

MTH-301 COMPUTATIONAL TECHNIQUES

UNIT I

MATRICES:- Eigenvalues and Eigenvectors of a real matrix , Characteristic equation , Properties of Eigenvalues and eigenvectors, Cayley-Hamilton Theorem , Diagonalization of matrices , Reduction of a quadratic form to canonical form by orthogonal transformation

UNIT II

INFINITE SERIES:- Sequences , Convergence of series , General properties , Series of positive terms , Tests of convergence (Comparison test, Integral test, Comparison of ratios and D'Alembert's ratio test) , Alternating series , Series of positive and negative terms , Absolute and conditional convergence , Power Series , Convergence of exponential, logarithmic and Binomial Series.

UNIT III

FUNCTIONS OF SEVERAL VARIABLES:- Limits and Continuity , Partial derivatives , Homogeneous functions and Euler's theorem , Total derivative , Differentiation of implicit functions , Change of variables , Partial differentiation of implicit functions , Taylor's series for functions of two variables . Errors and approximations, Maxima and minima of functions of two variables

UNIT IV

IMPROPER INTEGRALS:- Improper integrals of the first and second kind and their convergence, Evaluation of integrals involving a parameter by Leibnitz rule – Beta and Gamma functions, Properties, Evaluation of integrals using Beta and Gamma functions , Error functions.

UNIT V

MULTIPLE INTEGRALS:- Double integrals , Change of order of integration , Area enclosed by plane curves, Triple integrals, Volume of Solids, Change of variables in double and triple integrals, Area of a curved surface.

TEXT BOOKS :

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 40th Edition, 2007.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd.,

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Introduction to Mining

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(MIC-302)

UNIT 1: Exploratory Drilling

Drilling machines used for exploratory drilling viz. Rotary & Percussive, their attachments; Core Barrels; Conditions of applicability of drilling methods; Borehole Survey, Directional drilling, Underground methods of exploratory drilling.

UNIT 2: Drivage of Inclines/Drifts/Adits

Types of Openings; Choice of Openings; Location of Openings; Drilling, blasting, loading and transportation of muck during drivage of inclines/adits/drifts, Ventilation, lighting and drainage, Extension of center line; Organization and cycle of operations; Mechanized methods of drivages of inclines/adits/drifts.

UNIT 3: Shaft Sinking

Drilling, blasting, loading and transportation of muck, Ventilation, lighting and drainage, Extension of center line; Shaft lining and its design; Special methods of shaft sinking; Shaft boring; Deepening and widening of shafts. Upward drivage; Organization and cycle of operations.

UNIT 4: Introduction to Underground Mining

Definition of important terms, Mine development, Activities involved in development of a mine, Stages in the life of a mine, Introduction to unit operations in underground mining. Choice of method of mining, Introduction to various Underground Mining methods. Introduction to various types of machineries used in Underground mining.

UNIT 5: Introduction to Surface Mining

Definition of important terms, Advantages and disadvantages of surface mining, mineral deposits amenable to surface mining, Various surface mining methods, Introduction to unit operations in surface mining. Introduction to various types of machineries used in surface mining.

Text Books:

1. Surface Mining : G.B. Mishra
2. Mining Engineer's Handbook Vol. 1&2, 2 Edition: Edited by Harold Hartman
3. Introduction to mining : Hartman

Reference Books:

1. U.M.S. Notes
2. Elements of Mining Technology Vol. 1&3 : D.J.Deshmukh
3. Mining of Mineral Deposits : Shevyakov
4. Modern Coal Mining : Samir Kumar Das
5. Coal Mining : R.D.Singh
6. Mining : Boki

UNIT 1: The Earth in Space and Time

Solar System: - Size, Shape, Mass and Density of Earth; A Brief idea of the origin and the age of the Earth; Interior of the Earth:- seismic data, Density and Pressure within the Earth; The internal structure and composition of Earth; Elementary knowledge of Diastrophism, Earthquakes and volcanism:-Volcanic and Earthquake belts, their relationship with Plate Tectonics.

UNIT 2: Mineralogy

Physical Properties of Minerals; Classification of various Rock forming Minerals; Introduction and preliminary study of principle Rock-Forming Mineral groups:- Garnet, Pyroxene, Amphibole, Mica, Feldspar and Felspethoid, Megascopic Properties of economically important Non-Silicate Minerals.

UNIT 3: Igneous and Metamorphic Petrology

Elementary knowledge of Magma and its Crystallization; Classification of Igneous Rocks; Textures and Structures of Igneous Rocks; Petrographic Description of Common Igneous Rocks; Agents and Types of Metamorphism; Depth zones, Facies and Grades of Metamorphism and Petrographic Description of Common Metamorphic Rocks.

UNIT 4: Sedimentary Petrology

Textures and Structures of Sedimentary Rocks; Sedimentary Processes- Weathering, Transportation and Deposition; Classification and Petrographic Description of Common Sedimentary Rocks.

UNIT 5: Structural Geology

Concept of Deformation; Primary and Secondary Planer & Linear Structure of Rocks; Topography and its Representation. Altitude of strata- Dip and strike; Outcrop patterns; Width of Outcrop and Thickness of beds; Structural Contours; Geological Maps; Study of Unconformity; Folds, Joints, Faults and their influence in Mining Operations.

