principles of global positioning system & total station.

### **RECOMMENDED BOOKS**

1. Surveying Vol.I – E. Mason
2. Surveying & Levelling – T.P.Kanetkar
3. Geodetic Surveying Vol.I – David Clerk
4. Mineral Economics – Sinha & Sharma

## **MINE SURVEY – II (PRACTICAL)**

**Practical/Week : 6**

**Total Period: 66**

1. Study of different parts of Miner's dial. Finding out least count measurement of horizontal and vertical angle. Measurement of bearing by Traverse survey by Miner's dial.
2. Levels: Temporary and permanent adjustment, sensitivity of bubble tube practice with different types of level, preparation of a vol section special leveling contouring.
3. Temporary & permanent adjustment of theodolite.
4. Measurement of horizontal angle by reiteration and repetition methods.
5. Measurement of vertical angle.
6. Measurement of horizontal and vertical distance between two points including inaccessible points with tacheometer.

## **MINE VENTILATION**

Subject Ref.No.: Mg403

**Period per Week: 4 Hrs**

**Total Periods: 44**

**Lecture/week: 4**

**Total Marks: 200**

**Evaluation Scheme**

**Theory: 3 Hrs.**

**End Term Exam.: 80**

**I.A.: 20 (15+5)**

**Practical: 25**

**Sessional: 25**

## TOPIC WISE DISTRIBUTION OF PERIODS (Theory)

Sl.No.	Topic	Periods:	L
1.	Ventilation		06
2.	Air Crossing & Distribution		06
3.	Mechanical Ventilation		10
4.	Booster Fan & its Effect		06
5.	Auxiliary Ventilation		04
6.	Ventilation Survey		09
7.	Leakage of Air in Mines		03

## RATIONALE

The provision of proper ventilation is very essential for any underground mining operation. As a mining Engineer, one should have the thorough knowledge of types of ventilation, methods of air crossing, types of fans etc.

## OBJECTIVES

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

1. Describe different instruments measuring temperature, pressure and humidity and have idea on natural ventilation and laws of mine air friction.
2. Describe different types of ventilation and methods of air crossings and distribution.
3. Illustrate different types of fans, fan characteristics, Mine characteristics and selection of fans.
4. Identify different locations of booster fan and solve simple problems relating to this.
5. Explain different systems of auxiliary ventilation and its advantages and disadvantages.
6. Explain different ways of pressure survey, quantity survey & quality survey.
7. Explain causes & preventives measure of leakage of air in mines.

## COURSE CONTENTS (Based on specific objectives)

### 0.0 Ventilation

- 0.1 Calculate the quantity of air.
- 0.2 Describe the different types of Thermometer.
- 0.3 Describe the different types of Barometer.
- 0.4 Describe kata thermometer.
- 0.5 Describe water gauge.
- 0.6 Calculate ventilation pressure by using pitot static tube.
- 0.7 Explain effects of heat & humidity.
- 0.8 Explain natural ventilation motive column, geothermic gradient.
- 0.9 Enumerate laws of mine air friction and solve problems on above.

### 1.0 Air Crossing and distribution

- 1.1 Describe ventilation stopping, air crossing, ventilation door, bratis partition.
- 1.2 Describe different types of ventilation.
  - a) Accessional & declensional ventilation.
  - b) Homotropical & Antitropical ventilation.
  - c) Boundary ventilation.
  - d) Central & combined ventilation.
- 1.3 Explain splitting of air current & solve numerical problems on splitting.
- 1.4 Describe air locks at pit top.

## **2.0 Mechanical Ventilation**

- 2.1 Explain construction & principle of operation of centrifugal flow fans.
- 2.2 State fan laws & calculate fan efficiency.
- 2.3 Explain installation of mine fan with reversal arrangement.
- 2.4 Describe fan drift, fan drive, evasee and diffusers.
- 2.5 Explain fan characteristics and mine characteristics.
- 2.6 Describe methods for output control fans.

## **3.0 Booster fan and its Effects**

- 3.1 Describe installation and location of booster fan.
- 3.2 Solve problems relating to booster fan.

## **4.0 Auxiliary Ventilation**

- 4.1 Describe systems of auxiliary ventilation & condition of air.
- 4.2 Describe advantages & disadvantages of auxiliary ventilation.

## **5.0 Ventilation Survey**

- 5.1 Describe methods of pressure survey using barometer, gauge and pitot tube with manometer.
- 5.2 Describe the method of measurement of cross-sectional area.
- 5.3 Describe the method of velocity measurements by using anemometer, voltmeter, and pitot- static tube and smoke & cloud method.
- 5.4 Determine percentage of oxygen, methane, carbon monoxide SO<sub>2</sub> & H<sub>2</sub>S.

## **6.0 Leakage of air in Mines**

- 6.1 Describe causes and preventive measures of leakage of air in mines.

## **RECOMMENDED BOOKS**

1. Mine Ventilation – G.B.Mishra
2. EMT-H, - D.J.Desmukh.
3. Coal Mine Practices – E. Mason
4. UMS Volume-I
5. SME-Mining Engg. Hand Book- Vol.I & II 1993 edition.
6. A critical study of Indian Mining legislation – Rakesh & Prasad

## **MINE VENTILATION LAB**

**Period per Week: 4**

**Total Period: 44**

1. Determine the relative humidity by stationary hygrometer.
2. Whirling hygrometer.
3. Determine the cooling power of mine air using Kata thermometer.
4. Study and sketching of air crossing, regulator, ventilation doors, air locks at pit top & different types of stopping.
5. Study & use of Anemometer, Velometer and Pitot static-tube measurement of quantity of air flow.
6. Determine the duct characteristic.
7. Study of constructional features of axial flow and centrifugal fans.

# GENERAL ELECTRICAL ENGINEERING

L/wk T/wk P/wk  
4 0 4

Subject Ref.No.: Mg404

Period per Week: 4 Hrs. Total Marks: 100  
Total Periods:44

Evaluation Scheme  
Theory: 3 Hrs.  
End Term Exam.: 80  
I.A.: 20 (15+5)  
Practical  
End Term Exam.: 25  
Sess.: 25

## TOPIC WISE DISTRIBUTION OF PERIODS (Theory)

Sl.No.	Topic	Periods:	L
1.	Electrical cables for Mining use		04
2.	Fuses		03
3.	Circuit breakers		10
4.	Protective systems		07
5.	Industrial Drives- Mining Type		04
6.	Electric Breaking Used in Mines		05
7.	Flame proof and intrinsically safe apparatus		04
8.	Underground signaling arrangement		02
9.	Thyristors		05

## RATIONALE

Mining Engineer, it is essential to have the fundamental concepts of electrical mining and its applications in mining operation.

## OBJECTIVES

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

1. Describe various types of electrical cables used in Mines.
2. State & explain the purposes of uses.
3. Describe and explain circuit breakers and drawn circuit diagram of gate-end box and drill panel.
4. Describe different types of protective system.
5. Select electric drives of mining use.
6. Describe & explain different types of electric braking.
7. Describe proof apparatus and intrinsically safe apparatus.
8. Explain underground signaling arrangement.

## COURSE CONTENTS (Based on specific objectives)

### 1.0 Electrical cables for Mining use

- 1.1 Classify cables for mining use.
- 1.2 Constructional features of high tension and low-tension cables armoured & trailing cables.
  - 1.2.1 State use of cables & size of cables.
  - 1.2.2 State procedures of cable laying at surface, underground roadway & in shafts.
- 1.3 Describe cable joint box mining type.

### 2.0 Fuses

- 2.1 State importance of fuse materials.
- 2.2 Explain fuse current.
- 2.3 Describe HRD fuse.

### **3.0 Circuit Breaker**

- 3.1 Describe & explain air break switches.
- 3.2 Describe working principle of bulk oil circuit breaker.
- 3.3 Describe air blast circuit breaker.
- 3.4 Describe S.F.-6 circuit breaker.

### **4.0 Protective Systems**

- 4.1 Explain essential qualities of a good protective system.
- 4.2 State & describe types of relays (plunger, induction & direction over current, over loads, no volt and latching relay & frequency relay)
- 4.3 Describe protection of transformer by differential relay.
- 4.4 Describe buchholz relay (single & double float type)
- 4.5 Describe general principle of working-basis remote control circuit & various protective devices of Gate-End Box.
- 4.6 Describe functions & operation of drill panel.

### **5.0 Industrial drives- Mining type**

- 5.1 Explain starting & running characteristics of D.C. & A.C. Motors.
- 5.2 State selection of motors for mining use.

### **6.0 Electric breaking used in Mines**

- 6.1 Describe & explain regenerative breaking.
- 6.2 Describe & explain magnetic breaking.

### **7.0 Flame proof & intrinsically safe apparatus**

- 7.1 Define flame proof apparatus & intrinsically safe apparatus.
- 7.2 Describe & explain the safety features of flame proof & intrinsically safe apparatus.

