

REVISED COURSE STRUCTURE OF B TECH MINING MACHINERY ENGINEERING

FIRST SEMESTER (GROUP-I)

| Sl. No. | Course No. | Name of the Course | L | T | P | CH |
|-------------------------------|------------------|--|-----------|----------|----------|-----------|
| THEORY | | | | | | |
| 1. | AMC11101 | Mathematics – I | 3 | 1 | 0 | 7 |
| 2. | APC11101 | Physics | 3 | 0 | 0 | 6 |
| 3. | MMC11101 | Engineering Graphics | 1 | 4 | 0 | 6 |
| 4. | EEC 11101 | Electrical Technology | 3 | 1 | 0 | 7 |
| 5. | MMC 11103 | Engineering Mechanics | 3 | 1 | 0 | 7 |
| 6. | GLD/CMD 11301 | Earth System Science (Sessional) [AGL: 2-0-0] & [ESE: 1-0-0] | 3 | 0 | 0 | 6 |
| 7. | HSC 11301 | Value Education, Human Rights & Legislatives Procedure (Sessional) | 3 | 0 | 0 | 6 |
| PRACTICAL & OTHERS | | | | | | |
| 8. | APC11201 | Physics | 0 | 0 | 3/2 | 1.5 |
| 9. | EEC 11201 | Electrical Technology | 0 | 0 | 3/2 | 1.5 |
| | | Total Credit Hours | 19 | 7 | 3 | 48 |

FIRST SEMESTER (GROUP-II)

| Sl. No. | Course No. | Name of the Course | L | T | P | CH |
|-------------------------------|-------------|--|-----------|----------|----------|-----------|
| THEORY | | | | | | |
| 1. | AMC11101 | Mathematics – I | 3 | 1 | 0 | 7 |
| 2. | ACC11101 | Chemistry | 3 | 0 | 0 | 6 |
| 3. | MMC11102 | Manufacturing process | 1 | 4 | 0 | 6 |
| 4. | EIC 11101 | Electronics Engineering | 3 | 0 | 0 | 6 |
| 5. | CSC 11301 | Computer Programming (S) | 3 | 0 | 0 | 6 |
| 6. | DMS/AP11301 | Disaster Management [DMS 2-0-0] & Energy Resources[AP 1-0-0] (Sessional) | 3 | 0 | 0 | 6 |
| 7. | HSC 11101 | English for Science & Technology | 3 | 0 | 0 | 6 |
| PRACTICAL & OTHERS | | | | | | |
| 8. | ACC11201 | Chemistry | 0 | 0 | 3/2 | 1.5 |
| 9. | EIC 11201 | Electronics Engineering | 0 | 0 | 3/2 | 1.5 |
| 10. | CSC 11301 | Computer Programming (S) | 0 | 0 | 2 | 2 |
| | | Total Credit Hours | 19 | 5 | 5 | 48 |

SECOND SEMESTER (GROUP I)

| Sl. No. | Course No. | Name of the Course | L | T | P | CH |
|-------------------------------|-------------|--|-----------|----------|----------|---------------|
| THEORY | | | | | | |
| 1. | AMC12101 | Mathematics - II | 3 | 1 | 0 | 7 |
| 2. | ACC12101 | Chemistry | 3 | 0 | 0 | 6 |
| 3. | MMC12102 | Manufacturing process | 1 | 4 | 0 | 6 |
| 4. | EIC 12101 | Electronics Engineering | 3 | 0 | 0 | 6 |
| 5. | CSC 12301 | Computer Programming (S) | 3 | 0 | 0 | 6 |
| 6. | DMS/AP12301 | Disaster Management [DMS 2-0-0] & Energy Resources[AP 1-0-0] (Sessional) | 3 | 0 | 0 | 6 |
| 7. | HSC 12101 | English for Science & Technology | 3 | 0 | 0 | 6 |
| PRACTICAL & OTHERS | | | | | | |
| 8. | ACC12201 | Chemistry | 0 | 0 | 3/2 | 1.5 |
| 9. | EIC 12201 | Electronics Engineering | 0 | 0 | 3/2 | 1.5 |
| 10. | CSC 12301 | Computer Programming (S) | 0 | 0 | 2 | 2 |
| 11. | DSW | Co-curricular Activities | 0 | 0 | 0 | (3) |
| | | Total Credit Hours | 19 | 5 | 5 | 48+(3) |

SECOND SEMESTER (GROUP II)

| Sl. No. | Course No. | Name of the Course | L | T | P | CH |
|-------------------------------|------------------|--|-----------|----------|----------|---------------|
| THEORY | | | | | | |
| 1. | AMC12101 | Mathematics - II | 3 | 1 | 0 | 7 |
| 2. | APC12101 | Physics | 3 | 0 | 0 | 6 |
| 3. | MMC12101 | Engineering Graphics | 1 | 4 | 0 | 6 |
| 4. | EEC 12101 | Electrical Technology | 3 | 1 | 0 | 7 |
| 5. | MMC 12103 | Engineering Mechanics | 3 | 1 | 0 | 7 |
| 6. | GLD/CMD 11301 | Earth System Science (Sessional) [AGL: 2-0-0] & [ESE: 1-0-0] | 3 | 0 | 0 | 6 |
| 7. | HSC 12301 | Value Education, Human Rights & Legislatives Procedure (Sessional) | 3 | 0 | 0 | 6 |
| PRACTICAL & OTHERS | | | | | | |
| 8. | APC12201 | Physics | 0 | 0 | 3/2 | 1.5 |
| 9. | EEC 12201 | Electrical Technology | 0 | 0 | 3/2 | 1.5 |
| 11. | DSW | Co-curricular Activities | 0 | 0 | 0 | (3) |
| | | Total Credit Hours | 19 | 7 | 3 | 48+(3) |

