

MIC-701 SURFACE MINE ENVIRONMENT

UNIT-1

Environmental issues in mineral industry — national and global; ambient environment mining complexes; environmental impacts of mineral exploitation - underground and opencast mining and associated activities.

UNIT-2

Societal Environment : Societal environment and its management including resettlement and rehabilitation; socio-economic impacts; sustainable development; concept of carrying capacity based planning. Ecological environment and its management including biological reclamation. Land

UNIT-3

Environment : Visual impacts; landscape analysis; land use; landscape planning; physical reclamation and subsidence management.

UNIT-4

Air Pollution : Air pollution - sources, monitoring and control

Water Regime: Availability; water quality; water pollution treatment and water management.

Waste Management : solid wastes - generation, treatment and disposal

Noise and Vibrations : Causes, precautions, measurement, prevention and reduction. Blasting :

UNIT-5

Environmental aspects of blasting.:

Environmental Administration in India: Administration and Management, preparation of Environmental Management Plan. Environmental audit, salient features of Environment Protection Act

Reference Books

1. Environmental Impact of Mining : Stocks
2. Mining and Environment : Dr. B.B.Dhar
3. Mine Environment : Dhar and Thakur

LIST OF EXPERIMENT

1. Study of various types of pollution in surface mining
2. Study of mine reclamation and its types
3. Study of various environmental effect of surface mining

MIC-702 STRATA CONTROL

UNIT 1

SUPPORTS -Timber & steel supports, Examination of roof, Roof bolting, roof stitching, method of supporting roadways. Supporting under different conditions viz. Pit bottom, crossing, junctions, faulted area, longwall faces, depillaring areas and stoping areas, support loads .SSR, CTR, Support plan, Support withdrawal.

UNIT 2

POWERED SUPPORTS - their principles of operation, Classification, designation, constructional features and applications, Hydraulic fluids.

UNIT 3

STOWING -Principal methods of stowing, their relative merits and applicability, Hydraulic stowing, Pneumatic stowing, Mechanical stowing, Hand packing, face arrangements, pipe wear, pipe jams.

UNIT 4

STRATA CONTROL -Theories of ground movement, Rock pressure due to Narrow and Wide excavation, Front abutment and back abutment, Failure of roof and floor, measurement of strata movement, rock burst, bumps, gas outbursts, pot holes.

UNIT 5

SUBSIDENCE-Theories of subsidence, damage and loss due to subsidence, vertical and lateral movements and their estimation, angle of fracture and angle of draw, factors affecting subsidence, subsidence control, protection of surface structures, design of protection pillars including shaft pillars. Pot holes.

Reference Books:

1. Strata control in mines Chaing & Peng
2. Winning and Working of Coal R. T. Deshmukh & D. J. Deshmukh
3. Modern Coal Mining Practices R. D. Singh
4. D.G.M.S. Circulars (Tech.) 1995 onwards
5. Longwall Mining Syd. S. Chaing & Peng

LIST OF EXPERIMENT:

1. Study of Stowing
2. Study of Subsidence
3. Study of Support System

MIC-703 MINING MACHINERY – III

UNIT 1: FACE MACHINERY

Coal and rock Drilling, their constructional details, their applications, operation and maintenance, jumbo drill machines, introduction to coal cutting machine.

UNIT 2: LOADING AND TRANSPORTATION

Rocker shovel, gathering arms loaders, LHD and SDL machines- their construction and operation and maintenance, cavo loader, shuttle car and underground trucks, its construction, operation and application.

UNIT 3: CUTTER LOADERS

Different types of cutter loaders suitable for long wall and short wall faces, their constructions, operation and maintenance, winning methods different types of continuous miner & road headers their suitability, construction, operation and maintenance , mechanics of rock cutting, rock cutting tools and their performance.