### **8.0 Underground signaling arrangement**

- 8.1 Describe signals & shaft signal.
- 8.2 Describe use of telephone in underground 9 block diagram.

### **9.0 Thyristors**

- 9.1 State principles of thyristors and uses.
- 9.2 Explain in junction transistors.

### **RECOMMENDED BOOKS**

1. Electrical equipment in Mines – H. Cotton

## **GENERAL ELECTRICAL ENGINEERING**

1. Study of fuse.
2. Study of circuit breaker.
3. Study of Gate End Box.
4. Study of Relays.
5. Study of Cables.
6. Study of Mugger.

# MINE LEGISLATION & GENERAL SAFETY

L/wk T/wk P/wk

4 0 4

Period per Week: 4 Hrs. Total Marks: 100

Total Periods:44

Subject Ref.No.: Mg404

Evaluation Scheme

Theory: 3 Hrs.

End Term Exam.: 80

I.A.: 20 (15+5)

## TOPIC WISE DISTRIBUTION OF PERIODS (Theory)

Sl.No.	Topic	Periods:	L
1.	Mines Act 1952		06
2.	Mines Rules 1955		06
3.	Coal Mines Regulations 1957		18
4.	Mine Rescue Rules 1985		03
5.	Indian Explosive Rule 1983		06
6.	Indian Electricity Rules		05

## RATIONALE

Since Mining operations involve frequent accidents, it is very important for a mining engineer to be thoroughly conversant with various acts & rules framed for providing safety to workers.

## OBJECTIVES

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

1. Describe various aspects of Mines Act 1952.
2. Describe various aspects of Mines Rule 1955.
3. Describe various aspects of Coal Mines Regulations 1957.
4. Describe various aspects of Mines Rescue Rules 1955.
5. Describe various aspects of Indian Explosive Rules 1983.
6. Describe various aspects of Indian Electricity Rules 1956.

## COURSE CONTENTS (Based on specific objectives)

### 1.0 Mines Act 1952

- 1.1 Discuss various provisions of Mines Act 1952.

### 2.0 Mines Rules 1955

- 2.1 Discuss various provisions of Mines Rule 1955.

### 3.0 Coal Mines Regulation 1957

- 3.1 Discuss various Provisions of C.M.R. 1957.

### 4.0 Mines Rescue Rules 1985

- 4.1 Discuss various provisions of Mines Rescue Rules 1985.

### 5.0 Indian Explosive Rules 1983

- 5.1 Discuss various provisions of Indian Explosive Rules 1983.

### 6.0 Electric breaking used in Mines

- 6.1 Discuss various provisions of Indian Electricity Rules 1956.

## RECOMMENDED BOOKS

1. Mines Act 1952
2. Mines Rules 1955
3. CMR-1957
4. Mines Rescue Rules 1985
5. Indian Explosive Rules 1983
6. Indian Electricity Rules 1956

# PRACTICAL TRAINING REPORT & SEMINAR

L/wk T/wk P/wk  
0 0 2

Periods per week: 2  
Total Periods: 22

Evaluation Scheme  
practical

Sess.: 50 Marks.

Students will go to different Mines for practical Training during 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup> & 6<sup>th</sup> semester for a period of 4 weeks (30 days). After returning from training they have to submit training reports touching all aspects of mining & related operations i.e. geology, survey, drilling, blasting methods of work, ventilation, support, transportation & any problem in Mines detected by them. This will be followed as per curriculum. Their report will be evaluated by conducting seminar & viva voce tests. Training report will not be accepted without training certificate from the Mine Manager concerned.

## HIGHWAY AND HYDROGRAPHIC SURVEY

Periods/ Week -4  
Total Periods – 40

Theory – 3 Hrs.  
End Exam. – 80  
Internal Assessment-

20(15+5)

a) Introduction :

I.R.C. classification of Road. (2 periods)

b) Geometrics :

Formation width road, Margin Road shoulders, carriage way, side slopes, Formation level, camber and gradients(Ruling and exceptional) sight distances, Horizontal and vertical curves, Importance of transition curves, super elevation, problems on super elevation. (10 periods)

c) Typical cross section of road in cutting and filling typical cross section of a multilane highway passing through an urban area. (2 periods)

d) Use of I.R.C. table for finding elements of road geometrics. (1 period)

e) Survey plans and Estimates :

Basing considerations of road alignment in plain and hilly areas. (2 periods)

f) Factors to be considered for alignment of a road through urban area, concept of an ideal alignment, plans and estimate required for a highway project. (2 period)

g) Setting out alignment of roads setting out bench marks, control pegs for embankment and cutting profiles of embankments, Methods of checking chamber and gradient and alignment as per I.R.C. (3Periods)

h)Hill Roads :

Importance of hill roads in India typical cross-setting showing all details of a hill road in cut, partly in out and partly in fill including retaining and breast wall, Hair pin bends.( 5 periods)

i)Drainage :

Surface drains of location Details of typical side drains, Intercepting drains in hill – roads, Details of drains in cutting and embankment.

j) Hydrology :

Measurement of rainfall, Rain gauges, computation of average rainfall over a basin, Dickens and Rajee formula for flood discharge and khosls formula for run-off estimating annual stream flow, measurement by use of velocity area method, velocity of flow in a stream by pressure instruments current meters and flood estimating peak rate of run-off by using empirical formulas., unity Hydrography of run-off numerical examples. (10 periods)

# TEACHING & EVALUATION SCHEME

DISCIPLINE : Mining Engineering

SEMESTER :V

Sl. No	Subject	Teaching Scheme (Hours/week)			Evaluation Scheme					Total mark
					Theory			Practical		
		L	T	P	End Exam	Internal Assessment Class Test	Assignment	End Exam	Sessional	
1	Mining Legislation & General Safety-II	4	-	-	80	15	5	-	-	100
2	Mine Survey-III	4	-	-	80	15	5	-	-	100
3	Mining Methods (Underground Metal)	4	-	-	80	15	5	-	-	100
4	Mine Hazard & Environment	4	-	-	80	15	5	-	-	100
5	Mine Machinery-I	4	-	-	80	15	5	-	-	100

## Practical

1	Mine Survey-III Lab.	-	-	6	-	-	-	50	50	100
2	Mine hazard & Environment Lab.	-	-	4	-	-	-	25	25	50
3	Mine machinery-I Lab.	-	-	4	-	-	-	25	25	50
4	Training Report & Seminar	-	-	3	-	-	-	-	50	50
5	Library Study	-	-	2	-	-	-	-	-	-
Total :		20	-	19	400	75	25	100	150	750

NOTE : Evaluation for I.A (Theory) & Sessional Practical to be made as per guidelines of SCTE & VT.

## MINE LEGISLATION & GENERAL SAFETY-II

L/wk T/wk P/wk  
**4 0 0**  
**Period per Week: 4**  
**Total Periods:**  
**Lecture: 44**

Subject Ref.No.: Mg501  
**Total Marks: 100**  
**Evaluation Scheme**  
**Theory:**  
**End Term Exam.: 80**  
**I.A.: 20 (15+5)**

### TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topic	Period
1.	M.M.R. 1961	08
2.	Mines V.T.Rules 1966	04
3.	Mines Creche Rules	02
4.	Maternity Benefit Act	02
5.	Mines Accident & Safety	08
6.	Forest Act	03
7.	Environmental Protection Act 1986	06
8.	MMRD & MCRD	06
9.	Classified circulars (DGMS)	05

### RATIONALE

Same as that of Mg405

### OBJECTIVES

On completion of the above topics, students will be able to :

1. Describe various aspects of M.M.R. 1961.
2. Describe various aspects of Mines Vocational Training Rules 1966.
3. Describe various aspects of Mines Creche Rules 1966.
4. Describe various aspects of Maternity Benefit Act.
5. Describe various aspects of Mines Accident & Safety.
6. Describe various aspects of Forest Act.
7. Describe various aspects of Environmental Act 1986.

### COURSE CONTENTS (Based on specific objectives)

#### 1.0 Metalliferous Mines Regulations 1961

- 1.1 Discuss various provisions of Metalliferous Mines Regulations 1961.

#### 2.0 Mines V.T. Rules 1966

- 2.1 Discuss various provisions of Mines V.T. Rules 1966.

#### 3.0 Mines Creche Rules 1966

- 3.1 Discuss various provisions of Mines Creche Rules 1966.

#### 4.0 Maternity Benefit Act

- 4.1 Discuss various provisions of Maternity Benefit Act.

#### 5.0 Mines Accident & Safety

- 5.1 Discuss their classification, causes & prevention.
- 5.2 Develop concept about accident cost, accident report, procedure for conducting an enquiry to ascertain the causes of accidents.
- 5.3 Discuss procedure for investigation & reporting Mine accident, accident proneness, fatality rate, frequency rate & severity rate.
- 5.4 Explain role of supervision in accident prevention, accident due to opencast workings, statistical analysis of accidents, accident statistics, its head & method of data processing.
- 5.5 Develop basis concepts of safety, safety & productivity, safety consciousness & safety campaign, safety organization, safety audit.

