

# MINING ENGINEERING

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## **MIC-601 MINERAL PROCESSING**

### **UNIT 1: COMMINUTION**

Introduction, definition, scope and economic justification, main steps in ore dressing operations, comminution, crushing, principles of crushing, jaw crushers, gyratory crushers, cone crushers, roll crushers, gravity stamps their classifications and applications, grinding principles of grinding, application and classification of ball mills, rod mills, tube mills and Pebble mills.

### **UNIT 2: SIZING**

Object of sizing, scale of sizing, laboratory sizing, screening and classification, different type of screens, their mode of operations and application and limitation, classification principles of classification, movement of solids through fluids, different types of classifiers, hydraulic and pneumatic classifiers, sampling-importance of sampling and methods used.

### **UNIT 3: GRAVITY CONCENTRATION**

Jigging, flowing film concentrators like spirals and shaking tables, heavy media separation, applications and limitations of methods.

### **UNIT 4: FLOTATION**

Physico-chemical principles, function of various flotation reagents, important machines, their principles, and working, flotation of sulphide, oxide and non-sulphide ores.

### **UNIT 5: PROCESSING METHODS OF SOME COMMON MINERALS**

Electrostatic and Magnetic Separation - Principle operation and field of application, Pelletisation of low grade iron ore, Drying and dewatering - thickening, filtration and drying. Coal washing; Simplified flow sheets for beneficiation of coal and typical ores of copper, lead, zinc, iron and manganese with special reference to Indian deposits.

### **REFERENCE BOOKS:**

1. Ore Dressing by Gaudin
2. Ore Dressing by B. A. Wills

### **LIST OF EXPERIMENTS:**

1. Study of Jaw crusher
2. Study of Roll crusher
3. Study of Grinding mills
4. Study of Akin's classifier
5. Study of Shaking table
6. Study of Mineral jig.
7. Study of Spiral concentrator
8. Study of Flootation cell
9. Study of Thickners
10. Study of Washability curves

## **MIC-602 BLASTING TECHNOLOGY**

### **UNIT 1: COMMERCIAL EXPLOSIVES**

Classification, Low and High Explosive, Permitted and non-permitted explosives, Important characteristics, ANFO, Slurry, Emulsion explosives, Primers and boosters, cast booster, Bulk explosive system.

### **UNIT 2: INITIATION SYSTEM, STORAGE AND TRANSPORTATION OF EXPLOSIVES**

Detonators, safety fuse, Detonation cord, Detonating relay, Non-electric initiation system, NONEL, Electronic detonators, Exploder and other blasting tools, Magazines, transportation of explosives.

### **UNIT 3: SURFACE BLAST DESIGN**

Theory of Breakage, Bench Blasting terminology, Estimation of Spacing, Burden, Stemming length, Sub-grade drilling etc., Charge calculation, initiation sequence, delay timing, Decking decoupling, Secondary Blasting.

### **UNIT 4: UNDERGROUND BLAST DESIGN**

Terminology, cut holes, easers, trimmers, commonly used cut patterns, Wedge cut, drag cut, Pyramid cut, Burn cut, etc., blasting in sinking shaft, underground coal mine blasting, series and parallel connections of detonators.

### **UNIT 5: ENVIRONMENTAL IMPACT OF BLASTING**

Blast induced ground vibration, its measurement, prediction and control, Noise, its measurements and control, Fly rock its causes and control, Controlled Blasting Techniques.