THIRD SEMESTER

| Sl. No. | Course No. | Name of the Course | L | T | P | CH |
|-------------------------------|------------|-----------------------------------|-----------|----------|----------|-----------|
| THEORY | | | | | | |
| 1. | MMC13101 | Solid Mechanics | 3 | 1 | 0 | 7 |
| 2. | MMC13102 | Engineering Thermodynamics | 3 | 1 | 0 | 7 |
| 3. | MMC13103 | Kinematics of Machines | 3 | 1 | 0 | 7 |
| 4. | MMC13104 | Material Science and Engineering | 3 | 0 | 0 | 6 |
| 5. | AMR13101 | Methods of Applied Mathematics- I | 3 | 1 | 0 | 7 |
| PRACTICAL & OTHERS | | | | | | |
| 6. | MMC 13201 | Solid Mechanics | 0 | 0 | 2/2 | 1 |
| 7. | MMC 13202 | Engineering Thermodynamics | 0 | 0 | 2/2 | 1 |
| 8. | MMC 13203 | Kinematics of Machines | 0 | 0 | 2/2 | 1 |
| 9. | MMC 13301 | Machine Drawing | 1 | 5 | 0 | 7 |
| 10. | MMC 13801 | Project and Seminar | 0 | 0 | 2 | 2 |
| Total Credit Hours | | | 16 | 9 | 5 | 46 |
| Total Contact Hours=30 | | | | | | |

FOURTH SEMESTER

| Sl. No. | Course No. | Name of the course | L | T | P | CH |
|-------------------------------|------------|---|-----------|----------|----------|---------------|
| THEORY | | | | | | |
| 1. | MMC14101 | Fluid Mechanics | 3 | 1 | 0 | 7 |
| 2. | MMC14103 | Mechanical Engineering Design | 3 | 3 | 0 | 9 |
| 3. | MER 22132 | Mining Methods and Unit Operations | 3 | 0 | 0 | 6 |
| 4. | EER 14101 | Applied Electrical Engineering | 3 | 1 | 0 | 7 |
| 5. | AMR14101 | Numerical and Statistical Methods | 3 | 1 | 0 | 7 |
| PRACTICAL & OTHERS | | | | | | |
| 6. | MMC14201 | Fluid Mechanics | 0 | 0 | 2/2 | 1 |
| 7. | MMC14202 | Auto CAD & Solid Modeling | 0 | 0 | 2/2 | 1 |
| 8. | MMC 14203 | Soft Computing Lab-I | 0 | 0 | 3 | 3 |
| 9. | MMC 14801 | Project and Seminar | 0 | 0 | 2 | 2 |
| 10. | MMC14501 | Composite Viva-Voce | 0 | 0 | 0 | (2) |
| 11. | SWC14701 | Co-curricular activity | 0 | 0 | 0 | (3) |
| 12. | MMC 14601 | Field Visits | 0 | 0 | 0 | (2) |
| | - | Vocational Training of 6 weeks to be credited in V semester | - | - | - | - |
| Total Credit Hours | | | 15 | 6 | 7 | 43+(7) |
| Total Contact Hours=28 | | | | | | |

FIFTH SEMESTER

| Sl. No. | Course No. | Name of the Course | L | T | P | CH |
|--|------------|--|-----------|----------|----------|---------------|
| THEORY | | | | | | |
| 1. | MMC15101 | Dynamics of Machinery | 3 | 1 | 0 | 7 |
| 2. | EER 15102 | Mine Electrical Technology | 3 | 1 | 0 | 7 |
| 3. | MMC15105 | Manufacturing Technology | 3 | 1 | 0 | 7 |
| 4. | MMC 15104 | Machine Design | 3 | 3 | 0 | 9 |
| 5. | MSR15152 | Industrial Engineering and Management | 3 | 0 | 0 | 6 |
| PRACTICAL & OTHERS | | | | | | |
| 6. | EER15202 | Mine Electrical Technology Practical | 0 | 0 | 2/2 | 1 |
| 7. | MMC 15201 | Dynamics of Machinery | 0 | 0 | 2/2 | 1 |
| 8. | MMC 15205 | Manufacturing Technology | 0 | 0 | 2/2 | 1 |
| 9. | MMC 15204 | Soft Computing Lab-II | 0 | 0 | 2 | 2 |
| 10. | MMC 15601 | Field visits | 0 | 0 | 0 | (2) |
| 11. | MMC 15801 | Project and Seminar | 0 | 0 | 4 | 4 |
| 12. | MMC 15001 | Vocational Training* | 0 | 0 | 0 | (5) |
| 13. | - | Vocational Training of 2 weeks to be credited in VI semester | - | - | - | - |
| Total Credit Hours | | | 15 | 6 | 9 | 45+(7) |
| Total Contact Hours=30 | | | | | | |
| *6 weeks Vocational Training performed after IV semester is to be credited in 5th semester. | | | | | | |

