

SEVENTH SEMESTER

Course Code 7N1	Ground Control in Mines	L - T - P 3 - 0 - 2
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Unit 1

Engineering Rock Mass Classification

Practical significance of classification of rock masses, Bieniawski's RMR Classification Scheme & Laubscher's modification, Barton's Q- Classification Scheme, Excavation Support Ratio & Average Stand-up Time, Rock Structure Rating, CMRI Classification Scheme and its use in determination of appropriate support system for an underground mine

Unit 2

Stresses Around Underground Openings

Types of Openings - single & multiple openings, shapes of openings; Induced stresses around openings using classical closed - form solutions; Design considerations in selection of openings; Elementary introduction to concepts of numerical analysis methods - Finite Element Method (FEM), Boundary Element Method (BEM) and Hybrid Methods.

Pillar Design

Estimating average pillar stress by Tributary Area Method and its criticism; Factors affecting pillar strength; various important formulae for determination of pillar strength; Factor of Safety of pillars; Steps in design of pillars.

Unit 3

Rockbursts

Caving characteristics of roof rocks; Definition, types & phenomenology of rock bursts; Factors affecting proneness to rock bursts; Prediction of rock bursts; Monitoring of rock bursts - methods & instrumentation; Prevention & control of rock bursts; Bumps and Gas outbursts.

Unit 4

Subsidence

Definition - sub-surface & surface subsidence; Important theories of subsidence; Types of surface subsidence; Factors affecting subsidence; Related terminology; Subsidence profiles (lateral & vertical movement, strain curves); Subsidence prediction; Subsidence survey; Prevention & control of subsidence.

Unit 5

Monitoring Ground Movement

Purpose; Instruments for monitoring ground movement - Strain gauges, Strain rosettes, LVDT, Doorstoppers, Load Cells, Extensometers & Penetrometers, Microseisms, Geophones etc.

Photoelasticity

Principle & applications

Drillability, Cuttability and Blastability of rocks

Unit 6

Slope Stability of Opencast Benches

Effect of pit slope on mine economics; Common modes of slope failure; Factors affecting slope stability; Techniques of slope stability analysis; Measures to enhance stability of and to monitor & protect slopes.

Approved
[Signature]
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Chairman, BOS
Training Engg.

Unit 1

Introduction

The term 'Environment'; Essential elements/ingredients of environment; Environmental issues in industry in general – national & global; Statutory regulatory bodies on monitoring & control of environmental pollution; Impact of mining (underground, surface & associated) activities on environment

Unit 2

Air Pollution

Desirable composition of mine air; Sources of air pollution in underground and surface mines; Monitoring (periodic and continuous) of mine environment; Statutory provisions; Control measures

Unit 3

Water Pollution

Impact of mining on availability (downward migration of water table and its effect on quantum of ground water resource and surface vegetation) and quality of ground water and surface streams; Adverse effect of water pollution on crops and other flora; Monitoring, treatment and disposal of effluent water; Water management

Unit 4

Sound Pollution

Noise, ground vibration, air blast, fly rocks, damage to surface structures and other related problems due to blasting in mines; Sources of sound pollution and ground vibration; Monitoring of noise produced by machinery & blasting; Control of noise & ground vibration

Unit 5

Societal Environment

Socio-economic impacts of mining activities; Issues of resettlement and rehabilitation of displaced population;

Land Environment

Visual impacts; Impacts on land use; Land reclamation (including landscape planning); Subsidence management

Unit 6

Environmental Administration

Environmental administration & management in India; Environmental Impact Assessment and Environment Management Plan; Environmental audit

Course Code
7N3

Computer Applications in Mining

L - T - P
3 - 0 - 2

Unit 1

Database Management:

Database; DBMS (Database Management System); Desirable characteristics of an ideal DBMS; RDBMS (Relational Database Management System); Introduction to GIS (Geographical Information System) and GPS (Global Positioning System) and their applications; M.I.S. (Management Information System) – concept & applicability to mining industry.

Unit 2

Introduction to a Database Management Software

Microsoft Access, its essential features and use.

Unit 3

Newer concepts in problem solving

Elementary Introduction to Artificial Intelligence, Fuzzy Sets, Neural Networks, Neurofuzzy Solutions and Robotics.