UNIT 4: COMPRESSED AIR

Basic concept, compression process, working and constructional features of single stage and multistage compressor, unloading arrangement of compressor, layout of pipelines, transmission of compressed air, testing of compressor, safety features of compressor

UNIT 5: USE OF ELECTRICITY IN MINES

Flame proof enclosures & intrinsically safe apparatus, underground cables, drill panel, gate end box, circuit breakers, remote control (pilot circuit), installation of underground substation, earth leakage protection, cable joining, Electrical signaling provisions of IER related to mines

Reference books:

1. Elements of Mining Vol. III by D. J. Deshmukh
2. UMS Booklet
3. Winning and Working of Coal : R. T. Deshmukh & D. J. Deshmukh
4. Modern Coal Mining Practices : R. D. Singh
5. Longwall Mining : Syd. S. Chaing & Peng
6. Mine Winding & Transport by S.C.Walker

LIST OF EXPERIMENTS:

1. Study of LHD
2. Study of SDL
3. Study of Continuous Miner

MIC-704(A) SURFACE MINING -II

Unit I

Dragline, Stripping Shovel Layouts of open pit mines, Methods of sidcasting, Sidcasting by Stripping Shovel and Dragline, Range/ Balancing Diagram, calculation of operating radius. Layouts of waste dumps. Design of Haul roads.

Unit II

Introduction to continuous surface mining equipment, Bucket wheel excavators, constructional features, basic operation and productivity, Continuous surface miner, their construction, basic operation and productivity. Face Layouts.

Unit III

Ultimate pit design, Factors affecting ultimate pit limits; Significance of ultimate pit limits; Manual methods of developing ultimate pit limits. Floating cone technique, Production planning, some basic mine life and plant size concepts, Mine and Mill plant sizing

Unit IV

Introduction to rock slope engineering, Slopes in surface mines and their formation, Pit slopes and their influence on mine economics, Slope/Dump stability, Factors influencing slope/dump stability, various types of slope failure and their geometrical conditions.

Unit V

Determination of factor of safety of a slope under plane and circular failure, planning of slope stability investigations, Stabilization and protection methods for stability of slopes. Waste dump stability parameters

Reference Books:

1. Surface Mining : G.B. Misra
2. Surface mining equipment : Martin
3. Surface Mining : Pfleider
4. Rock slope Engg. : Hoek & Bray
5. SME handbook : Hartman
6. Surface Mine Planning & Design : Hustrulid & Kuchha

MIC-704(B) NUMERICAL METHODS IN MINING ENGINEERING

UNIT-1

Introduction To Elastic And Plastic Models Fundamentals, elastic, plastic, homogeneous and isotropic, non-linear elastic and elastoplastic models.

UNIT-2

Finite Difference Methods Concept, formation of mesh element, finite difference patterns, solutions, application to mining.

UNIT-3

Finite Element Methods Concept, discretisation, element configuration, element stiffness, assemblage and solutions, two and three dimensional solutions, linear and non-linear analysis, applications in geomechanics; simulation of joints in strata.

UNIT-4

Boundary Element Method Concept, discretisation, different methods of solution for isotropic and infinite media.

UNIT-5

Practical Applications In Mining And Rock Mechanics Practical Applications in stress analysis, slope stability, subsidence prediction, pillar design, rock burst, etc.

Reference Books:

1. Desai, C.S. and Abel, J.F. Introduction to the finite Element Method, Van Nostrand Riehokl Co., New York, 1983
2. Zienkiewicz, O.C. The Finite Element Method in Engineering Science, Tata McGraw Hill.
3. Segerlind, L.J., Applied Finite Element Analysis, John Wiley and Sons, New York, 1987
4. Mukhopadyay, M. Matrix Finite Element – Computer and Structural Analysis, Oxford and IBH Publishing co., 1984
5. Brown, E.T. (Ed) Analytical and Computational Methods in Engineering and Rock Mechanics, Allen and Unwin, London, 1987