SIXTH SEMESTER

| Sl. No. | Course No. | Name of the Course | L | T | P | CH |
|--|------------|---|-----------|----------|----------|---------------|
| THEORY | | | | | | |
| 1 | MMC16103 | I C Engines | 3 | 1 | 0 | 7 |
| 2 | MMC16104 | Fluid Power and Control | 3 | 1 | 0 | 7 |
| 3 | MMC16106 | Drilling Engineering | 3 | 0 | 0 | 6 |
| 4 | MMC16107 | Pumps, Fans & Compressors | 3 | 1 | 0 | 7 |
| 5 | MMC 16108 | Open pit Production Machines | 3 | 0 | 0 | 6 |
| PRACTICAL & OTHERS | | | | | | |
| 6 | MMC16203 | I C Engine | 0 | 0 | 2/2 | 1 |
| 7 | MMC16204 | Fluid Power and Control | 0 | 0 | 2/2 | 1 |
| 8. | MMC16207 | Pumps, Fans & Compressors | 0 | 0 | 2/2 | 1 |
| 9. | MMC16601 | Field visits | 0 | 0 | 0 | (2) |
| 10 | MMC 16801 | Project and Seminar | 0 | 0 | 4 | 4 |
| 11. | MMC 16001 | Vocational Training | 0 | 0 | 0 | (2) |
| 12. | MMC 16501 | Composite Viva voce | 0 | 0 | 0 | (2) |
| | - | Vocational Training of 6 weeks to be credited in VII semester | - | - | - | - |
| Total Credit Hours | | | 15 | 3 | 7 | 40+(6) |
| Total Contact Hours=25 | | | | | | |
| *2 weeks Vocational Training performed after V semester is to be credited in VI semester. | | | | | | |

SEVENTH SEMESTER

| Sl. No. | Course No. | Name of the Course | L | T | P | CH |
|---|------------|---------------------------------------|-----------|----------|----------|---------------|
| THEORY | | | | | | |
| 1. | MMC17103 | Underground Production Machines | 3 | 0 | 0 | 6 |
| 2. | MEC 17102 | Mine Legislation & Safety | 4 | 2 | 0 | 10 |
| 3. | MMC17104 | Open-pit Loading & Transport Machines | 3 | 0 | 0 | 6 |
| 4. & 5. | | Elective (any two) | 2×3 | 0 | 0 | 12 |
| | MME17108 | Tribology | | | | |
| | MME17111 | Bulk Solids Handling Equipment | | | | |
| | MSR17153 | Operation Research | | | | |
| | MME17102 | Finite Element Analysis | | | | |
| | MME17105 | Mechanical Vibration | | | | |
| | MEE 17102 | Rock Excavation Engineering | | | | |
| PRACTICAL & OTHERS | | | | | | |
| 6. | MMC17203 | Mining Machinery Lab-I | 0 | 0 | 2/2 | 1 |
| 7. | MMC17801 | Project and Seminar | 0 | 0 | 6 | 6 |
| 8. | MMC 17001 | Vocational Training* | 0 | 0 | 0 | (5) |
| Total Credit Hours | | | 16 | 2 | 7 | 41+(5) |
| Total Contact Hours=25 | | | | | | |
| *6 weeks Vocational Training performed after VI semester is to be credited in VII semester. | | | | | | |

EIGHTH SEMESTER

| Sl. No. | Course No. | Name of the Course | L | T | P | CH |
|-------------------------------|------------|--|-----------|----------|----------|---------------|
| THEORY | | | | | | |
| 1 | MMC18103 | Automobile Engineering | 3 | 1 | 0 | 7 |
| 2. | MMC18104 | Maintenance Engineering | 3 | 1 | 0 | 7 |
| 3. | MMC18105 | Underground Loading and Transport Machines | 3 | 1 | 0 | 7 |
| 4. & 5. | | Elective (any two) | 2×3 | 0 | 0 | 12 |
| | MME18102 | Automation and Robotics | | | | |
| | MME18105 | Plant Layout and Mechanical Handling | | | | |
| | MME18106 | Micro-Electro-Mechanical System (MEMS) | | | | |
| | MME18111 | Mineral Processing Equipment | | | | |
| | MEE18101 | Innovative Mining Systems | | | | |
| | MEE18105 | Underground Space Technology | | | | |
| PRACTICAL & OTHERS | | | | | | |
| 6. | MMC18203 | Mining Machinery Lab-II | 0 | 0 | 2/2 | 1 |
| 7. | MMC 18801 | Project and Seminar | 0 | 0 | 6 | 6 |
| 8. | MMC 18501 | Comprehensive Viva-Voce | 0 | 0 | 0 | (4) |
| Total Credit Hours | | | 15 | 3 | 7 | 40+(4) |
| Total Contact Hours=25 | | | | | | |

CAPSULE COURSES (For Non-Departmental Students)

SIXTH SEMESTER

| Sl. No. | Course No. | Name of the Course | L | T | P | CH |
|----------------|-------------------|---------------------------|----------|----------|----------|-----------|
| 1. | MMR16101 | Mining Machinery I | 3 | 1 | 0 | 7 |

SEVENTH SEMESTER

| Sl. No. | Course No. | Name of the Course | L | T | P | CH |
|----------------|-------------------|---------------------------|----------|----------|----------|-----------|
| 1. | MMR17101 | Mining Machinery II | 3 | 1 | 0 | 7 |

THIRD SEMESTER

THEORY

MMC13101 Solid Mechanics (3-1-0)

Basic concepts of mechanics of materials: stress strain behavior of engineering materials.
Concept of stress and strain field, stress-strain transformation, Hook's law and compatibility conditions
Mohr's circle representation for plane stress and plane strain, thermal stresses and strains, volumetric stress and strain
Stresses in pressure vessels: thin, thick and compound cylinders.
Beam Analysis: stresses in beams, deflection in beams, statically indeterminate beam analysis.
Strain energy concept for structural members
Torsion of circular members and thin walled tubes
Combined stresses and strains in structural members
Springs: Helical and Leaf springs,
Failure theories; Buckling of columns.