- 5.6 Describe rules of safety committee.
  - 5.7 Explain the role of workmen inspectors.
  - 5.8 Discuss terms like industrial fatigue, preventive maintenance, productive equipments & duties of Safety Officer.
- 6.0 Forest Act**
- 6.1 Discuss various provisions of Forest Act.
- 7.0 Environmental Act 1986**
- 7.1 Discuss various provisions of Environmental Act 1986.
- 8.0 MMRD Act & MCRD Rules**  
 Various provisions of Mineral conservation & exploitation.  
 National Mineral policy.
- 9.0 Classified Circulars (DGMS)**
- 9.1 As amended up-to-date.

**RECOMMENDED BOOKS**

1. M.M.R.- 1961
2. Mines V.T.Rules- 1966
3. Mines Creche Rules- 1966
4. Maternity Benefit Act
5. Pit Head bath Rules
6. Worker's compassion Act
7. Environmental Act-1986
8. DGMS Circulars

**MINE SURVEY – III**

L/wk T/wk P/wk  
**4 0 6**

Subject Ref.No.: Mg502

**Period per Week: 10 Total Marks: 200**  
**Total Periods**  
**Lecture: 44**

**Evaluation Scheme**  
**Theory:**  
**End Term Exam.: 80**  
**I.A.: 20 (15+5)**  
**Practical**  
**End Term Exam.: 50**  
**Sess.: 50**

**TOPIC WISE DISTRIBUTION OF PERIODS (Theory)**

Sl.No.	Topic	Periods:	L
1.	Traversing with theodolite		05
2.	Tacheometry		05
3.	Triangulation & Trilateration		06
4.	Correction of Surface & Underground Survey		05
5.	Setting out curves		05
6.	Stope surveying		05
7.	Face surveying in Open Pits		05
8.	Simple Problems on Dip, Fault, strike, Boreholes, Drift etc.		08

## **RATIONALE**

Same as that of Mg303

## **OBJECTIVES**

On completion of the subject, students will be able to :

1. Explain different methods of traversing with theodolite to know traversing adjustment & closing error both in Opencast & Underground Mines.
2. Comprehend principle of tacheometry & its application in measurement of distance.
3. Explain principle of triangulation & trilateration.
4. Explain principles of correlations by different methods.
5. Define various terms in connection with curve setting, laying out of curves by different methods.
6. Explain different methods of stope surveying, transfer of stope faces to mine Plan.
7. Transfer mines grid co-ordinate to open pit face, laying out of faces in open pits, fixations of bench parameters, transfer of R.L. to each bench floor, determine overall pit slope angle.
8. Solve simple problems on dip, fault, strike, borehole, drifts etc.

## **COURSE CONTENTS** (Based on specific objectives)

### **1.0 Traversing with theodolite**

- 1.1 Define continuous azimuth method, double foresight method & deflection angle methods.
- 1.2 Evaluate coordinates from the booking of theodolite traversing.
- 1.3 Solve miscellaneous problems in rectangular coordinates.

### **2.0 Tacheometry**

- 2.1 Define stadia & its principle.
- 2.2 Explain diaphragm, reticules, tacheometer, instruments constants.
- 2.3 Find out height & distance from stadia intercepts, tangential systems, movable hair method.
- 2.4 Define accuracy in tacheometry.
- 2.5 Explain tacheometric contouring.
- 2.6 Solve tacheometric problems.

### **3.0 Triangulation and Trilateration.**

- 3.1 State purpose & principle involved in triangulation & trilateration method.
- 3.2 Classify various methods of triangulation survey primary, secondary & tertiary colliery triangulation.
- 3.3 Develop concept about reconnaissance survey. Describe methods of measuring angle, types of theodolite used in triangulation survey.
- 3.4 State other equipment require in sighting & marking triangulation station point.
- 3.5 Describe the procedure of sighting at night time, reference direction, magnetic & true meridian & its determination.
- 3.6 Describe the methods of base line measurement- E.D.M.
- 3.7 Define tape correction.
- 3.8 State construction of triangulation station of permanent nature.
- 3.9 State various adjustments like adjustment of observed values of triangulation angles, adjustment of quadrilateral, adjustment of polygon- Trilaterations.
- 3.10 Explain corrections of colliery triangulation with national grid.

#### **4.0 Correlation of surface and underground survey**

- 4.1 State direct correlation by traversing & optical methods.
- 4.2 Describe orientation by wires in two shafts.
- 4.3 Explain correlation by mines in vertical shafts.
- 4.4 State co-planning/ alignment, weissbach triangle weis-quadrilateral methods, precise magnetic correlation.

#### **5.0 Setting out curves**

- 5.1 State elements of curves.
- 5.2 Define designation of curves, simple, compound & reverse curves.
- 5.3 Explain setting out of surface & underground curves by chords & offsets, chords and angle, tangent and offset, plate layers method.
- 5.4 Describe various setting out by chain & one theodolite, two theodolites.
- 5.5 Define super elevation, transition and vertical curves.

#### **6.0 Stope Surveying**

- 1.1 Explain tape triangulation, instrumental survey.
- 1.2 Determine stope face.
- 1.3 State preparation of stope planes, plotting the stope station, plotting of stope face to the mine plan.
- 1.4 Describe various methods like graphical rectangular triangle, ray.
- 1.5 Find out area of extraction by Planimeter and calculation of triangle thereof.

#### **7.0 Face surveying of Open Pits**

Describe transfer of mines grid Coordinate to open pit faces.

State laying out of faces in open pit.

Explain fixation of bench parameters, transfer of R.L. to each bench floor.

Determine overall pit slope angle.

#### **8.0 Simple problems on Dip, Fault, Strike, Borehole, Drifts.**

- 8.1 Solve various numerical problems related to dip, strike, fault, borehole & drifts.

### **RECOMMENDED BOOKS**

1. Plane & Geodetic Survey – D.Clerk
2. Surveying E. Mason – Vol.I & II
3. Metalliferous Mine Surveying – F.Winniberg
4. U.M.S. Vol.-III & Extra Lesions.
5. Mineral Economics – R.K.Sinha & N.L.Sharma

## **MINE SURVEY – III (PRACTICAL)**

**Periods per week: 06**

**Total Periods: 66**

**Evaluation Scheme**

**Practical:**

**End Exam.: 50 Marks**

**Sess.: 50 Marks**

Periods-22

1. Do the various methods of measuring with theodolite.
2. Determine the horizontal & vertical distance by Tacheometric method.
3. Fix triangulation and measurement of peripheral and hub angles. Base line measurement applying all corrections and plotting by co-ordinates.
4. Determine the north.
5. Set out curves by tape and theodolites.
6. Correlate underground and surface survey during survey camp.  
(Student will go for a survey camp to a suitable place for conducting survey work).

# MINING METHODS ( UNDERGROUND METAL )

L/wk T/wk P/wk

4 0 0

Subject Ref.No.: Mg503

**Period per Week: 4 Total Marks: 100**

**Evaluation Scheme**

**Total Periods**

**Theory:**

**Lecture: 44**

**End Term Exam.: 80**

**I.A.: 20 (15+5)**

## TOPIC WISE DISTRIBUTION OF PERIODS (Theory)

Sl.No.	Topic	Periods:	L
1.	Development in underground metal mines		10
2.	Comparative study between Coal & Metal Mining		03
3.	Stoping Method		15
4.	Physiomechanical Properties of Rocks		05
5.	Rock burst		03
6.	Face mechanization		08

## RATIONALE

As Mining Engineer, one should have the knowledge in fundamental principles of generation in underground metal mines.

## OBJECTIVES

On completion of the subject, students will be able to :

1. Explain various methods of development used in underground metal mines.
2. Compare between coal & metal mining.
3. Explain various stopping methods used in u/g metal mines.
4. Develop concept of physico-mechanical properties of rock.
5. Explain causes & prevention of rock burst.
6. Describe about face mechanization.

## COURSE CONTENTS (Based on specific objectives)

### 1.0 Development in underground Metal Mine.

- 1.1 Explain formation of blocks of mineral deposit.
- 1.2 Explain level interval
- 1.3 Describe
  - i) Open raising method
  - ii) Two compartment method
  - iii) Jora raise lift
  - iv) Long hole drilling method.
  - v) Alimak raise climber
  - vi) Raise borer.

### 2.0 Give a comparative study between coal and metal Mining.

### 3.0 Stopping methods.

- 3.1 Classify stopping methods with application and factors affecting methods of stopping.
- 3.2 Describe the following methods with layout including drilling, blasting, transportation and supports.
  - a) Open stopping.
  - b) Open stopping with pillar support.
  - c) Shrinkage stopping.
  - d) Cut & fill stopping.

- e) Square set stoping.
- f) Block caving.
- g) Sub-level caving.
- h) Top slicing.