MIC-704(C) MINE VENTILATION AND CLIMATE ENGINEERING

UNIT-1

Composition Of Mine Atmosphere Mine gases - production, properties, effects and detection; sampling and analysis of mine air; methane content; methane drainage; methane layering; flame safety lamp and its uses; methanometer; radon gas and its daughter products; continuous monitoring of gases

UNIT- 2

Heat And Humidity Sources of heat in mines; effects of heat and humidity; psychrometry, kata thermometer; heat stress, air-conditioning

UNIT-3

Natural Ventilation Seasonal variations, calculation of NVP from air densities and thermodynamic principles

UNIT- 4

Air Flow Through Mine Openings Laws of flow, resistance of air ways, equivalent orifice, distribution of air; flow control devices; automation and remote control of ventilation installations; ventilation surveys; permissible air velocities in different types of workings

UNIT- 5

Mechanical Ventilation Types of mine fans; theory, characteristics and suitability of fans; selection, testing and output control; fans in series and parallel; forcing and exhaust configurations; reversal of flow; fan drifts, diffusers, evasees

Reference Books:

1. Mine Ventilation : G. B. Mishra
2. Sub-surface mine ventilation : Macperson
3. Mine ventilation and air-conditioning in mines : Harman
4. Element of Mining Technology Vol 2 : D. J. Deshmukh

MIC-705(A) MINE DISASTERS

UNIT-1

Spontaneous Combustion Mechanism, causes, susceptibility indices, detection, preventive measures and control. Incubation period and its determination.

UNIT-2

Mine Fires Classification of fires, causes, detection, preventive measures. Dealing with underground and surface fires. Fire fighting – direct methods, sealing off and inertisation.

UNIT-3

Explosions Mechanism, causes, characteristics, preventive and control measures of firedamp and coal dust explosions. Investigation after explosion.

UNIT-4

Reopening of Sealed-off Area Monitoring of atmosphere behind sealed-off area. Precautions to be taken before reopening. Methods of reopening.

UNIT-5

Inundation Causes and preventive measures. Precautions to be taken while approaching old water-logged workings and while working under water bodies. Safety boring apparatus. Dewatering procedure. Design and construction of water dams and barriers.

Reference Books:

1. Mine Disasters and Mine Rescue- [M.A. Ramlu](#)
2. Mine Disasters- Misra G.B.
3. Mine Disasters -R.D. Singh

MIC-705(B) NUMERICAL METHODS IN GEOMECHANICS

UNIT- 1

Finite Difference Method Concept, formation of mesh, finite difference patterns, solutions.

UNIT- 2

Application in mining problems.

UNIT-3

Finite Element Method Concept, discretization into elements, element types, element stiffness,

UNIT- 4

assemblage and solution. Simulation based on FEM.

UNIT- 5

Boundary Element Method Concept, discretization, solution for isotropic and infinite media.

Application to Mining Engineering Problems.

Reference Books:

1. Numerical Methods In Geomechanics -Mcgrawhill.
2. Numerical Methods In Geomechanics -Gupta Dey
3. Numerical Methods In Geomechanics -Dr. C.P.Gandhi

MIC-705(C) MINE HAZARD AND RESCUE

UNIT-1

Mine Fires : Causes of mine fires; spontaneous combustion - mechanism, susceptibility indices, factors affecting spontaneous combustion; detection and prevention of spontaneous heating; accidental fires – causes and prevention; dealing with mine fires - direct and indirect methods, fire stoppings; fires in quarries, coal stacks and waste dumps.

UNIT-2

Mine Explosions : Firedamp and coal dust explosions – mechanisms, causes and prevention; stone-dust and water barriers; investigations after an explosion.