References:

1. Strength of Materials: Part I, II, S. Timoshenko, CBS Publishers, 1985.
2. Engineering Mechanics of Solids, E. P. Popov, EEE/PHI, 1993.
3. Introduction to Solid Mechanics, I. H. Shames and J. M. Pittarresi, EEE/PHI, 2003.
4. Mechanics of Materials, F. P. Beer, E. R. Johnston, Jr. & J. T. DeWolf, TMH, 2004.

MMC13102 Engineering Thermodynamics (3-1-0)

Basic Thermodynamics: Introduction, thermodynamic system, control volume, properties, processes and cycles, thermodynamic equilibrium, concept of continuum, Quasi-static process; Zeroth law of thermodynamics, Work and heat transfer, First Law of Thermodynamics for a closed systems, Steady flow energy equation; Second Law of Thermodynamics: Kelvin-Planck and Clausius statements; Causes of irreversibility; Carnot's theorem; Absolute temperature scale; Inequality of Clausius; Entropy principle; Entropy transfer and entropy generation; Quality of energy; Energy principle; Guoy-Stodale theorem; Properties of a pure substance; p-v, p-T, T-s and h-s diagrams;
Applied Thermodynamics: Steam generators: Classification, construction, mountings, accessories, its functions and performance; Air standard cycles; Otto, Diesel, Dual, Stirling and Ericsson cycles; Vapour power cycles, Rankine cycle; Reheat and regenerative cycles; Vapour compression Refrigeration cycle and Gas turbine cycle. Principle of working of 2-S and 4-S internal combustion engines.

References:

1. Engineering Thermodynamics - P.K. Nag, Tata McGraw Hill
2. Thermodynamics – An Engg. Approach : Y A. Cengel & M. A. Boles, Tata McGraw Hill
3. Engineering thermodynamics - Van Wylen, &
4. Fundamentals of Thermodynamics: Sonntag, Borgnakke and Van Wylen, John Wiley & Sons
5. A textbook of Engg. Thermodynamics: R K Rajput, Laxmi Publications
6. Fundamentals of Engg. Thermodynamics: E. Rathakrishnan, Prentice-Hall of India
7. Engineering Thermodynamics – C P Arora, Tata McGraw Hill
8. A Course in Internal Combustion Engines - M.L.Mathur & R.P.Sharma, Dhanpat Rai

MMC13103 Kinematics of Machines (3-1-0)

Kinematic pairs, inversion, mobility and range of movements. Displacement, velocity and acceleration analysis of planar linkages. Dimensional synthesis for motion. Simple Mechanism, Devis and Ackermann steering mechanisms, Hooke's joint. Mechanical Couplings, Cam profiles: Velocity, Acceleration, Synthesis. Types of gears, motion and synthesis of simple, reverted and

planetary gear trains. Brakes: Types, Analysis. Clutches: Types, Analysis. Dynamometers.

References:

1. Mechanism and Machine Theory by J.S.Rao and R.V. Dukkipati, New Age International
2. Theory of Machines and Mechanisms by J.J. Shigley and J.J.Uicker, McGrawhill
3. Theory of Mechanism and Machine by A. Ghosh and A.K. Mallik, East West Press (Pvt.) Ltd., New Delhi
4. Theory of Machine by W.G.Green, Blackie & Sons Ltd.

MMC13104 Material Science and Engineering (3-0-0)

Classification and selection of engineering materials; Bonds in solids, Electron theory of metals, Crystal Geometry, Structure and Defects in crystals and methods of their determination, Electron theory of Metals, Diffusion in Solids, Mechanical properties of materials and their assessment methods, Alloy Systems, Phase diagrams of common Engineering alloy systems, TTT Curves, Heat Treatment Processes, Strengthening Mechanisms of Materials, Basics of Thermal, Optical, Electrical and Magnetic Properties of Materials, Concepts of Creep, Fatigue, Fracture and Corrosion, Introduction to Semiconductors, Superconductivity, polymers, Ceramics, Composites, Shape Memory Alloys, Metglasses, and Nanostructured Materials.

References:

1. Materials Science and Engineering, William D Callister Jr, John Wiley & Sons, Inc.
2. Physical Metallurgy Principles, T. E. Reed-Hill & R Abbaschian, Thomson.
3. Elements of Materials science & Engineering, L.H.VanVlack. Addison Wesley Pub. Company.
4. Mechanical Metallurgy, G.E. Dieter, McGraw-Hill, London.
5. Materials Science and Engineering, V.Raghvan, Prentice Hall of India

AMR13101 Methods of Applied Mathematics I (3-1-0)

Part – I

Complex Variables: Limit, continuity and differentiability of function of complex variables. Analytic functions. Cauchy-Riemann's equations, Cauchy's integral theorem, Morera's theorem, Cauchy's integral formula, Taylor's and Laurent's series, singularities, Residue theorem, contour integration.

Special Functions: Solution of Bessel equation, recurrence relations and generating function for $J_n(x)$ orthogonal property and integral representation of $J_n(x)$. Solution for Legendre equation, Legendre polynomial, Rodrigue's formula, orthogonality property and generating function for $P_n(x)$.

Part – II

Laplace Transform: Laplace transform of simple functions, properties of Laplace transform, t-multiplication and t-division theorems, Laplace Transform of derivatives, integrals and periodic functions. Inverse Laplace transform and its properties, convolution theorem. Use of Laplace transform in evaluating complicated and improper integrals and solution of ordinary differential equations related to engineering problems.