#### 4.0 Physico-mechanical properties of rocks

- 4.1 Define Physico-mechanical properties such as hardness, compressive Strength, I.S.I., P.S.I. & drill ability. Time dependent properties of rocks.

#### 5.0 Rock Bruist

Explain causes and prevention of rock bruist.

#### 6.0 Face mechanization

- a. Describe use of jumbo drill with air leg.
- 6.2 Describe various transportation machineries like L.H.D., rocker shovel, spiral chutes and draw points, Scraper etc.

### RECOMMENDED BOOKS

1. SME Mining Engineering Hand Book Vol.I & II-1993 edition.
2. Metal Mining – Chacharker
3. Mining Engineering Hand Book – Peele
4. EMT Vol.II – D.J.Desmukh
5. Mining Ground control – Prof. B.S. Verma
6. Rock Mechanics – Jermic
7. Rock Mechanics – Jugger & Cook
8. Metalliferous Mining – Higam

## MINE HAZARDS & ENVIRONMENT

L/wk T/wk P/wk

**4 0 4**

**Period per Week: 8 Total Marks: 150**

**Total Periods**

**Lecture: 44**

**Practical: 44**

Subject Ref.No.: Mg504

**Evaluation Scheme**

**Theory:**

**End Term Exam.: 80**

**I.A.: 20 (15+5)**

**Practical**

**End Term Exam.: 25**

**Sess.: 25**

### TOPIC WISE DISTRIBUTION OF PERIODS (Theory)

Sl.No.	Topic	Periods:	L
1.	Mine gases & gas testing		04
2.	Emission of firedamp in U/g coal mines		02
3.	Mine fires & spontaneous heating		07
4.	Mine Explosion		07
5.	Mine Inundation		05
6.	Mine lighting & Illumination		03
7.	Mine dust		03
8.	Noises & Vibration		03
9.	EIA & EMP		02
10.	Mine environment (Introduction only)		04
11.	Rescue apparatus		04

### RATIONALE

As a Mining Engineer, one must be thoroughly conversant with various sources of mining hazards as also the remedial measures needed to be undertaken to avoid any mishap.

## **OBJECTIVES**

After completion of the subject, students will be able to:

1. Describe different gases in mines, its testing, physiological effect on miners, detection of fire damp by flame safety lamp, explain the method of gas testing by CO-detectors & methanometers.
2. Explain how firedamp is emitted in mines.
3. Explain causes of mine fires & spontaneous heating.
4. Define explosion, explain causes & elaborate necessary steps required for prevention of coal dust & firedamp explosion.
5. Define mine inundation, explain causes & elaborate necessary preventive measures required.
6. Describe lighting arrangement, lighting standards explain glare & its effect
7. Explain properties of dust, effect on human body dust diseases.
8. Explain the effect of noise & vibration on miners & mine structures & other surface structure.
9. Develop concept about EIA & EMP.

## **COURSE CONTENTS (Based on specific objectives)**

### **1.0 Mine gases & gas testing**

- 1.1 Define atmosphere air & mine air.
- 1.2 State different gases as found in mines, their properties & physiological effect.
- 1.3 State various sources of formation of CO, firedamp, black damp & after damp in mines.
- 1.4 Describe flame safety lamp & its working principle.
- 1.5 Explain gas testing by flame safety lamp by accumulation test & percentage state.
- 1.6 State precaution for gas testing.
- 1.7 Describe various parts of combustion tube flame safety lamp, special features.
- 1.8 State limitations of flame safety lamp.

### **2.0 Emission of firedamp in U/g workings**

- 2.1 Describe gradual exudation, blower & outbursts of firedamp in U/g workings.

### **3.0 Define fires & spontaneous heating**

- 3.1 Describe causes & factor affecting spontaneous heating.
- 3.2 Define incubation period.
- 3.3 State preventive measures against spontaneous heating.
- 3.4 Explain CO/O<sub>2</sub> ratio & CO<sub>2</sub>/O<sub>2</sub> ratio.

### **4.0 Mine Explosion**

- 4.1 Describe coal dust & fire damp explosion with their causes & prevention.
- 4.2 State inflammability of coal dust & fire damp.
- 4.3 Explain Coward's diagram.
- 4.4 State prevention, suppression & treatment of dust.
- 4.5 Describe sampling of dust in Mines.
- 4.6 Stone dust barrier.

### **5.0 Mine Inundation**

- 5.1 State sources of water in mines & its danger.
- 5.2 State precaution against inundation.
- 5.3 Describe burnside's safety boring apparatus.
- 5.4 State precaution while approaching water logged area.
- 5.5 Describe water dams- its construction & design. (Without derivation of formula)
- 5.6 Explain water danger plan.

### **6.0 Mine lighting & illumination**

- 6.1 State effect on safety level of illumination at different working places at mines with reference to D.G.M.S. circulars.

## **7.0 Mine Dust**

State various types of mine dusts their formation & physical properties of dust, composition, size, concentration & time of exposure.

Describe sampling of dust by gravimeter dust sampler & other methods.

Describe occupational disease like pneumoconiosis, silicosis, asbestosis, aystagnus, epidermophytosis, ankylostomiasis, beal, diseases, radiation hazards etc.- their causes & preventive measures.

## **8.0 Noise & Vibration**

- 8.1 Describe sources of noise & vibration effects & its control.

## **9.0 EIA & EMP**

- 9.1 Describe allowable concentration of pollutants in industrial & domestic sectors as per the standards of MOEF & CPCB.
- 9.2 Explain necessity of preparation of EIA & EMP for environmental clearance of a mining project from the government agency.

## **10.0 Mine environment (Introduction only)**

- 10.1 Afforestation.
- 10.2 Waste dump Management.
- 10.3 Topsoil Management.
- 10.4 Air & Water Management.
- 10.5 Mine aesthetics.
- 10.6 Reclamation and rehabilitation.
- 10.7 Water Dam Management.

## **11.0 Rescue apparatus, Proto-iv, Proto-v, Draeger BG-174, Self rescuer, Smoke helmet, Gas mask.**

## **RECOMMENDED BOOKS**

1. Mine Ventilation – G.B.Mishra
2. EMT-II & III – D.J.Desmukh
3. Coal Mine Practices – E.Mason
4. UMS Vol-I
5. A Critical Study of Indian Mining Legislation – Rakesh Prasad.

## **MINING HAZARD AND ENVIRONMENT LAB**

**Period per week: 04**

**Total Periods: 44**

**Evaluation Scheme**

**Practical**

**End Term Exam: 25**

**Sess.: 25**

1. a) Estimation of CH<sub>4</sub> in air sample using flame safety lamp and detection by a methanometer.
- b) Accumulation & percentage test of CH<sub>4</sub> by flame safety lamp.
2. Study & use of different types of methonometer.
3. Determination of CO by using CO-dectector.
4. Determination of CO<sub>2</sub> in air sampling by CO<sub>2</sub> detectors.
5. Gas analysis by (I) Orsat apparatus.
6. Haldane apparatus for gas analysis.
7. Study & uses of Konimeter.
8. Sampling of dust by gravimetric dust sampler.

# MINE MACHINERY – I

L/wk T/wk P/wk  
**4 1 4**

**Period per Week: 8**      **Total Marks: 150**  
**Total Periods: 09**  
**Lecture: 44**  
**Tutorial: 11**  
**Practical: 44**

Subject Ref. No.: Mg505

**Evaluation Scheme**  
**Theory:**  
**End Term Exam.: 80**  
**I.A.: 20 (15+5)**  
**Practical**  
**End Term Exam.: 25**

## TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topic	Periods:	L	T
1.	Transportation in Mines		14	03
2.	Wire ropes		09	02
3.	Headgear		03	01
4.	Cage & shaft fittings		04	01
5.	Winding drum		03	01
6.	Friction Winding		04	01
7.	Skip Winding		04	01
8.	Pit top & Bottom Layout		03	01

## RATIONALE

It is imperative that a Mining Engineer should be thoroughly conversant with various types of machine used in mining operations.

## OBJECTIVES

On completion of the subject, students will be able to:

1. Describe different types of transportation methods in mines.
2. Describe type & construction of wire, their uses, maintenance & related calculation.
3. Explain headgear's functions & its design factors.
4. Describe constructional & safety features of cage and shaft.
5. Describe different profiles of winding drum, various safety devices & related calculations.
6. Describe different types of friction winding & its function.
7. Explain skip-winding arrangements.
8. Draw various arrangements at pit top & pit bottom layouts.

## COURSE CONTENTS (Based on specific objectives)

### 1.0 Transportation

- 1.1. Transportation in mines.
  - 1.1.1 State type of rope haulage.
  - 1.1.2 Describe various types of rope haulage with simple sketches.
  - 1.1.3 Solve numerical problems on different type of rope haulage.
  - 1.1.4 State & describe different type of safety devices on rope haulage roadways.
  - 1.1.5 State & describe different types of clips & coupling.