Unit 4

Applications of Computer Programming

Programming for solving problems of mining - mine ventilation networks, pillar design, blast design, haulage & winding calculations

Unit 5

Computer Graphics

Computer Aided Design; Graphics in C; Introduction to AUTOCAD

Unit 6

Input/Output Devices

VDUs, AGP cards, Printers, Plotters, Digitisers, Scanners and Pointing devices

Course Code
7N4

Mineral Economics

L – T – P
3 – 0 – 0

Unit 1

Introduction

Uniqueness and economic importance of mineral industry; Concept & classification of mineral resource; Geographical distribution of important mineral deposits and mining fields in India; National mineral policy

Unit 2

Mine Sampling

Definition, purpose and scope; Size of sample; Classes of sample; Methods of sampling; Errors in sampling; Salting; Safeguards against salting

Unit 3

Computation of Reserves

Computation of tonnage, average assay width, stoping width, clean width, milling width, average length etc.; Reliability of mine sampling

Unit 4

Valuation of Mineral Property

Examination and valuation of mines/mineral properties; Time value of money; Present value & its computation; Life of a mine; Concepts of redemption of capital, depreciation; Preparation of valuation reports

Unit 5

Conservation of Mineral Resource

Scope and limitations; Losses of minerals in mining; Dilution and recovery

Costs of Mining

Capital and operating costs; Factors affecting operating costs; Standard cost and forecast; Budget & budgetary control

Unit 6

Economic Feasibility

Need for economic analysis; Sources of finance and the cost of capital; Methods of investment appraisal; Risk Analysis; Royalty, taxes and duties; Small mines and their socio-economic significance; Mineral price and pricing; Price Index

Unit 1

Introduction

Concept of system, components and system environment; Classification of systems; Systems analysis

Decision Making

Decision problems; Model formulation; Decision analysis based on expected monetary value and utility value

Unit 2

Linear Programming

Concepts; Graphical solutions; Simplex Method; Primal-dual models; Sensitivity Analysis; case examples from mining engineering

Unit 3

Network Analysis

Determination of the shortest path; Critical Path Method (CPM) and Programme Evaluation Review Technique (PERT); case examples from mining engineering

Dynamic Programming

Dynamic programming and stagecoach problem

Unit 4

Simulation

Introduction, concept, scope and limitations; Monte Carlo simulation; Simulation of equipment maintenance and inventory systems in mines

Unit 5

Transportation and Assignment Problems

Mathematical modelling and solution algorithms; applications to mining engineering; Basic queuing models with constant arrival and service rates

Unit 6

Inventory Management

Introduction, concept, scope and limitations; Classical EOQ model; EOQ model with quantity discount; Static and dynamic inventory problems for single and multiple items; Inventory optimisation under space and budgetary constraints

(III) Mining

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Unit 1

Geodesy

Physical and geometric geodesy; Spheroid and ellipsoid; Geocentric, geodetic and astronomical co-ordinates; Orthometric and dynamic heights; Geodetic instrumentation and techniques

Unit 2

National Grid

Map projections; UTM; Different co-ordinate systems; Transformation of co-ordinates

Unit 3

Geographic Information System (GIS)

Introduction; Working principle; Database associated with GIS; Application of GIS in surface mining, land development, road construction etc.;

Unit 4

Global Positioning System (GPS)

Introduction; Working principle; Application in surface mining including tracking of important equipments; Application to mine survey and face monitoring

Unit 5

Astronomy

Introduction and scope; Astronomical triangle; Conversion of time systems; Precise determination of azimuth by astronomical methods
Satellite Imagery – Use in cartography

Unit 6

Remote Sensing – Introduction, working principle and applications in mining engineering
Electronic Distance Measurement (EDM) – working principle and application in mine survey
Total Station
Synthetic Aperture Radar (SAR) Interferometry – principle and applications in subsidence survey and resource estimation

Unit 1

Introduction

Scope and importance of rock excavation engineering in mining industry; Physico-mechanical and geotechnical properties of rocks vis-à-vis excavation method; Selection of suitable excavation method

Unit 2

Drilling

Mechanics of rock drilling; Design and operating parameters of surface and underground drilling; Evaluation of drilling performance; Drillability of rocks