### **REFERENCE BOOKS:**

1. Surface Blast Design by C.J. Konya.
2. Explosives and Blasting by G.K. Pradhan
3. Modern Techniques of Rock Blasting by U. Langefors and B. Kihlstrom.
4. Indian Explosive Act and Rules
5. Engineering Rock blasting operations, Bhandari
6. Surface Blast Evaluation, N. R. Thote & Pradhan
7. Surface Blasting, P. Pal Roy

### **LIST OF EXPERIMENTS:**

1. Measurement of ground vibration by seismograph
2. Development of predictor equation from the recorded data
3. Measurement of VOD by VOD mate and its analysis
4. Study of various fragmentation assessment techniques
5. Handling of WIPFRAG software
6. Design of blast for coal face
7. Design of blast for underground metal mine
8. Design of blast for bench blasting
9. Study of various blasting tools
10. Study of bulk explosive systems

## **MIC-603 MINING ECONOMICS**

### **UNIT 1: SAMPLING**

Methods of sampling, Errors in sampling, analysis of samples, estimation of grade and reserves  
Different types of reserves. Salting, precautions against salting.

### **UNIT 2: MINE VALUATION**

Different methods, Depreciation, Amortization and Redemption of capital, life and present value  
of a mine.

### **UNIT 3: FINANCIAL MANAGEMENT**

Methods of framing and financing industrial enterprises, Memorandum and articles of  
association, shares, debentures, dividends and interest. Break even chart and inventory control.

### **UNIT 4: INVESTMENT DECISIONS**

Discounted cash flow methods, non-discounted cash flow methods, advantages and  
disadvantages of them, internal rate of return, Net Present Value.

### **UNIT 5: BOOK KEEPING**

Preparation of Balance sheet, Profit and Loss Account.

### **REFERENCE BOOKS:**

1. Mineral Economics , R.T. Deshmukh
2. SME Handbook, Vol. I
3. Mineral Economics , Sinha and Sharma

## **MIC-604(A) GROUND CONTROL**

### **UNIT-1 DESIGN OF MINE OPENING**

Stress distribution around narrow and wide openings. Extent of failure around mine openings. Determination of size of opening and extent of failure.

### **UNIT-2 DESIGN OF PILLARS**

Determination of shape and size of pillars in coal and hard rock mines, barrier pillars.

### **UNIT-3 SUBSIDENCE**

Theories of subsidence. Factors affecting subsidence. Sub-critical, critical and super-critical widths of extraction. Subsidence prediction and control. Design of shaft pillar.

### **UNIT-4 SLOPES**

Types of slope failure. Analysis of slope failure. Factors affecting slope stability. Drainage and reinforcement of slopes. Monitoring of slopes. Stability of waste dump.

### **UNIT-5 ROCK BURSTS**

Rock bursts and bumps – mechanism, prediction and control.

### **REFERENCE BOOKS:**

1. Elements of Mining Tech. Vol I,II,III by D. J. Deshmukh
2. Coal Mine Ground Control by Syd S Peng

### **LIST OF EXPERIMENT:**

1. Study of Factors affecting subsidence
2. Study of Prediction and Control of Rock Burst

## **MIC-604(B): UNDERGROUND METALLIFEROUS MINING**

### **STATUS OF METALLIFEROUS MINING INDUSTRY IN INDIA**

#### **DEVELOPMENT**

Opening of deposits – shafts (vertical and inclined), declines and adits. Cross-cuts. Division of ore body into levels and blocks. Level interval.

#### **DRIVING OF RAISES**

Conventional and raise boring machines methods.

#### **STOPPING METHODS**

Classification. Room and Pillar method. Sublevel stopping. VCR method. Shrinkage stopping – conventional and VCR. Cut and fill stopping and its variation. Sublevel caving. Block caving – spontaneous and induced. Dilution and recovery. Productivity. Unit supports and mass support systems. Selection of stopping methods.

#### **SPECIAL MINING SITUATIONS**

Special problems in deep mines. Solution mining. Leaching methods. Bacterial leaching. Sea-bed Mining.

#### **ORE BODY AND HOST ROCK**

Salient features, dilutions, type of dilutions, methods of dilution assessment, computation of net smelter returns of mine, economic considerations for selection of stopping methods.

#### **PILLAR RECOVERY METHODS**

## **MIC -605(A) MINE PLANNING & DEVELOPMENT**

### **UNIT I**

Coal reserves and their estimation, Geological and technological data needed for mine planning, Preparation of project and feasibility reports, Planning and scheduling of various mining operations.

