

Rajiv Gandhi Proudyogiki Vishwavidyalaya Bhopal

M.Tech (Mining Engineering)

First Semester Syllabus

MTMI 101- Applied Rock Mechanics

UNIT I - Stress Analysis: Stress analysis in 2D and 3D, equations of equilibrium, Mohr's Circles, plane stress and plane strain condition, stress distribution in simple structures, Flexure of beams and rectangular plates

UNIT – II- Properties of Rocks: Physico-mechanical properties of rocks including tri-axial strengths and in-situ strengths and their application in the design of different types of excavations, rock indices viz. drillability index, caving index, etc. Time dependent properties of rocks and their application in structural design, static and dynamic elastic constants of rocks, rock mass classification methods. Selection excavator based on rock properties.

UNIT III- In-Situ Stresses and Theories of Failure: In-situ stresses and instrumentation, drilling and blasting, measurement of stresses, strains, deformations, in-situ stress determination, strata monitoring in underground and opencast mines, mechanics of drilling and blasting, blast vibration and its monitoring. Different theories of rock failure and their applications in design of mining structures.

UNIT IV - Design of Underground Openings, Subsidence, Rock Burst and Slope Stability: Design of single and multiple underground openings, pillars including shaft pillar, scaling factors, mining subsidence, rock burst, design of slopes and spoil banks, slope stability in rock & soil and its analysis, slope monitoring and stabilisation techniques. Design of pillars including barrier and shaft pillars.

UNIT V -Design of Mine Supports: Advances of mine supports, supports and bord and pillar and longwall workings, rock load assessment, design of different types of supports like conventional and non-conventional supports like shotcrete, fibre reinforced shotcrete, strata grouting, rock bolting, supports in tunnels and shafts

Text Books/Reference Books:

1. Obert, L. and Duvall, W.I., Rock Mechanics and Design of Structure in Rock John Wiley and Sons Inc., New York, 1967.
2. Vutukuri, V.S., and Lama, R.D., Handbook on Mechanical Properties of Rocks, Vol. I, II, III and IV, Transtech Publication, Berlin, 1974/78
3. Peng, S.S., Ground Control, Wiley Interscience, New York, 1987.
4. Brady, B.H.G. and Brown, S.T., Rock Mechanics, Wiley Interscience, 1985.
5. Hoek, E., and Brown, S.T., Underground Excavations in Rocks, Institute of Mining Metallurgy, London, 1980.

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MTMI 102- MINE PLANNING AND DESIGN

UNIT – I- Introduction: Technical factors in mine planning, methodology of mine planning, short range & long range, mine modelling, mine simulation systems approach to mine planning based on mine subsystem and their elements, mine plan generation.

UNIT – II- Open Pit Mining: Selection of initial mine cuts, location of surface structures, division of mining area into blocks, mine design, bench drainage, geometry, haul roads, slope stability; open pit limits and optimisation, calendar plan, production planning, production scheduling, economic productivity indices.

UNIT – III- Underground Mining: Location of mine entries, mine and auxiliary, optimisation of mine parameters, design of shaft pillars and protective pillars, planning of production capacity, layout of development drives / raises / winzes etc, length of faces, size of panels, etc, planning of support systems, ventilation, lay out of drainage system, planning production schedule and monitoring, selection of depillaring / stopping method, manpower management, economic/ productivity indices, techno economic analysis, mine reclamation design.

UNIT – IV- Equipment Planning: Latest technological developments in increase in both types and capacities of equipment used in mining operations. Planning and selection of equipment for different mining conditions. Equipment design for optimum drilling and blasting operations. Equipment information – performance, monitoring and expert systems. Innovative mining systems.

UNIT – V- Project Implementation and Monitoring : Pre-project activities – feasibility report, environment clearance, detailed project, report, sources of funds, import of technology, selection of contracts and contract administration, time management, cost control material management system, project quality assurance, social responsibility, government orders and guidelines. Environmental impact assessment and preparation of environmental management plan. Mine closure plan.

1. Text Books/Reference Books:

2. Jayanth Bhattacharya, Principles of Mine Planning-Allied Publishers, Delhi 2003.
3. Hustrulid, W. and Kuchta, M., (eds)., Fundamentals of Open pit Mine Planning and Design, Elsevier, 1995.
4. Ehrenburger, V and Fajkos, A., Mining Modelling, Elsevier, 1995.
5. Bawden, W.F., and Archibald., J.F., Innovative Mine Design for the 21st Century Elsevier, 1993.
6. Passamehtoglu, A.G., Karpuz, C., Eskikaya, S. and Hizal, T., (Eds), Mine Planning and Equipment Selection, Elsevier, 1994.
7. Pazdziora, J., Design of Underground Hard Coal Mines, Elsevier, 1988.
8. Swilski, and Richards, Underground Hard Coal Mines, Elsevier, 1986.
9. Singh, B. and Pal Roy, P., Blasting in Underground excavations and mines, CMR Dhanbad, 1993.