Unit 3

Drilling

Bit wear; Bit selection; Problems of drilling; Economics of drilling

Blasting

Mechanics of rock fragmentation by explosives; Advances in explosives; **Selection criteria** of explosives for rock excavation; Blast design for surface excavations and its **optimisation**

Unit 4

Blasting

Advanced blast initiation systems; Blast performance evaluation; **Cast blasting**; Techno-economic and safety aspects of surface and underground blasting; **Contour blasting**; Computer-aided blast designs; Review of tunnel blasting techniques **and recent advances**

Unit 5

Modern Rock Excavation Equipments

Shovels, draglines, bucket wheel excavators, rippers, dozers, **scrapers**, auger drills, shearers, ploughs, road headers, continuous miners, tunnel boring machines; **Recent advances** in excavation machinery/principle

Unit 6

Mechanics of rock cutting

General theories of rock cutting; Design of cutting tools for **optimum** penetration and **wearing** characteristics; Drillability and machinability characteristics of rocks; Theory of rock tool interaction for underground and surface machinery – **shearer**, **plough**, continuous surface miner, bucket wheel excavator; scraper etc.

EIGHTH SEMESTER

Course Code	Mine Management	L – T – P
8N1		3 – 1 – 0

Unit 1

Introduction

Evolution of modern management theory and practice; Principles of scientific management; Elements of management functions – planning, organisation and control; Systems and contingency approach to management; Structure and design of organisation for mining enterprises; Introduction to essential features of M.I.S. (Management Information System)

Unit 2

Personnel Management

Manpower planning and recruitment, selection, training and development of human resource; Performance appraisal and merit rating; Motivation & Incentive; Leadership; Absenteeism; Organisation development

Unit 3

Production Management

Production forecasting, planning and control – short and long term – in mines; Determination of norms and standards of operations by work study; Analysis of mine capacities and capabilities; Quality control; Productivity – concept and measurement

Unit 4

Industrial Relations

Human relations; Trade Union movement in India – its origin & evolution; Industrial Disputes Act; Discipline and enquiries

Unit 5

Industrial Psychology

Psychology and its relation with business, industry and management; Physical factors and their effect on management; Psychological tests – utility and development; Tests for selection and development; Fatigue; Accident proneness

Unit 6

Behavioural Sciences for Management

Human needs and organisation design; Conflicts in an organisation – sources and resolution; Conflict and growth; Communication; Behavioural view of controlling; Eliciting positive response to controls

Course Code
8N2

Mine Legislation and Safety

L - T - P
3 - 1 - 0

Unit 1

Introduction

General principles of mining laws; Development of mining legislation in India; Sources of legislation; DGMS and its role in monitoring and ensuring safe mining practices including conducting various examinations for working mining personnel

Unit 2

Mining Laws

The Mines Act, 1952; The Mines Rules, 1955; Mines and Minerals (Regulation & Development) Act, 1957; Relevant provisions of Indian Electricity Rules, 1956; Vocational Training Rules, 1966

Unit 3

Mining Laws

The Coal Mines Regulations, 1957, Standing orders and DGMS circulars

Unit 4

Mining Laws

The Metalliferrous Mines Regulations, 1961; Mines Rescue Rules, 1985

Unit 5

Mine Accidents

Occupational Hazards of mining; Classification of accidents; Statistics – frequency and severity rates; Causes of accidents; Investigations into accidents and reports

Unit 6

Safety Measures

Measures for improving safety levels in mines; MAP & ZAP; Emergency Measures; Emergency Organisation

Course Code	Mine Planning	L - T - P
8N3		3 - 1 - 0

Unit 1

Introduction

Principles of planning; Features of mine planning; planning for new projects and reconstruction planning; Short range and long range planning; Phases of mine planning; Project implementation and monitoring; Geological reports, Feasibility Reports

Unit 2

Fixing the mine boundary – surface and underground; Size of mine; Limited and unlimited reserves; Optimum designed capacity; Reserve estimation; Planning Panel System of Mining

Unit 3

Mine entries: types, their application, location, selection, choice of shape and determination of size of opening.
 Infrastructural planning: CHP, workshop, power, water requirement and communication in mines