1.1.6 Describe rail sleepers, rail fastenings, fish plate, ballast, friction roller, vertical roller, bevel pulley, jim crow, transition curves & various types of crossing.

1.2 Transportation by conveyors.

1.1.1 State different types of conveyors used in Mines.

1.1.2 State & describe take up arrangements of belt conveyor.

1.1.3 Calculate carrying capacity of belt conveyor.

1.1.4 Describe safety devices of belt conveyor.

1.1.5 Solve simple numerical problems on belt conveyor.

1.1.6 Describe constructional features of shaker conveyor, scraper chain conveyor. Armored flexible conveyor, cable belt conveyor & steel cord belt conveyor.

1.1.7 State applicability advantages & disadvantages of various type of conveyors.

## **2.0 Wire Ropes**

2.1 State the types of wire ropes used in Mines.

2.1.1 Describe constructional features of wire ropes & lay of wire ropes.

2.2 Define factor of safety to wire ropes nominal & actual factor of safety of wire ropes.

2.2.1 State factors influencing the F.O.S.

2.3 State efficiency of rope construction, space factor & cross sectional area rope.

2.1 State factors affecting deterioration of ropes.

2.2 Describe care & maintenance of ropes.

2.3 State & describe testing & examination of wire ropes.

2.4 Give the procedure of splicing of wire rope

2.5 Calculate the size of wire ropes for winding & haulage.

2.6 Describe rope capel for haulage winding & recapping.

## **3.0 Headgear**

3.1 State function of headgear.

3.2 Calculate height of headgear.

3.3 Describe constructional features of headgear pulley.

3.4 Define angle of fleet.

## **4.0 Cage and shaft fitting**

4.1 Describe cage, cage suspension gear, detaching hooks & its function, safety catch at headgear & keps.

4.2 State types of guide.

4.3 State & describe rigid guide, flexible shoes, guide rope suspension & tensioning arrangement.

## **5.0 Winding drum**

5.1 State different profiles of winding brake.

5.2 Describe different types of winding brake.

5.3 Describe various types of safety devices on winding system.

## **6.0 Friction Winding**

1.1 State & describe principle & constructional features of ground-mounted koepe & tower-mounted koepe.

1.2 State advantages & disadvantages of koepe winding.

1.3 Describe multirope system of koepe winding.

## **7.0 Skip winding**

1.1 Describe constructional features bottom discharge skip.

1.2 Compare skip winding cage winding.

## **8.0 Pit top & Pit bottom circuit layout**

State factors affecting pit top & pit bottom layouts.

Describe different types of pit top & pit bottom car/tub circuit layouts.

## RECOMMENDED BOOKS

1. Mine hoisting – Dr. M.A.Ramulu
2. SME Mining Engg Hand Book
3. Material Handling in Mines, IIT Khargpur
4. EMT III – D.J.Desmukh
5. Mine Transport – N.T.Kerlin
6. UMS Volume.

## MINE MACHINERY – I LAB

**Period per week: 04**

**Total Periods: 44**

**Evaluation Scheme**

**Practical:**

**End Term Exam: 25 Marks**

**Sess.: 25 Marks**

1. Study of Wire rope.
2. Study of rope splicing.
3. Study of rope cappel.
4. Study of safety hook.
5. Study of keps.
6. Study of guide in shaft.
7. Study of clips used in endless rope haulage.

## PRACTICAL TRAINING REPORT & SEMINAR

**L/wk T/wk P/wk**  
**0 0 2**

**Subject Ref.: Mg506**

**Periods per week: 3**

**Total Marks:50**

**Evaluation Scheme**

**Total Periods: 22**

**practical**

**Practical: 33**

**Sess.: 50 Marks.**

Students will go to different Mines for practical Training during 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> & 5<sup>th</sup> semester for a period of 4 weeks (30 days). After returning from training they have to submit training reports touching all aspects of mining & related operations i.e. geology, survey, drilling, blasting, methods of work, ventilation, support, transportation & any problem in Mines detected by them. This will be followed as per curriculum. Their report will be evaluated by conducting seminar & viva voce tests. Training report will not be accepted without training certificate from the Mine Manager concerned.

## SURVEY INSTRUMENT TECHNOLOGY –II

Periods/ Week -4

Theory – 3 Hrs.

Total Periods – 40

End Exam. – 80

Internal Assessment-

20(15+5)

- a) The theodolite transit and non transit types :

Different parts. Horizontal and vertical angle measurement, clamps and tangent screws bearing their limits and fits, striding level through compass, tubular compass auxiliary telescope, optical plum, optical micro meter, Internal

illumination system. Details of micrometer least count to read the micrometer error and adjustment. The estimation microscope, double reading theodolite, the universal theodolite, Travistock theodolite watt microscopic theodolites the American transit, the wye-non transit theodolite, Permanent adjustment of transit theodolite, and wye theodolite.

a) The compass :

Plain compass or miner's dial leans dial, headings dial microptic dial testing and permanent adjustment of the compass, prismatic compass.

b) The level :Dumpy level, wild dumpy level, watts quick set level, the wye level, cook's reversible level, the tilting level, the zeiss level, leveling staff, target staff, permanent- adjustment of dumpy level. Adjustment of wye level and tilting levels, the hand level. Abney level, clinometers foot rule clinometers, ghat tracer, optical automatic level dumping device used.

c) Gyroscope, its principle and use.

d) Constructional details of planimeter, Ediograph and pentagraph.

e) Photo theodolite and sterio comparator, principle of computation.

f) Telemeter and tange finder construction and adjustments.

g) Effects of weather on survey instrument.

Books Recommended :

1) Plane and geodetic survey : By Clark – Vol-I & II

2) Mason Surveying – Vol –I

3) U.M.S. Extraction to M.S. Course

4) Principles and use of Surveying instruments : By D.G. Olliver.

## TEACHING & EVALUATION SCHEME

DISCIPLINE : Mining Engineering

SEMESTER : VI

Sl. No	Subject	Teaching Scheme (Hours/week)			Evaluation Scheme					Total mark
					Theory			Practical		
		L	T	P	End Exam	Internal Assessment Class Test	Assignment	End Exam	Sessional	
1	Entrepreneurship & Mine mgt.	4	-	-	80	15	5	-	-	100
2	Mine Machinery-II	4	-	-	80	15	5	-	-	100
3	ELECTIVE	4	-	-	80	15	5	-	-	100
4	(i)Mineral Dressing (ii) Material Handling & Transportation in mines (iii)Drilling technology (iv) Modern Mine Surveying									
5	Mining Geology	4	-	-	80	15	5	-	-	100

### Practical

1	Mine Geology	-	-	6	-	-	-	50	50	100
2	Mine Sketching	-	-	6	-	-	-	50	50	100
3	Computer problem solving in Mines	-	-	3	-	-	-	25	25	50
4	Mine Machinery-II	-	-	3	-	-	-	25	25	50
5	Project Work Training Report & Seminar	-	-	3	-	-	-	-	50	50
6	Library Study	-	-	2	-	-	-	-	-	-
<b>Total :</b>		16	-	23	320	60	20	150	200	750

NOTE : Evaluation for I.A (Theory) & Sessional Practical to be made as per guidelines of SCTE & VT.

# ENTERPRENURSHIP & MINE MANAGEMENT

L/wk T/wk P/wk  
4 0 0

Periods per week: 04  
Total Periods  
Lecture: 44

Total Marks: 100

Evaluation Scheme  
Theory:  
End Term Exam: 80  
I.A.: 20 (15+5)

## TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	Periods:	L
1.	Entrepreneurship		04
2.	Management & Organisation		03
3.	Financial Management		03
4.	Marketing Management		02
5.	Manpower Management		03
6.	Management Techniques		03
7.	Scientific Management		02
8.	Management by Objectives		03
9.	Motivation		02
10.	Work Study		04
11.	Wages		03
12.	Incentives		02
13.	Industrial Psychology		03
14.	Trade Unions		02
15.	Industrial Dispute Act		05

## RATIOALE

A Mining Engineer should possess entrepreneurial qualities of efficient management of mining operations. Since a large number of employees are involved in mining, a mining engineer should have the knowledge of industrial psychology, trade unions and their functions, Industrial Dispute Act etc.

## OBJECTIVES

On completion of the subject, students will be able to:

1. Define entrepreneurship & its characteristics.
2. State the principle and function of entrepreneurship management.
3. Explain the procedure involved in financial management.
4. Explain the procedure involved in marketing management.
5. State the meaning of the manpower management.
6. Explain management techniques.
7. State the principles and advantages of scientific management.
8. Explain the meaning of management by objects.
9. Explain motivational technique.
10. Explain the procedure of work-study.
11. Describe wage system and different type of wages.
12. State basic concepts of incentives.

13. State the meaning of industrial psychology working conditions & environment.
14. State & explain the functions of trade unions & their function.
15. State the Industrial dispute Act.

