

Mining Engineering syllabus for written test for Lecturers of Polytechnics.



1. Drilling and Blasting

1.1 Types of explosives, their composition and properties; classification; Selection of explosives; Types of initiating systems – Electrical Detonators, Detonating Fuse, Detonating Relays, NONEL, Electronic Detonators, Blasting accessories, exploders, Blast instrumentation Drilling; Blasthole drills – types, classification, applicability and limitations; Mechanics of drilling, performance parameters, drilling cost, compressed air requirement for hole cleaning; Selection of drilling systems, drilling errors, organization of drilling.

1.2 Blasting: Mechanics of rock fragmentation; Livingstone theory of crater formation; Factors affecting blasting, Blast design – estimation of burden and spacing, estimation of charge requirement; Initiation patterns; Secondary blasting – pop and plaster shooting; Problems associated with blasting, Ground vibration and air over pressure

2. Mine Surveying

Principle of Surveying, Chain Surveying, Compass surveying, Theodolite, Plane Table surveying, Techeometry, triangulation, contouring, errors and adjustments, Underground surveying, Curves, Photogrammetry, EDM, Total Station, GPS, GIS and remote sensing (only basics)

3. Geology for Mining

3.1 Structural Geology: Study of topographic maps; Attitude of planar and linear structures; Effects of topography on outcrops. Unconformities, folds, faults and joints - their nomenclature, classification and recognition. Forms of igneous intrusions - dyke, sill and batholiths. Effects of folds and fractures on strata/ore bodies and their importance in mining operations. Principles of stereographic projections of linear and planar features of rocks.

3.2 Economic Geology and Exploration Geology: Ore and gangue; Processes of ore formation; Major Indian mineral deposits (Iron, Manganese, Copper, Lead, Zinc) - distribution and mode of occurrence. Mineral Exploration – concepts and methods viz. surface and subsurface; Exploration strategy and design; Stages of exploration; Resources and reserves

3.3 Coal and Petroleum Geology: Rank, characteristics and important constituents of coal; Classification and origin of coal; Chief characteristics of Indian coals; Geology of the principal coalfields of India

4. Rock Mechanics

4.1 Engineering classification of rocks and rock masses: Classification systems in rock engineering; Classification of intact rocks; Classification of rockmasss-Terzaghi's rock load, RQD, Rock Structure Rating, Bieniawski's RMR, Barton's Q-System, Laubscher's-MRMR, Hoek's-GSI, Palmstrom's Rmi, CMRI-ISM Rock mass classification and Recent developments; correlations between different classification systems; Applications of Rockmass Classification in rock engineering

4.2 Concept of stress and strain in rock: Analysis of stress, strain and constitutive relations in isotropic and anisotropic rocks.

4.3 Physico-Mechanical properties of rock: Determination of physical properties, strengths, strength



indices and static elastic constants; Parameters influencing strength; Abrasivity of rock and its determination.

Dynamic properties of rock and rock mass: Propagation of elastic wave in rock media; Determination of dynamic strength and elastic constants of rock.

4.4 Time dependent properties of rock: Creep deformation and strength behaviour; Creep test and rheological models; Strength and Deformability of Rock Mass: In situ shear tests; Evaluation of shear strength; In situ bearing strength test; In situ deformability tests- Plate Loading Test, Plate Jacking Test and Borehole Jack Tests; Failure criteria for rock and rock mass; Theories of rock failure; Coulomb, Mohr and Griffith criteria; Empirical criteria.

4.5 Pre-mining state of stress: Sources, methods of determination including over coring, hydro-fracturing methods and other methods.

## 5. Surface Mining

5.1 advantages and disadvantages; Role of surface mining in total mineral production; Deposits amenable to surface mining vis-à-vis excavation characteristics; Surface mining unit operations; Surface mining systems vis-à-vis equipment systems

5.2 Box cut – objective, types, parameters, methods; Factors affecting selection of box cut site; Production benches – formation, parameters and factors affecting their selection; Ripper: Types, classification, applicability and limitations; Method and cycle of operation; Estimation of output; Concept of ripparability; Estimation of number of drills required for a given mine production; Shovel-dumper operation, Dragline operation, Scrapers, Dozers

5.3 Front-end-loaders: Applicability and limitations; Method and cycle of operation; Minimum tipping-load – concept, estimation and significance; Calculation of maximum working load and selection of bucket capacity of a front-end-loader for a given job condition; Continuous methods of excavation and transport, Conveyors, Semi-continuous methods of excavation and transport.

5.4 Mining of developed coal seams and dimensional stones; Slopes in surface mines

## 6. Underground Coal Mining:

6.1 Introduction: coal resource and their geographical distributions; Coalification and factors affecting coalification process, modes of accumulation of coal, evidences in support of in-situ and drift theories; Geological time scale vis-à-vis formation of coal, occurrence and distribution of coal in various stratigraphic horizons; Coal seam structure and abnormalities, geological and other features of Indian coalfields.

6.2 Bord and Pillar Mining: General principles of Bord and Pillar (B&P) development, Design of B&P workings, statutory provisions related to B&P workings, Semi-mechanised and mechanized schemes of





B&P development; Mechanised face loading. Conditions suitable for mechanical loaders and continuous miners.

Pillar Extraction: statutory provisions on depillaring; principles of designing pillar extraction, factors affecting choice of pillar extraction; partial and full extraction

Longwall Mining: longwall face layouts, advancing and retreating faces, single versus double unit longwall faces, orientation of longwall faces; single versus multiple heading gate roads, factors affecting length and width of longwall panel.

6.3 Roof Supports: Timber props and cogs; friction/hydraulic props and chocks; other steel supports; types of roof bolts; function, applicability and advantage of roof bolting and cable bolting; powered supports; systematic support rules

### 7. Underground Metal Mining

Development: Choice of level interval and back/block length; Shape, size, position, excavation and equipping of shaft station/plat, grizzly, ore/waste bin, main ore pass system, underground crushing and loading stations, underground chambers, sump and other subsidiary excavations; Arrangements for dumping into main ore pass; Underground crushing, loading and hoisting.

Cross-cuts and drifts, Stopping, Mine supports

### 8. Mine ventilation and underground Hazard:

Underground atmosphere, Heat load sources and thermal environment, air cooling, Mechanics of airflow, distribution, Natural and Mechanical ventilatuion, Mine fans and usages, Auxillary ventilation, ventilation survey and planning, ventilation network

Mine gases, Methane drainage, Underground hazards from fires, explosions, dust and inundation; Rescue apparatus and practices; Safety management plan; Accident data analysis, assessment; Mine lighting; Mine legislation, occupational hazard and safety.

### 9. Mining Machinery

Generation and transmission of Mechanical, Hydraulic and pneumatic power, Material Handling; Wire ropes, haulages, conveyors, face and development machinery, hoisting systems, pumps, comminution methods and machinery.

### 10. Mine Economics, Mine Planning

10.1 Mineral Resource classification; discounted cash flow analysis; Mine valuation, Mineral taxation.

10.2 Sampling methods, practices and interpretation; Reserve estimate techniques; Basics of geo-statistics and quality control; Optimization of facility location; Mine planning and its components, Determination of Mine size and mine life; ultimate pit configuration and its determination, optimum mill cut-off grade and its determination; slope planning, Design of haul road, Selection of mining system in relation to equipment system.

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