Text Books:

1. Engineering And General Geology : Parbin Singh
2. Physical And Engineering Geology : S.K. Garg
3. Rutley's Elements of Mineralogy : H.H. Read
4. Principles Of Petrology : G.W. Tyrell

List of Experiments:

1. *Megascopic Description of Rock Forming Minerals.*
2. *Megascopic Description of important Igneous, Sedimentary, Metamorphic Rocks.*
3. *Basic Concept of Contours, Attitude of Beds, Width of Outcrop, True and Apparent Dips, Rules of V's.*
4. *Study of Geological Maps and Preparation of Cross Sections.*

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Mining Surveying-I : **(MIC-304)**

UNIT 1: Chain Survey

Linear Measurements; Types of chains; Tapes; Errors in chaining and corrections in linear measurements; Direct and indirect Ranging; Principles of chain surveying. Offsets, Limiting length of offsets; Booking field notes; Obstacles in chaining; Instruments for setting out right angles.

UNIT 2: Compass Survey

Theory of Magnetism; Dip of Magnetic needle; Prismatic Compass; Surveyor's Compass; Bearings; Designation of Bearings; Calculation of Included Angles; Local Attraction; Magnetic Declination.

UNIT 3: Plane Table Surveying

Principles of Plane Tabling; Working operations; Methods of Plane Table Surveying; Two and Three point problems.

UNIT 4: Miner's Dial

Construction, Use, Tests and Adjustments; Loose and fast Needle surveying; Common sources of errors in Dial surveying; Methods of elimination and compensation.

UNIT 5: Levelling

Definitions of important terms used in levelling; Development in levelling Instruments; Types and Constructional details of Dumpy Level, Auto Level; Temporary and Permanent Adjustments; Methods of levelling; Straight edge levelling; Fly levelling; Check levelling; Reciprocal levelling; Longitudinal Sections; Cross- Sectioning; Trigonometric levelling; Methods of booking and reduction of levels; Levelling through drifts and shafts (Including steeply inclined shafts) ; Plumbing measurements of depth of shaft and subsidence.

Text Books:

1. Mine surveying by S. Ghatak
2. Surveying & Levelling by B. C. Punamia

List of Experiments:

- 1. Ranging and Chaining of line of 50 Meter.**
- 2. Determination of width of an obstacle which can be seen across but can't be chained.**
- 3. Determination of area of a field by Cross staff survey.**
- 4. Study of various types of chained**

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(MIC-305) Mechanics of Solids & Fluid

UNIT-1 Concept of Stress and Strain

Stress and strain at a point; Axial and shear stresses, Ultimate and working stresses; Relation between stress and strain, Poisson's Ratio; Two dimensional state of strain, Principle stresses and Principle planes, Mohr's Circle, Two state of strain, Principle strains and principle axis of strain; Determination of Principle strain from strain measurements; Calculation of Principle stresses from Principle strains; Composite bars in tension and compression; Thermal stresses in composite bars.

UNIT-2 Bending Stresses in Beams and plates

Pure bending, Bending Stresses, Section Modulus of rolled and built up sections, Composite beams, Distribution of normal and shear stresses across the section of a simple beam with vertical section of symmetry; Theory of plates.

UNIT-3 Deflection of beams

Slope and deflection of beams by deflection methods; Area moment and conjugate beam methods, propped cantilever and fixed beams.

UNIT-4 Introduction to Fluid Mechanics

Physical properties of fluids; Compressible and Incompressible fluids; Newtonian and Non-Newtonian fluids.

UNIT-5 (A) Fluid Statics

Pressure, density and height relationships; manometer pressure on curved and plane surfaces; Centre of Pressure; Buoyancy; Stability of Immersed and Floating bodies; Fluids in relative equilibrium.

UNIT-5 (B) Fluid Kinematics

Classification of flow: Uniform and Non-Uniform; Steady and Non- Steady; Laminar and Turbulent; One, Two, Three dimensional flows; Stream lines; Streak lines; Path lines; Stream Tubes; Elementary Explanation of stream function and velocity potential; Basic idea of flow nets.

Text Books:

1. Strength of material by B.S. Punmiya
2. Strength of material by Ramamurtham
3. Fluid Mechanics by Bansal

Reference Books:

1. Fluid Mechanics, F. M. White

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Mining Environment-I

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(MIC-306)

Unit 1: Mine Atmosphere

Pollution in Mine Atmosphere, Mine Gases, Their Origin, Occurrence, Physiological effects and Detection, Calibration of Detectors, Methane Drainage. System for Monitoring of Mine Environment by Tube bundle apparatus and Telemonitoring systems. Analysis of Mine air by Haldane Apparatus, Gas Chromatograph.

Unit 2: Heat and Humidity

Heat and Humidity in Mine Atmosphere, their Sources and Effects, Cooling Power of Mine Air, Assessment of Comfort Conditions, Air Conditioning of Mines, Surface, Underground and Divided Installations, Spot Coolers.

Unit 3: Theory of Ventilation

Objects and Standards of Ventilation, Flow of Air in Ducts and Mine Roadways, Resistance of Air Ways, Laws of Ventilation, Chezy's and Atkinson's Equations, Equivalent Resistance and Equivalent Orifice of Mine.

Unit 4: Mine Ventilation And Ventilation Devices

Natural Ventilation Pressure and its Measurements, Thermodynamics of Natural Ventilation, Distribution and Control of Air Current, Doors, Regulators, Stoppings and their Types, Air Crossings, Air Locks.

Unit 5: Flame Safety Lamps And Mine Illumination

Constructional details of Flame Safety Lamp, Gas Testing by Flame Safety Lamp, Types of Portable Lamps, their Maintenance and Examination, Lamp Room Design and Organization, Lighting from Mains, Photometry and Illumination Surveys, Standards of Illumination for Underground and Open Cast Working

Text Books:

2. Elements of Mining Technology by D.J. Deshmukh, Vol.II
3. Mine Environment & Ventilation by G.B. Misra

Reference Books:

1. Mine Ventilation, UMS
2. Subsurface Mine Ventilation, M. J. McPherson