## **COURSE CONTENTS (Based on specific objectives)**

### **1.0 Entrepreneurship**

- 1.1 Define entrepreneurship.
- 1.2 Explain role of entrepreneurship in industrial development.
- 1.3 Describe entrepreneurship characteristics.

### **2.0 Entrepreneurship management**

- 2.1 State principle of entrepreneurship management.
- 2.2 State function of management.
- 2.3 Explain organizational structure.
- 2.4 Describe the scope of entrepreneurship in small mines & allied industries.

### **3.0 Financial management**

- 3.1 State types of working capital.
- 3.2 Discuss principle & function of financial institution.
- 3.3 Describe the principle of mine economies & cost control avenues.

### **4.0 Marketing management**

- 4.1 Discuss the principle of marketing management & materials management.
- 4.2 Describe the application of material & marketing management principles in mines.

### **5.0 Meaning & objective of man-power management.**

- 5.1 Describe human behaviour & group attitude of labours in mines.

### **6.0 Management techniques**

State basic concepts of management.

Briefly discuss on planning, organizing, coordinating, motivating, directing & controlling.

Describe mine organization structures, competent persons & officials.

- 7.0 State main principles & advantages of scientific management.
- 8.0 Discuss the meaning of the term management by objectives, its necessity & advantages.
- 9.0 Motivation
  - 9.1 Define & describe different kinds of motivation.
  - 9.2 Explain different motivational techniques.
- 10.0 State basic concept, procedure and advantages of work study, time study & motion study.
- 11.0 Define wage, nominal wage, real wage, living wage, minimum wage, fair wage & fall back wages (Definitions as per Mines Act & Rules).
  - 11.1 Discuss essentials of good wages system.
- 12.0 State basic concept of incentives.
- 13.0 State meaning of industrial psychology working condition & environment.
- 14.0 Develop concept about trade unions & their function.
- 15.0 State main provision of Industrial dispute Act-1956.

# MINE MACHINERY – II

L/wk T/wk P/wk

**4 0 3**

**Period per Week: 7 Total Marks: 150**

**Total Periods:**

**Lecture: 44**

**Practical: 33**

**Evaluation Scheme**

**Theory:**

**End Term Exam.: 80**

**I.A.: 20 (15+5)**

**Practical**

**End Term Exam.: 25**

**Sess.: 25**

## TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topic	Periods:	L
1.	Underground face machineries		15
2.	Opencast machineries		12
3.	Mine Pumps		08
4.	Bore hole pump		05
5.	Pipes and valves		04

## RATIONALE

Same as that of Ms 505.

## OBJECTIVES

On completion of the subject, students will be able to:

1. Describe various underground face machineries & its applicability.
2. Describe various opencast machineries & its applicability.
3. Describe various types of pump & its applicability.

## COURSE CONTENTS (Based on specific objectives)

### 1.0 Underground face machineries.

- 1.1. Electric coal drill
  - 1.1.1 Describe constructional features, operation, principle & use of electric coal drill.
  - 1.1.2 State types of drill rods & drill bits used in electric coal drill.
- 1.2 Describe basic constructional features of gathering arm loader, scraper loader, side discharge loader & load & haul loader.
- 1.3 Describe basic constructional features & operation principle of jack hammer drill & air leg drill.
- 1.4 Describe basic constructional features & operation principle of road header & Shearer loader.

### 2.0 Opencast machineries

- 2.1 Describe basic constructional features of surface miner, dragline, shovel & backhoe, bucket wheel excavator.
- 2.2 Describe basic constructional features of dumper, dozer, scraper & road grader.

### 3.0 Mine Pumps.

- 3.1 Classify mine pumps.
- 3.2 Describe constructional features, working & use of ram pumps.
- 3.3 Centrifugal & turbine pumps.
- 3.4 Describe constructional features of centrifugal & turbine pumps.

- 3.5 State principle of centrifugal & turbine pumps & its applicability.
- 3.6 Explain balancing the axial thrust of turbine pumps.
- 3.7 Draw characteristic curves for turbine pumps.
- 3.8 Solve numerical problems on centrifugal & turbine pumps.
- 3.9 Describe constructional features and working principle & use of rotor pump (screw pump)
- 3.10 Describe constructional features & working principle of sinking pump.
- 3.11 State procedure of suspension in shaft.

#### 4.0 Bore hole pump

- 4.1 Describe constructional features & working of bore hole pump.
- 4.2 State installation of bore hole pump.

#### 5.0 Pipes and valves

- 5.1 State types of pipe used in Mines.
- 5.2 State types of valve used in Mines.
- 5.3 Describe constructional features of various type of valves.
- 5.4 State & describe different types of pipe joints.
- 5.5 Describe support of rising main pipe in shaft.
- 5.6 State the procedure of supporting the pipe in shaft.

#### RECOMMENDED BOOKS

1. Electrical equipment in Mine – H. Cotton
2. Winning and Working of Iron Ore – Desmukh & Desmukh
3. E.M.T. Vol.-III – D.J.Desmukh

#### MINE MACHINERY – II (LAB)

1. Study of Centrifugal Pumps.
2. Study of Turbine Pumps.
3. Study of Roto Pump.
4. Study of Sinking Pump.
5. Study of electric coal drills & its accessories.
6. Study of air leg drill.
7. Study of scrapper & shaker conveyer.
8. Study of scrapper loader.

#### MINERAL DRESSING (ELECTIVE)

L/wk T/wk P/wk  
**4 0 0**

**Period per Week: 4 Total Marks: 100**

**Total Periods:**

**Lecture: 44**

**Evaluation Scheme**

**Theory:**

**End Term Exam.: 80**

**I.A.: 20 (15+5)**

#### TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topic	Periods:	L
1.	Introduction		02
2.	Unit Operations		05
3.	Grinding		06
4.	Lab. Sizing		05
5.	Industrial Screening		05
6.	Gravity Concentration		06
7.	Heavy Media Separation		05
8.	Floatation		05
9.	Magnetic & Electrostatic Separators		05

## **RATIONALE**

In case of metalliferous mines, the ultimate goal is the extraction of metals. Prior to sending ores into the process of extraction, it requires dressing for removal of desirable gangue minerals as far as possible. So a Mining Engineer, specially attached to metalliferous mines should have some basic concepts about mineral dressing.

## **OBJECTIVES**

On completion of the subject, students will be able to:

1. Comprehend physical & chemical properties of ores, know the application in mineral dressing.
2. Explain the principle of operation of Blake & Dodge jaw crushers, Gyratory Cone crushers, roll crushers.
3. Explain the principle of ball mill, open circuit & close circuit Grinding.
4. Explain the principle of lab.sizing.
5. Explain the principle of operation of industrial screening. Comprehend the principle of operation of classifiers & their application in the field.
6. Comprehend elementary idea about gravity concentration.
7. Explain the principle of operation of heavy media separation.
8. Comprehend elementary principle of floatation process.
9. Explain the principle & application of magnetic separators.

## **COURSE CONTENTS (Based on specific objectives)**

### **1.0 Introduction**

1.1 Describe the objective & scope of application of mineral dressing in surface & u/g mines.

### **2.0 Unit operations**

2.1 Explain the principle of Blake & dodge jaw crushers, gyratory & cone crushers, roll crusher.

### **3.0 Grinding**

3.1 Explain the principle of ball mill operation, open circuit grinding, close circuit grinding, dry & wet grinding.

4.0 Explain the procedure for size analysis & use of standard screen as also screening techniques employed.

### **5.0 Industrial screening**

5.1 Explain the principle of industrial screening, type of screening ( without calculation)

5.1.1 Explain the operation of classifier & their application.

### **6.0 Gravity concentration**

Explain the general principles of wilfly table & its operation.

Develop elementary idea regarding the operation jigs.

### **7.0 Heavy media separation**

7.1 Explain the fundamental principle of heavy media separation – Chance process.

### **8.0 Floatation**

8.1 Comprehend elementary principle of froth floatation, practical utility of frother, collection, modifiers & depressants.

8.2 Describe & illustrate floatation cell.

## 9.0 Magnetic & Electrostatic Separators

Explain the principle of operation of magnetic & electrostatic separators.  
Describe the application of separators in mineral dressing.

### RECOMMENDED BOOKS

1. Principles of Mineral Dressing- Gaudin A.M.
2. Hand Book of Mineral Dressing Ores & Minerals – A.E.Taggart
3. Mineral Processing Technology – B.A.Wills

## MATERIAL HANDLING & TRANSPORTATION IN MINES (ELECTIVE)

L/wk T/wk P/wk

4 0 0

Period per Week: 4 Total Marks: 100

Total Periods:

Lecture: 44

Evaluation Scheme

Theory:

End Term Exam.: 80

I.A.: 20 (15+5)

### TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topic	Periods:	L
1.	Introduction to surface & Underground haulage system		04
2.	Rope haulage		05
3.	Conveyors		06
4.	Locomotive haulage		06
5.	Aerial ropeways		05
6.	Introduction hydraulic transportation		05
7.	Man riding haulage		05
8.	Spiral chutes		03
9.	Flow of materials in bins, bunkers		05

### RATIONALE

A Mining Engineer entrusted with the responsibility of supervising material handling in a mine should have specialized knowledge in this area including transportation in mines.