Partial Differential Equations: Classification of partial differential equations, solutions of one dimensional wave equation, one dimensional unsteady heat flow equation and two dimensional steady heat flow equation by variable separable method with reference to Fourier trigonometric series.

PRACTICAL

MMC 13201 Solid Mechanics (0-0-3/2)

1. Tensile Strength Testing of a given mild steel specimen on Universal Testing Machine (UTM)
2. Compressive strength testing of a given specimen on Universal Testing Machine (UTM)
3. Bending and Shear test of a Material on Universal Testing Machine (UTM)
4. Impact testing on impact testing machine: Charpy and Izod.
5. Hardness testing of given specimen using Rockwell and Vickers/Brinell testing

Machines

6. Fatigue testing on fatigue testing machine
7. Creep testing on creep testing machine
8. Torsional rigidity test of shaft
9. Stiffness test of closed coiled helical spring
10. Fatigue test of Mild steel specimen
11. Flow detection of a test piece by Magnetic crack detector

MMC 13202 Engineering Thermodynamics (0-0-3/2)

1. To study construction and operation of 2-stroke SI engine model.
2. To study construction and operation of 4-stroke SI engine model.
3. To study construction and operation of 4-stroke CI engine model.
4. To study construction and operation of various boiler models.
5. Performance testing of a 4-stroke Diesel engine.
6. Performance testing of a 4-stroke Petrol engine.
7. Performance testing of a steam boiler.
8. Performance testing of a steam power plant cycle.

MMC 13203 Kinematics of Machines (0-0-3/2)

1. To determine M. I. of a connecting rod.
2. To verify the relation of compound pendulum & to determine the radius of gyration
3. To study radius of gyration of bi-filar suspension
4. To study the undamped free vibration of spring mass system
5. To find out the coefficient of friction between sliding belt (rope) and a fixed pulley
6. To find out efficiency of a screw jack by raising & lowering conditions
7. To verify polygon law of forces.

MMC 13301 Machine Drawing (1-5-0)

Revision on projection of points, lines and planes; projection of lines and planes to auxiliary planes; projection and section of solids to various planes and true shapes of sectioned surface; Inter-penetration of solids; surface development of solids . Standard conventions for section of machine components. Drawing of simple nuts and bolts, keys, cotters, pins. Assembly drawing of Gib and cotter joint, Knuckle joint, universal joint and screw jack; simple machine and engine parts like bearings, couplings, valves, eccentric, large and small end of connecting rod, piston head.

FOURTH SEMESTER

THEORY

MMC14101 Fluid Mechanics (3-1-0)

Fluid and their properties: Concept of fluid, difference between solids, liquids and gases; ideal and real fluids; properties of fluid, Newtonian and non-Newtonian fluids.

Fluid Statics: Pressure and its measurement, Pascal's law and its engineering applications, Hydrostatic force on a plane and curved submerged surfaces, resultant force and center of pressure, Buoyancy and flotation, stability of floating and submerged bodies, metacentric height and its determination, pressure distribution in a liquid subjected to constant horizontal/vertical acceleration, rotation of liquid in a cylindrical container.

Fluid Kinematics: Classification of fluid flows, velocity and acceleration of fluid particle, local and convective acceleration, normal and tangential acceleration, streamline, path line and streak line, continuity equation; Rotational flows, rotation velocity and circulation, stream and velocity potential functions, flow net.

Fluid Dynamics: Euler's equation, Bernoulli's equation and steady flow energy equation; applications of Bernoulli's equation, impulse momentum equation, flow along a curved streamline, free and forced vortex motions.

Boundary Layer Flow: Navier-Stokes equation, Boundary layer concept, displacement, momentum and energy thickness, von-karman momentum integral equation, laminar and turbulent boundary layer flows, drag on a flat plate, boundary layer separation and control.

Viscous Flow: Relationship between shear stress and pressure gradient, flow through pipes, flow between two parallel plates; Kinetic energy and momentum correction factor.

Dimensional Analysis and Similitude: Fundamental and derived units and dimensions, dimensional homogeneity; Rayleigh's and Buckingham's Pi method for dimensional analysis; Dimensionless numbers and their significance; model studies.

Flow measurements: Pitot tube, Siphon, Venturimeter, Orificemeter, Mouthpiece, Weirs and notches

Flow Through Pipes: Major and minor losses in pipes, hydraulic gradient and total energy lines, series and parallel connection of pipes, branched pipes; equivalent pipe, power transmission through pipes.

References:

1. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas, TMH
2. Fluid Mechanics – V L Streeter and E B Wylie, McGraw Hill
3. Fluid Mechanics and Hydraulic Machines – R. K. Bansal, Laxmi Publications
4. Fluid Mechanics and Hydraulic Machines – R K Rajput, S chand & Co. Ltd.
5. Mechanics of Fluids – I H Shames, McGraw Hill
6. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar, S.K. Kataria and Sons
7. Gas Dynamics for engineers – P Balachandran, PHI Learning Pvt. Ltd.

MMC 14103 – MECHANICAL ENGINEERING DESIGN (3–3–0)

Introduction to Engineering Design: Philosophy of engineering Design, mechanical engineering design, design process, design considerations, codes and standards.

Selection of Materials: classification, mechanical properties and application of Ferrous, Non-Ferrous metals and their alloys, Non-Metallic materials, Powdered materials, Composite materials and ceramics.