UNIT-3

Inundation : Causes and prevention, precautions and techniques of approaching old workings; safety boring apparatus, pattern of holes; design and construction of water dams, shaft dams, emergency bulk heads, strengthening of dams

UNIT-4

Rescue And Recovery : Rescue equipment and their uses, rescue stations and rescue rooms; organization of rescue and recovery areas, re-opening of sealed-off workings
Illumination in mines- it's effect on safety, efficiency and health ; common types of safety lamps & their uses and limitations, maintenance and examination of lamps, their charging, cleaning, lighting, re-lighting ; lamp room design and organization;

UNIT-5

lighting from mains – different types of illumination devices; illumination of pit bottoms. main roads, faces, pump houses and haulage rooms; standards of illumination in underground and opencast mines
Airborne respirable dust in underground mines - generation, dispersion, measurement and contro; classification, physiological effects, dust measurement, sampling of air-bone dust

Reference Books:

1. Mine Hazard And Rescue -[M.A. Ramlu](#)
2. Mine Hazard And Rescue -[R.D. Singh](#)
3. Mine Hazard And Rescue- [D. J. Deshmukh](#)

MIC-706(A) MINING INDUCED SUBSIDENCE ENGINEERING

UNIT-1

Causes – Effect of depth, width of excavation, seam thickness and angle of draw.

UNIT-2

Types of subsidence – non-effective width, sub-critical, super-critical width.

UNIT-3

Theories of subsidence, sub-surface subsidence due to mining.

UNIT-4

Rock kinematics, Extent of movement in the overlying beds.

UNIT-5

Special Methods of Mining to control subsidence.

Prediction and nomograms of subsidence.

Reference Books:

1. Mining Induced Subsidence Engineering- Kolymbas, Dimitrios
2. Mining Induced Subsidence Engineering- Gattinoni, Paola, Pizzarotti, Enrico, Scesi, Laura
3. Mining Induced Subsidence Engineering -Dimitrakopoulos, Roussos (Ed.)

MIC-706(B) OPERATIONS RESEARCH IN MINING

UNIT-1

Introduction to Operations Research

UNIT-2

Linear Programming & Dynamic Programming Transportation – problems in mining, supply of coal from various mines to various destinations, cost optimisations and optimisations tools.

UNIT-3

Network Analysis

CPM and PERT Analysis.

UNIT-4

Inventory Models

Definition, deterministic models, probabilistic models and their applications to mining.

UNIT-5

Non-linear Programming

Unconstrained and constrained external problems. Programming methods – separable, quadratic, stochastic, geometric.

Reference Books:

1. Operations Research In Mining -Frederick S. Hillier
2. Operations Research In Mining -Wayne L. Winston
3. Operations Research In Mining -Paul Goodwin

MIC-706(C) MINING LEGISLATION & SAFETY-I

UNIT-1

Introduction to Acts, Rules & Regulation applicable to Mining Industry, Development of mining legislation in India.

UNIT-2

Mines Act - 1952 & Mines Rules - 1955

UNIT-3

Coal Mines Regulations -1957, Ventilation, Standard of ventilation, main mechanical ventilator, Installations & Restrictions, Splits and Airways, Introduction to draft CMR-2006 & **Metalliferous Mines Regulation-1961**
Ventilation, Explosives, Official Duties

UNIT-4

Mine Crèche Rules 1966

UNIT- 5

Mine Vocational Training Rules- 1966 Application of Rules, General vocational training (scope and standard), training centres, and arrangements for training

Reference Books:

1. Legislation in Indian Mines (A critical Appraisal) Vol. II & I, - S. D. Prasad & Prof. Rakesh
2. CMR-1957 & MMR-1961 - L. C. Kaku
3. Mines Act-1952 & Mines Rules-1955 - L. C. Kaku
4. Vocational Training Rules - L. C. Kaku
5. Mine Accidents - S.J. Kejeriwal
6. CMR-2017- L C Kaku

MIC-707 Industrial Training -II

Duration:- 2 weeks after the VI semester in the summer break, Assessment in VII semester. Students must observe following to enrich their learning during industrial training:

- Industrial environment and work culture.
- Organizational structure and inter personal communication.
- Machines/ equipment/ instruments - their working and specifications.
- Product development procedures and phases.
- Project planning, monitoring and control.