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MTMI 103- PROJECT MANAGEMENT

UNIT – I Financial Analysis

Mining costs. Break Even Analysis. Net Present Value (NPV). Internal Rate of Return (IRR). Incorporating, risk in the NPV calculation. Sensitivity analysis. Preparation of balance sheets.

UNIT – II Personnel Management

Requirement schedule. Qualifications, experience. Press advertisement. Processing of applications. Tests, selection and appointment. Induction and training programmes.

UNIT – III Work Study

Time and motion study.

UNIT – IV Inventory Planning and Management Purchasing and Tendering

Purchase procedures in public sector. Preparation of tender documents.

UNIT – V Project Monitoring

Monitoring techniques. Management Information Systems (MIS).

UNIT – VI Industrial Disputes

Types and causes of industrial disputes. Settlement of industrial disputes.

UNIT – VII Mine Closure Planning

Issues in mine closure planning. Different mine closure operations. Role of regulatory authorities and mineoperator in mine closure. Post-mining site rehabilitation programme.

UNIT – VIII Quality Management

Concepts, practices and trends.

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MTMI 104 - OPERATIONS RESEARCH

UNIT – I Introduction to Operation Research

Basic concepts.

UNIT – II Linear Programming

Simplex methods, dual problem and post optimality analysis.

UNIT – III Dynamic Programming

Concept, recursive equation approach, computational procedure, forward and backward computations and problems of dimensionality.

UNIT – IV Network Analysis

Network representation, critical path calculations, probability and cost considerations in project scheduling, construction of time chart and resource leveling.

UNIT – V Inventory Models

Definition, deterministic and probabilistic models.

UNIT – VI Queuing Theory

Basic concepts, axiomatic derivation of the arrivals and departures, distribution for Poisson queues, Poisson queuing models, non-Poisson queuing models, queuing models with priorities for service.

UNIT – VII Non-linear Programming

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

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MTMI 105 - Environmental Control And Management

UNIT – I The theory and practice of creating safe, healthy and efficient working environment at an underground or surface mine.

UNIT – II Air pollution from surface mining and processing. Sources and classification of air pollutants – standards, monitoring and control. Transport and dispersion of air pollutants, Air quality modeling.

UNIT – III Water quality – physical, chemical, biological, criteria and standards. Monitoring, treatment and control of contaminated water.

UNIT – IV Noise and ground vibrations: sources, monitoring, prevention and control.

UNIT – V Tailings: characterization, technical issues, sampling and analysis, site selection and design of tailings impoundment.

UNIT – VI Environment planning systems and methodologies based on the principle of sustainable development including environmental impact assessment & management.

1. A.P. Sincero, and G. A Sincero ., *Environmental Engineering*,, Prentice Hall of India , 2002
2. Masters, G.M. and Ela, W.P.,, *Environmental Engineering and Science*, Prentice Hall of India , 2008
3. Metcalf and Eddy et al., *Wastewater Engineering: Treatment and Reuse*, McGraw Hill Education , 4th edition, 2017
4. Lawrence, D.P., *Environmental Impact Assessment: Practical solutions to recurrent problems*,, John Wiley , 2003

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MTMI 106 - ROCK MECHANICS LAB

List of Experiments:

1. Sample collection and Specimen preparation.
2. Determination of moisture content, density, voids ratio and porosity of rocks.
3. Determination of compressive strength, modulus of elasticity and poisson's ratio of rocks.
4. Determination of tensile strength of rocks.
5. Determination of shear strength, angle of internal friction and cohesion of soil.
6. Determination of point load strength index of rocks.
7. Determination of protodyknov's strength index of rocks.
8. Determination of slake durability index of rocks.
9. Determination of cohesion and angle of internal friction of rocks using triaxial test.
10. Determination of hydraulic conductivity of sand.

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MTMI 107 - MINE PLANNING AND DESIGN LAB

List of Experiments:

1. Estimation of reserves of coal and metaliferous deposits.
2. Design of the haul roadway of open pit mines.
3. Design of the surface mine.
4. Design of underground coal mine.
5. Design of mine ventilation system for board and pillar method.
6. Design of mine ventilation system for long wall panel.
7. Design of blast for open pit workings.
8. Design of blast for cast blasting technique.