Designing for Strength: Different types of loading on machine members & associated stresses, factor of safety & design stress, stress concentration, Design for simple and combined loading, choice of theory of failures, Effect of temperature, design considerations for varying loads, Endurance limit, Mechanism of Fatigue failure and associated factor of safety by different methods. Combined steady and variable loads.

Joints: Classification, integrity and uses of different type of permanent and detachable joints, design procedures for Riveted, Welded, Threaded, Cotter, Knuckle and interference joints.

Design consideration under eccentric loading: Wall brackets, hangers, base plate joints of pillar cranes and crane hooks.

Levers and Power screws: Design and Selection of different components of Power Screw, Levers and Links.

Shafts & Coupling : Design for steady, combined and fluctuating loads, rigidity and critical speed considerations in shaft design. Design of Keys, Splines and Couplings.

Mechanical Drives: Classification and selection steps for main components of belt, rope and chain drives.

Springs, Clutches and Brakes: Classification, application and design consideration of springs, clutches and brakes.

References:

1. Machine Design, V. L. Maleev and J. B. Hartman.
2. Mechanical Engineering Design, J. E. Shigley, Mischke & R. Charles.

3. Design of Machine Elements, M. F. Spotts & T. E. Shamp.
4. Machine Design, Robert L. Norton.
5. Design Data Hand Book, PSG College of Technology.
6. Relevant Indian Standards.

MER 22132 – MINING METHODS & UNIT OPERATIONS (3–0--0)

Surface mining: Deposits amenable to surface mining; Box cut: objectives, types, parameters and methods; Production benches - objectives, formation and bench parameters; Unit operations and associated equipment; Classification of Surface Mining Systems.

Underground coal mining: Deposits amenable to underground coal mining; Classification of underground coal mining methods; Bord and pillar methods – general description and applications and merits and demerits; Selection of panel size, operation involved and associated equipment; Longwall methods – Types and their general description, applicability, merits & demerits; Selection of face length & panel length, operations involved and associated equipment; Methods for mining steeply inclined seams and thick seams; Hydraulic mining.

Underground metal mining: Deposits amenable to underground metal mining; Shape, size & position of drifts & cross cuts; Raises & Winzes; Classification of underground metal mining methods; Stopping methods – general description, applicability, operations involved and associated equipment for room and pillar mining, Stope & Pillar mining, shrinkage stoping, sub-level stoping, cut & fill stoping, VCR methods, Sub-level caving & Block caving.

References:

1. Mining, Boky
2. Coal Mining Practices, Statham.
3. Longwall Mining, Syd S. Peng and H. S. Chiang.

EER 14101 Applied Electrical Engineering (3-1-0)

Operation and characteristics of three-phase Induction motors; Methods of starting & speed control of three phase induction motor; Ward-Leoard method of speed control of DC motor; Basic principles of Thyristor controlled variable speed DC and AC motors.

Principles of rate making of electricity and power factor improvement; Substation arrangement; Circuit breakers; Protective relays: - Induction pattern over current relay, thermal overload relay, earth fault relay, Lightning Arrester, Fuses: - types and selection.

Power cables: - Types & selection, Types of motor enclosure, FLP enclosures for hazardous area equipment, Intrinsically safe circuit.

Industrial application & control of electrical motors: - Types of electric motors and their application in Industry; Controller for the speed control of DC & AC motors.

Diesel – Electrical oil rigs. I.E rules applied to mines & oil fields.

References:

1. A text book on power system engineering, Soni, Gupta, Bhatnagar, Chakrabarti.
2. Electrical Machines, Nagrath and Kothari.
3. Electrical Drives, G. K. Dubey.

AMR14101 Numerical and Statistical Methods (3-1-0)

Part – I

Numerical Methods: Solution of algebraic and transcendental equation by bisection, iteration, false position and Newton-Raphson methods.

Solution of a system of linear simultaneous equations by Gauss elimination, Gauss-Jordan, Crout's triangularisation, Jacobi and Gauss-Seidel methods.

Finite difference, Symbolic relations, Interpolation and Extrapolation, Newton-Gregory forward and backward, Gauss forward and backward, Stirling, Bessel and Lagrange's formulae, Inverse interpolation by Lagrange and iterative methods, Numerical differentiation and integration: Trapezoidal, Simpson's 1/3rd, Simpson's 3/8th and Weddle quadrature formulae.

Numerical solution of first order ordinary differential equations by Taylor's series, Picard's, Euler's, Modified Euler's, Runge-Kutta and Milne's methods. Solution of simultaneous first order and second order ordinary differential equations with initial conditions by Runge-Kutta and Milne's methods. Numerical solution of boundary value problems by finite difference method.

Part - II

Statistical Methods : Moments, skew ness and kurtosis.

Probability: Various approaches of probability, two theorems (without proof), conditional probability, Bayes theorem.

Random variable: Definition, probability mass & density functions, distribution function, mathematical expectation and moment generating function.

Probability distributions: Bernoulli, binomial, Poisson and normal distributions.

Theory of least squares and curve fitting.

Correlation and Regression: Simple, multiple & partial correlation coefficients, regression lines, regression coefficients and their properties.

Test of significance: Normal test, t-test, chi square test and F test.

PRACTICALS

MMC14201 Fluid Mechanics (0-0-3/2)

1. To determine the coefficient of discharge, contraction & velocity of an orifice.
2. To determine the coefficient of discharge of venturimeter.
3. To verify the Bernoulli's Theorem.
4. To determine the friction factor for the pipes.
5. To determine the discharge coefficient for a V- notch or rectangular notch.
6. To find critical Reynolds number for a pipe flow.
7. To determine the minor losses due to sudden enlargement, sudden contraction and bends.
8. To show the velocity and pressure variation with radius in a forced vortex flow.