Unit 4

Selection of Mining Methods

Selection; Factors to be considered; Surface v/s underground; Selection of various methods of extraction; Production estimation; Production potential of different panels; Fixing the target of mine

Unit 5

Transportation planning

Alternatives; Choice of men, material and mineral handling transport systems; Selection
 Ventilation planning: Objectives; Steps; Network solutions; Economic of ventilation

Unit 6

Drainage planning

Assessment of make of water; Drainage layout; Design of sumps; Selection of pumps and pumping capacity

Manpower planning

Project Construction Schedule;

Planning for mine closure and post mining land use

Course Code
8N4

Elective II
Mine Management Information System

L - T - P
3 - 1 - 0

Unit 1

Introduction

Information as a Resource

Introduction to information management; Concept of management information system; Planning of information resources

Unit 2

Information systems

Computer based information management systems; Information methodologies and tools; Systems approach to various operations in mines; Analysis of systems

Unit 3

Computer fundamentals for information system

Database and database management systems; Data mining; Data ware house; Data banks; Data storage and handling; Relational and other data bases

Unit 4

Information storage & retrieval

Capturing of information - On-line, off-line, pre-processing, formatting etc; Forms and output; Data processing systems; Data communication; Data loggers etc.

Unit 5

Mine management information system

Production information; Human resource information; Geological information; Geo-technical information; Environmental information; Survey information; Stores and inventory information; Marketing, financial information etc.

Unit 6

Decision support systems for mine managers

Modeling, simulation, expert systems; office automation; Network layout of computer nodes and data communication

Course Code
8N4

Elective II
Mine Safety Engineering

L – T – P
3 – 1 – 0

Unit 1

Introduction

Safety management systems in Indian mining industry; Engineering aspects of safety management; Recent trends of development of safety engineering approaches

Unit 2

Risk Assessment

Basic concept of risk, reliability and hazard potential; Elements of risk assessment; Statistical methods; Control charts

Unit 3

Risk Assessment

Appraisal of advanced techniques – fault tree analysis; Failure mode and effect analysis; Quantitative structure – activity relationship analysis; Fuzzy model for risk assessment

Unit 4

Safety Audit and Control

Measurement of safety efficiency; Safety audit methods; Safety records management

Unit 5

Enacting Safety Measures

Safety legislation; Safety meetings; Constitution of safety committees including pit safety committee

Unit 6

Safe Practices

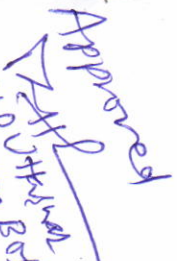
Ergonomics; Safe operational practices; Safety codes; Implementation and monitoring of safety programmes

**SCHEME OF EXAMINATION AND TEACHING
FOR THE B.E. FOUR YEAR COURSE IN MINING ENGINEERING (SEMESTER PATTERN)
EIGHTH SEMESTER - FOURTH YEAR B.E. MINING ENGINEERING**

Sr.No	Subject	Examination Scheme			Teaching Scheme				Board
		Paper/ Maximum Pract./ Marks	Minimum Marks for Passing	Duration of Theory Paper (hour)	L	T	P	Total	
8N1	Mine Management	Paper C.A 80 20	40	3	3	1	0	4	Mining
8N2	Mine Legislation and Safety	Paper C.A 80 20	40	3	3	1	0	4	Mining
8N3	Mine Planning	Paper C.A 80 20	40	3	3	1	0	4	Mining
8N4	Elective II	Paper C.A 80 20	40	3	3	1	0	4	Mining
8N5	1. Underground Space Technology 2. Mine Safety Engineering 3. Management Information System Project and Seminar	Pract. C.A 75 75	75	0	0	0	6	6	
	Training Seminar	C.A 75					2	2	
	Survey Camp	C.A 50					2	2	
	Total		675	12	4	10	26		

L=Lecture, T=Tutorial, P=Practical, Pract.=Practical, C.A=College Assessment

Note: Total duration of practical training during vacations between third to eighth semesters should be atleast two months out of which one month practical training should be completed before sixth sem.

Approved

 Dr. M. D. Jadhav, B.E.
 Department of Mining Engg.