### **UNIT II**

Planning and scheduling of various mining operations, linear programming, Simplex methods and transportation problem. Operation Research - Scope of application in mining, Linear programming, formulation and solution, Network planning with special reference to CPM/PERT, System approach for project scheduling.

### **UNIT III**

Division of mine area into units and sub units, Area, Reserve, Life and Capacity of mine, Panel size, Design of long wall face.

### **UNIT IV**

Cost of various mining operations, Optimum size of mines, Mode of opening up of deposits, Choice of opening, Location and size of Development openings.

### **UNIT V**

Mine Services Design of haulage, hoisting and drainage systems, Design of pit top and pit bottom, Coal handling plants, Railway siding etc.

### **TEXT BOOKS:**

1. Advance Coal Mining by R.T. deshmkh and V.S. Vorobjev
2. Mine Planning by S.P. Mathur
3. Mine Planning by B.J. Bhattacharya

### **LIST OF EXPERIMENT:**

1. Study of Coal Reserve in India.
2. Study of Mode of Openings.

## **MIC-605(B) CLEAN COAL TECHNOLOGY**

### **UNIT 1: COAL UTILIZATION**

Coal Production and utilization trends, Status of coal utilization technology and related operation and environment problems, Coal qualities and their effect on selection of efficient methods for eco-friendly utilization of coal.

### **UNIT 2: PRE-COMBUSTION TECHNOLOGY**

Necessity, Scope and limitation of pre-combustion coal cleaning technology, Washability characteristics and preparation problem related to coal quality, Principles, operations and selection of processes for coal preparation, Plant performance evaluation, and forecasting of cleaning results, Environment problems and related mitigating measures

### **UNIT 3: COMBUSTION AND PRE- COMBUSTION TECHNOLOGY**

Necessity, scope, and limitations of combustion and post-combustion clean coal technologies, Developments, basic principles, operating features of clean coal technologies, Selection, Performance and related environmental problems and their Control

### **UNIT 4: WATERS AND POLLUTANTS**

Characterization, impacts, control, treatment and safe disposal of water pollutants released from various stages of clean coal technologies, Utilization of Wastes and Pollutants.



## **MIC-606(A) TECHNOLOGY OF UNDERGROUND EXCAVATION**

### **TUNNELLING**

Drilling and blasting, mucking, transportation support, ventilation and illumination. Tunnel boring machines – factors influencing its performance, choice of TBMs, types of TBMs.

### **DESIGN AND CONSTRUCTION OF LARGE UNDERGROUND EXCAVATIONS**

Shape, dimensions, structural behaviour, methods and sequence of excavations.

Power stations.

Storage caverns.

Metro and large diameter trenches for communication.

Nuclear waste repositories and excavations for defence purposes.

## **MIC-606(B) FUNDAMENTALS OF DRILLING TECHNOLOGY**

### **DRILLING METHODS**

Classification, factors affecting drilling of rock – thrust, rotation, flushing, feed, rock type, alignment and deviation, flushing and suction drilling. Drillability of rocks. Basis for choice of methods - diameter, depth, and rock types. Ergonomics of drilling.

### **PRINCIPLES OF DRILLING**

Drilling mechanics, factors affecting rock drilling, alignment and deviation.

### **EXPLORATORY DRILLING**

Diamond drilling – types, rocks, barrels, bits and wire line system.

### **PRODUCTION DRILLING**

Percussive drilling – mechanism, types and methods. Constructional features, specifications, merits and limitations of various types of percussive drills machines. Rotary blast hole drilling – classification, characteristics, performance and applications of rotary cutting and rotary crushing drilling techniques.

### **MISCELLANEOUS DRILLING TECHNIQUES**

Water-jet assisted drilling, fire jet drill, drilling for coal field degasification and horizontal and directional drilling.