MMC14202 AutoCAD and Solid modeling (0-0-3/2)

1. Construct complete and correct 3-D model involving the following techniques:
 - a. Create geometric elements (lines, points, arcs, circles, etc)
 - b. Extrude solids from sketcher
 - c. Create surfaces and solids.
 - d. Generate fillets and chamfers from solid edges
2. File management, plotting, and modification of solid models.
3. Use of the tools provided for geometric transformation and measurement
4. Demonstrate the ability to create dimensioned 2-D drawing from 3-D space solids
5. Construction of simple machine components.
6. Techniques of assembling the different machine components and finding the sectional views.
7. Conversion of 3D model to 2D drawings.
8. Preparation of bill of materials

MMC14203 Soft Computing Lab I (0-0-3)

1. M File Creation, Polynomial fitting, Matrix manipulation, different types of plots in MATLAB.
2. Solution of polynomial equation, differential & integral calculus
3. Modeling and Simulation

4. Optimization
5. Linear control analysis
6. Different waveform generations in MATLAB

FIFTH SEMESTER

THEORY

MMC15101 Dynamics of Machinery (3-1-0)

Static force analysis, free-body diagram, static equilibrium, analysis of multiforce member, force analysis with friction.

Dynamic force analysis, shaking effect, dynamic equilibrium, dynamic analysis of mechanisms.

Dynamics of reciprocating and rotary machines, turning moment diagram, fluctuation of energy.

Balancing of reciprocating and rotary machines, single and multi-cylinder engine balancing.

Cam dynamics, analysis of disc cam with reciprocating roller follower, analysis of elastic cam system.

Rigid body dynamics, Governors and Gyroscopes.

Introduction to Free and Forced Vibrations, critical speed of shaft, vibration measuring instruments.

References:

1. Theory of Machines and Mechanisms, Joseph E. Shigley, John J. Wicker, McGraw hill & Co.
2. Kinematics and Dynamics of Planar Machinery, Burton Paul, Prentice Hall Inc.
3. Theory of Machines, W. G. Green, Blackie & Sons.
4. Shock and Vibration Handbook, C. M. Harries, McGraw hill & Co.

EER 15102 -- Mine Electrical Technology (4—0—0)

Transmission and Distribution of Electrical Power in Mines: Performance of short transmission lines; radial and ring – main distribution systems, substation arrangements for opencast and underground mines, distribution of electrical power in mines, mining type cable.

Mining type switchgears and protective devices: Types of circuit breakers, Gate end box, Drill panel, and Tran switch, Field Switch.

Symmetrical faults and circuit breaker rating calculation.

Protective relays – thermal and induction disc type overload relays; mining type earth fault relay.

Signaling and communication: Haulage and Coal face signaling systems for underground coal mines, basic concept of underground mine communication.

Power Economics: Types of industrial tariffs, power factor improvement in mines.

Electrical drives and Power Semiconductor Controller: Selection of motors and starters for mining applications; introduction to power semiconductor devices, basic principles of operation of thyristor controlled variable speed mine electrical drives, electrical braking.

Electrical Safety in Mines: Neutral Grounding and Equipment earthing practice in mines, principles of flameproof enclosure, intrinsic safety, Indian Electricity Rules as applied to mines – main provisions. Mine Lighting system.

References:

1. A text book on power system engineering, Soni, Gupta, Bhatnagar, Chakrabarti.
2. Coal Mining Practice [Vol – III], Statham
3. Electrical Equipment in Mines, H. Cotton.
4. Electrical Drives, G. K. Dubey.

MMC 15105 MANUFACTURING TECHNOLOGY (3-1-0)

Introduction of manufacturing processes, Importance of manufacturing economics & technological considerations in manufacturing,

Metal Forming Processes: Elastic & plastic deformation, yield criteria, hot working vs. cold working, bulk deformation processes, Sheet Metal working processes, Die & punch assembly, Lubrication, defects in metal forming processes. Unconventional Metal forming processes.

Casting process: Basic principle & survey of casting processes, patterns, moulding sand, gating system, Solidification of casting, Sand casting, Die casting, centrifugal casting, Investment casting. casting defects, melting practices.

Metal Cutting: Introduction, Cutting tool, Mechanics of chip formation, Cutting fluids/lubricants, Tool materials, Tool wear mechanism, and tool life, Machinability, Machine tools. Unconventional machining processes.

Welding processes –Broad classification of welding processes, application and welding defects.

References:

1. Materials and Processes in Manufacturing, Degarmo, J. T. Black, Prentice Hall of India Pvt Ltd.
2. Manufacturing Processes for Engineering Materials, Kalpakjian and Schmid, Prentice Hall.
3. Fundamentals of modern manufacturing processes, M. P. Groover.

MMC15104 Machine Design (3-3-0)

Introduction: Machine design and design process, probabilistic approach to design, Introduction to computer aided design.

Manufacturing consideration in machine design: Standardization, Interchangeability, Preferred Fits using basic hole system, Dimensions, Tolerances and manufacturing methods, Surface roughness, preferred numbers.

Seals and gaskets: Classification, Materials and uses of Static, Dynamic, Labyrinth, Oil and mechanical face seals.

Bearings: Classification, application and selection steps for sliding contact and rolling elements bearings, lubricants and lubrication of bearings.

Gears and Gear box: Design for strength and selection steps for Spur, Helical, Bevel and worm gears. Design steps for fixed and variable speed gearboxes, Gear Box Lubrication.