### OBJECTIVES

On completion of the subject, students will be able to:

1. Classify underground & surface transportation system in mines.
2. Explain the basic mechanics and design of rope haulage system.
3. Describe various types of conveyor & its design.
4. Explain various types of locomotive haulage used in underground mines.
5. Describe aerial ropeway & its applicability.
6. Describe hydraulic transportation in mines.
7. Explain man riding haulage system.
8. Explain spiral chute.
9. Describe flow of materials in bins & bunkers.

### COURSE CONTENTS (Based on specific objectives)

## **1.0 Introduction to surface & underground haulage system**

- 1.1 Classify underground & surface haulage system.
- 1.2 State factors affecting design of a haulage system.
- 1.3 Find out the capacity of a haulage system in a given production.

## **2.0 Rope haulage**

- 2.1 Describe formula of gravity haulage, direct rope haulage, double drum balanced direct rope haulage, main & tail rope haulage and endless rope haulage.
- 2.2 Calculate size of rope & power of motors required in direct rope haulage, endless rope haulage & main and tail rope haulage from a given production.
- 2.3 Describe constructional features & operation of tipplers.

## **3.0 Conveyors**

- 3.1 State factors affecting design of belt conveyor, cable belt conveyor and steel cord conveyors.
- 3.2 Find out carrying capacity of belt conveyor, cable belt conveyor & steel cord conveyor.
- 3.3 Describe constructional features of belt conveyor & cable belt conveyor.
- 3.4 Describe formula to calculate drive capacity of belt conveyor & cable belt conveyor.

## **4.0 Locomotive haulage**

- 4.1 State different types of locomotive haulage.
- 4.2 Describe basic constructional features of trolley wire, compressed air & diesel locomotives.
- 4.3 State applicability, merits & demerits of locomotives.
- 4.4 Describe safety devices of diesel locomotive including flame trap around exhaust conditioner box.
- 4.5 Solve numerical problems.

## **5.0 Aerial ropeways**

- 5.1 Classify aerial ropeways.
- 5.2 State applicability of aerial ropeways.
- 5.3 Describe constructional features of bicable and twin cable ropeways.
- 5.4 Describe loading, unloading & angle stations bicable & thin cable ropeways.

## **6.0 Hydraulic transportation of solids**

- 1.1 Define hydraulic transportation.
- 1.2 Discuss theory of hydraulic transportation of solids in mines (without derivation)
- 1.3 Design the hydraulic transportation system.
- 1.4 State applicability, advantages & disadvantages of hydraulic transportation in Mines.

## **7.0 Man riding haulage**

- 1.1 State different types of man riding system.
- 1.2 Describe constructional features of monorail, deorail & flight chairs & conveyor system.

## **8.0 Spiral Chutes**

- 1.1 State capability of spiral chutes.
- 1.2 Explain working principle of spiral chutes.
- 1.3 Describe constructional features of spiral chutes.

## **9.0 Flow of materials in bins, bunkers**

Describe bins & bunkers.  
Explain flow of materials in bins & bunkers.  
Design bunkers & bins for a given production.

## RECOMMENDED BOOKS

1. Mining Machinery – T. Bryson
2. Material Handling in Mines IIT Kharagpur journal
3. Mine Transport – N.T.Kerlin
4. EMT Vol.-III – D.J.Desmukh
5. S.M.E. Mining Engineering Hand Book

## DRILLING TECHNOLOGY (ELECTIVE)

L/wk T/wk P/wk

**4 0 0**

**Period per Week: 4 Total Marks: 100**

**Total Periods:**

**Lecture: 44**

**Evaluation Scheme**

**Theory:**

**End Term Exam.: 80**

**I.A.: 20 (15+5)**

### TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topic	Periods:	L
1.	Exploratory Drilling		09
2.	Blast hole drilling & compressed Aid drills		09
3.	Water well drilling		07
4.	Foundation drilling		07
5.	Oil well drilling		12

### RATIONALE

A Mining Engineer entrusted with the responsibility of supervising drilling operation in mines should have specialized knowledge in various types of drilling operation.

### OBJECTIVES

On completion of the subject, students will be able to:

1. Explain various method of exploratory drilling & its application in mines.
2. Describe different blast hole drills.
3. Explain different rock drills as used in Mines.
4. Explain different water well drills used in field.
5. Describe foundation drilling techniques.
6. Describe general features of oils, rigs & other related accessories system.

### COURSE CONTENTS (Based on specific objectives)

#### 1.0 Exploratory drilling

- 1.1 Explain diamond core drilling & calyx chilled shot boring, different types of bits & drilling equipments like drill rods, core barrels, drill bits, casings, water swivels, lifting bail.
- 1.2 Describe core analysis & logging, surveying of boreholes, deviation & correction.

#### 2.0 Blast hole drilling & compressed air drills

- 2.1 Explain the principles of operation of churn drill & drill masters.

2.2 Study of C.A. drills such as jack hammer, wagon drills, DTH, drifters & stoppers.

### 3.0 Water well drilling

3.1 Describe cable drills, modern water well drills, rotary mud drilling.

### 4.0 Explain formation testing or dry-drilling.

### 5.0 Oil well drilling

Describe general features of oil rigs, sources of power supply, types of drive, rotary table, hoist derrick, crown & traveling block.

Explain control mechanism including types of gears, clutches hydraulic pumps.

Describe control mechanism of spindle movement, tri-cone rock roller bits, running in and pulling out of drill pipes, mud technology, casing & cementing.

## RECOMMENDED BOOKS

1. Oil Well Drilling Technology – Mc Cray & Cole
2. Diamond Drilling Handbook – C.P.Chugh
3. Water well Drilling Hand Book – A Johnson Publication.

## MODERN MINING SURVEYING (ELECTIVE)

L/wk T/wk P/wk

**4 0 0**

**Period per Week: 4 Total Marks: 100**

**Total Periods:**

**Lecture: 44**

**Evaluation Scheme**

**Theory:**

**End Term Exam.: 80**

**I.A.: 20 (15+5)**

## TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topic	Periods:	L
1.	Spherical trigonometry		09
2.	Field astronomy		09
3.	Elements of photogrammetry		12
4.	Global positioning system		08
5.	Total station		06

## RATIONALE

A Mining Engineer entrusted with the responsibility of supervising mine survey works should be thorough conversant with the latest developments & techniques employed in mine surveying.

## OBJECTIVES

On completion of the subject, students will develop the fundamental concept of:

1. Spherical Trigonometry.
2. Field astronomy.
3. Elements of photogrammetry.
4. Global positioning system.
5. Total station.

## COURSE CONTENTS

### 1.0 Spherical Trigonometry

- 1.1 Define some common terms used in spherical trigonometry like sphere, great circle, small circle, side of a triangle, angle of a triangle. Spherical axes, spherical triangle, right angled triangle.
- 1.2 Convert rectangular to spherical co-ordinates.
- 1.3 Define convergence of meridian & parallel of latitude.

### 2.0 Field Astronomy

- 2.1 Define some terms used in field astronomy like celestial sphere, celestial latitude, celestial longitude, azimuth, hour angle, declination, altitude, Zenith, Nadir, right ascension, celestial meridian, celestial equator, Zenith distance, vertical circle, celestial horizon, Astronomical triangle etc. Discuss different astronomical co-ordinates for heavenly bodies.
- 2.2 Determine apparent time, meantime, sidereal time, standard time, relation between different types of time.
- 2.3 Determine latitude, time & azimuth of a place.

### 3.0 Element of Photogrammetry

- 3.1 Know the Phototheodolite.

Define camera axis, picture plane, principal points, focal length, nodal point, perspective centre, principal distance, principal plane print and isocentre in terrestrial photogrammetry.

Explain fundamental principles behind stereophotogrammetry.

Define vertical photograph, titled photograph, oblique photograph, perspective projection, exposure station, flying height focal length, principal point, Nadir point, ground Nadir point, till, principal place, principal line, isocentre, azimuth of the principal plane, horizontal point. Find out the scale of the photograph.

### 4.0 Global positioning system

- 4.1 Define global positioning system (GPS). Explain the principal of working of the system in brief.
- 4.2 Outline the application of GPS in Mining engineering.

### 5.0 Total station

- 5.1 Identify different components of GPS
  - 5.1.1 Describe the applications of GPS in Mines.

## RECOMMENDED BOOKS

1. Surveying Vo.-II – Dr. B.C.Purnmia
2. Modern concept of Mine Surveying – Prof. Alam Chand.

## MINING GEOLOGY

L/wk T/wk P/wk

**4 1 6**

**Period per Week: 11 Total Marks: 200**

**Total Periods:**

**Lecture: 44**

**Tutorial: 11**

**Practical: 66**

**Evaluation Scheme**

**Theory:**

**End Term Exam.: 80**

**I.A.: 20 (15+5)**

**Practical**

**End Term Exam.: 50**

**Sess.: 50**

## TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topic	Periods:	L	T
1.	Stratigraphy		09	03
2.	Fossil Fuels		09	02

3.	Prospecting & Exploration	09	02
4.	Economic Geology	09	03
5.	Sampling	08	01

## **RATIONALE**

In majority of the cases, materials that need to be explored comprise rocks & minerals. It is therefore, essential for an engineer to have basic knowledge of mining geology.

## **OBJECTIVES**

On completion of the paper, students will be able to:

1. Outline the importance of Stratigraphy & Geological time Scale in the study of geology.
2. The major Groups & economic minerals associated with them that form the basis for the study of stratigraphy.
3. Describe the use, origin mode of occurrence & distribution of fossil fuels & where top look for them.
4. Explain the fundamental principles that underline the search for economic minerals. He will achieve a certain amount of clarity in using geological, geophysical & geochemical methods for looking for important mineral deposits.
5. Develop a comprehensive idea regarding mineralogy mode of occurrence, uses & distribution of ores.
6. Undertake sampling work according to BIS specification.

## **COURSE CONTENTS (Based on specific objectives)**

### **1.0 Stratigraphy**

- 1.1 Describe the principles of stratigraphy.
- 1.2 Describe the geological time Scale.
- 1.3 Describe the stratigraphic sequence, lithology, distribution & economic mineral deposits of Iron Ore series, Cuddpah Supergroup, Vindhyan super group & gondwana super group.

### **2.0 Fossil fuels**

- 2.1 Coal
  - 2.1.1 Describe the different ranks of coal.
  - 2.1.2 Describe different grades of coal like A,B,C,D.
  - 2.1.3 Describe the various theories accounting for the origin of coal.
  - 2.1.4 Describe various important lower gondwana Coalfields of India.
- 2.2 Petroleum
  - 2.2.1 Describe the organic & inorganic theories accounting for the origin of petroleum.
  - 2.2.2 Define oil pool & oil trap.
  - 2.2.3 Describe process of accumulation of oil.
  - 2.2.4 Describe different important oil fields in India.

### **3.0 Prospecting & exploration.**

- 3.1 Define prospecting.
- 3.2 Differentiate between prospecting & exploration.
- 3.3 Enumerate & describe various criteria for geological exploration.
- 3.4 Describe various methods of Geophysical prospecting.
- 3.5 Explain Geochemical prospecting.
- 3.6 Differentiate between biogeochemical & geobotanical prospecting.

### **4.0 Economic Geology**

- 4.1 Define ore & gangue.

- 4.2 Define tenor & grade.
- 4.3 Describe the mineralogy, mode of occurrence, distribution & use of iron ore deposits in India.
- 4.4 Describe the mineralogy, mode of occurrence, & description of Chromites deposits in India & its uses.
- 4.5 Describe the mineralogy, mode of occurrence & distribution of copper deposits in India & uses of this metal.
- 4.6 Describe the mineralogy, mode of occurrence, distribution of lead & zinc deposits in India & the uses of these metals.

### 5.0 Sampling

Define sampling, outline the method of preparation of samples for assay.

Explain sampling

Describe the different methods of sampling as outlined by Bureau of Indian Standards. (BIS)

### RECOMMENDED BOOKS

1. Geology of India & Burma – M.S. Krishnan
2. An Introduction to geology of Coal & coalfields of India – N.L.Sharma, K.S.V.Ram
3. Geology of petroleum – A.I.Levorsen
4. Geological prospecting & Exploration – V.K.Kreiter
5. A Hand Book of economic geology – A.K.Sen, P.K.Guha
6. Mineral Economics – R.K. Sinha, N.L.Sharma

### MINING GEOLOGY (LAB)

1. Identification of Igneous, Sedimentary & Metamorphic rocks in hand specimens.
2. Interpretation of contour maps & geological maps.
3. Describe the specific gravity of small specimen by Joley's spring balance.

### MINES SKETCHING (SESSIONAL)

L/wk T/wk P/wk

**4 0 6**

**Period per Week: 6 Total Marks: 100**

**Total Periods**

**Practical:66**

**Evaluation Scheme**

**Theory:**

**Practical**

**End Term Exam: 50**

**Sess.: 50**

1. Study & sketch of power shovels, draglines, scraper, jack hammer, DTH & hand held coal drill machine.
2. Study & sketch of centrifugal & turbine pump, pit top & pit bottom layout different types of u/g haulage layout.
3. Draw plan & elevation of cage & skip.
4. Draw plan, elevation & side view of headgear structure.
5. Draw the plan of a long wall face equipped with power support. Shearer loader. AFC stage loader & Gate Belt. Label each equipment along with top gate, Bottom gate, Face & goaf.
6. Draw the longitudinal section of a Cut & fit Stope.
7. Draw the sketch of diamond crossing.
8. Draw the plan & elevation of LHD & SDL machines.

9. Draw the plan & elevation of a Boom type road Header machine.
10. Draw the plan of magazine, modern lamp room cabin along with self-rescue rack & lamp maintenance room.
11. Draw a layout of a mechanized opencast working with surface continuous miner.

## **COMPUTER PROBLEMS SOLVING IN MINES**

L/wk T/wk P/wk  
**0 0 3**

**Period per Week: 3 Total Marks: 50**  
**Total Periods**  
**Practical:33**

**Evaluation Scheme**  
**Theory:**  
**Practical**  
**End Term Exam: 25**  
**Sess.: 25**

Draw the flowchart (DFC), write & run the programme on the problems relate to

1. Ventilation networking.
2. Transport linkage.
3. Winding system design & capacity assessment ( torque, power, speed etc.)
4. Mine production & productivity calculation.
5. Mine Planning & design.

## **PROJECT WORK, TRAINING REPORT & SEMINAR**

L/wk T/wk P/wk  
**0 0 3**

**Periods per week: 3 Total Marks:50**  
**Total Periods**  
**Practical: 33**

**Evaluation Scheme**  
**Theory**  
**Practical.**  
**Sessional: 50**

Students will go to different mines on practical training at the end of 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> & 5<sup>th</sup> Semesters for a period of 4 weeks/30 days. In the 6<sup>th</sup> Semester they will be assigned a project related to field. They will submit the project report after returning from training. On returning from mines a presentation is to be given by the students which will be evaluated followed by viva-voce examination.

They are also required to submit training reports touching all the aspects of the Mining & related operation i.e. geology, survey, drilling, blasting, method of work, ventilation, support, transportation & any problem in Mines detected by them. This will be followed as per the curriculum. Training report will not be accepted without training certificate from the Mine Manager concerned. In addition, students have to submit reports on study Tour on different Mines visited by them.

### **PHOTOGRAMETRY AND REMOTE SENSING**

Periods/ 3Week  
 Total Periods – 40

Theory – 3 Hrs.  
 End Exam. – 80  
 Internal Assessment-

20(15+5)

- a) Introduction :  
 Scope and importance of photographs
- b) Photogrametry Surveying – Types of photogrametry surveying(Terrestrial and aerial)

→Principle of terrestrial photogrametry – Different methods a) Graphical b) Analytical

→Stero photogrametry and field work.

→Elementary idea about photo theodolites and its application in photogrametry surveying, simple problems related to this subject.

Aerial photogrametry :

Flying photography ground control and mapping, Elementary ideas of instruments used in aerial surveying such as **a)** areoplane **b)** aerial camera **c)** accessories required for interpretation and plotting.

c) Terminology used in aerial surveying :-

- 1) Plumb points
- 2) Principal points
- 3) Iso-centres
- 4) Principal plane and plate parallels
- 5) Horizontal trace
- 6) Angle tilt
- 7) Principal distance
- 8) Scale and distortion of vertical photography
- 9) Scale and distortion of tilted/obligne photographs.

d) Principles of Binocular vision and stereo scopic fusion, flight planning with examples

→Plotting from air photographs and heightening , plotting machines, photo interpretation, comparison between air photographs and maps.

→Application of Air Photograph, simple problems.

e) Remote Sensing :

Introduction, plat forms of remote sensing, Electromagnetic radiation and interaction mechanism study of remote sensors, electro optical sensors and optical infrared remote sensors, Requirements of remote sensors photographic cameras, television camera.

Elementary idea about the technology of remote sensing from space.

Applications of remote sensing to mine surveying.

BOOKS :

1. Surveying and leveling : By T.P. Kanetkar & S.V. Kulkarai
2. Photoogrammetric Engg. and Remote Sensing : By Doyle
3. Photoogrammetric Engg. : By Ross.
4. Remote Sensing : Joseph and Kamat
5. Remote Sensing South East Asia : By I. Suchia.