I.C Engine components: Design of Cylinder, piston, connecting rod and crankshaft.

Flywheel: Design of flywheel and pulleys.

Wheels and Axles: Design of wheels and axles.

Winches: Design of hand operated and powered winches.

Drums: Design of light, medium and heavy duty drums.

Pumps: Design of pump impellers.

References:

1. Machine Design, V. L. Maleev and J. B. Hartman.
2. Mechanical Engineering Design, J. E. Shigley, Mischke & R. Charles.
3. Design of Machine Elements, M. F. Spotts & T. E. Shamp.
4. Machine Design, Robert L. Norton.
5. Design Data Hand Book, PSG College of Technology.
6. Relevant Indian Standards.

MSR15152 Industrial Engineering and Management (3-0-0)

Basic functions of management – planning, organizing, staffing, directing and controlling.

Introduction to industrial Engineering techniques.

Productivity: definition, measurement.

Work study and its role in improving productivity of an organization.

Types of Production systems.

Introduction to production planning and control.

Concepts of human resource management – selection, training and development.

Finance management – capital budgeting techniques, payback period, ARR, NPV, IRR, PI; Sources of capital; Costs concepts and Break even analysis.

Project management – Introduction, Network construction & identification of critical activities in CPM & PERT.

References:

1. Essentials of Management, Koontz and O'Donne.
2. Finance Sense, Prasanna Chandra
3. Industrial Management, M E Thukaram Rao.
4. Work Study, I.L.O.
5. A Management Guide to PERT/CPM, J D Wiest and F K Levy.

PRACTICALS

EER15202 - Mine Electrical Technology Practical (0-0-3/2)

1. Study of Gate-End-Box
2. Study of Drill Panel
3. Study of CBT and Earth Fault Relay
4. Study of Mining Type Electric Cable
5. Study of Pillar Switch
6. Determination of IDMT characteristics of induction type overload relay.
7. Determination of characteristics of thermal overload relay.
8. Study of power factor improvement by static condenser.

MMC 15201 Dynamics of Machinery (0-0-3/2)

1. Experimental verification of the gyroscopic couple
2. To balance the masses statically and dynamically of a single rotating mass system (4 rotor)
3. To study the performance of Porter, Proell and Hartnell Governor
4. To study the modes of vibrations and frequency of whirling shafts
5. To study the cam dynamics
6. To study the undamped free vibration of spring mass system
7. To study the forced damped vibration of spring mass system
8. To study the longitudinal vibration of helical coiled spring
9. To study the forced vibration of simply supported beam for different damping.
10. Verification of Dunkerley's Rule
11. To study the pressure profile of lubricating oil at various conditions of load and speed for Epicyclic Gear Train

MMC 15205 MANUFACTURING TECHNOLOGY (0-0-3/2)

1. Study of the machine tools like Milling Machine, Gear Hobbing Machine, Gear Shaper, Tool & Cutter Grinder
2. Gear manufacturing on gear hobbing/gear shaping machine tool.
3. Sand preparation and testing: specimen preparation for testing permeability, clay content, grain fineness number, moisture content, green compression strength, green shear strength, splitting strength, hardness, etc.;
4. Casting of metals after preparation of suitable moulds; Experiments on properties of post casting, fettling, cleaning, deburring, and polishing operations;
5. Experiments on different welding process.
6. Inspection of welded joints as per BIS.

MMC15204 Soft Computing Lab II (0-0-3)

1. Preparing models for simulation and control analysis.
2. Multiple simulations of different systems at the same time.
3. Creation of sub-system models or capsules and incorporation of capsules in integrated model.
4. Structural analysis
5. Fault diagnosis

SIXTH SEMESTER

THEORY

MMC 16106 - DRILLING ENGINEERING (3—0—0)

Construction and operation of coal drills, jackhammer drills, drifters, blast-hole drills, DTH drills, jumbo drills; Drill bits and rods; Diamond drilling- principles, operating features, wire line drilling, core barrels, bits, reamer shells, drilling fluid, pumps, fishing tools, standards of components; Oil well drilling- percussive, rotary and bottom drive drilling, bits, drill steel and components, hoisting and rotary systems, mud circulation systems and accessories, drill hole deviation, directional drilling, fishing operation, casing design, coring, bore hole problems; recent development in rock drilling.

References:

1. Drilling-the manual of methods, applications and management; Australian drilling industry training committee Ltd.
2. Diamond drilling; C P Chugh; Oxford & IBH Publishing Co.
3. Manual of drilling technology; C P Chugh; Oxonian Press Pvt Ltd.
4. Drilling technology handbook; C P Chugh.
5. Offshore drilling technology; Frank R Carmichael; Noyes Data Corporation.
6. Applied drilling engineering; SPE Text Book Series.
7. Drilling Engg by Jamal J. AZAR & G. Robello Samuel , Penwell publications
8. Drilling Engineering; Jamal J Azar, Robello Samuel; Penwell Publications.

MMC 16107 - PUMPS, FANS & COMPRESSORS (3 - 1 - 0)

General:

Classification and application of fluid flow machineries; Basic concepts of capacity, head, power, energy and efficiency.

Centrifugal Pumps and Fans:

Principle of operation; Euler's equation, theoretical and actual head, energy equation for liquid flow through impeller, construction of impeller, multistage centrifugal pumps, axial thrust balancing, performance characteristics, parallel and series operations of pumps, capacity regulations; basic calculations; selection of mine pumps; Pumping system layout for mines.

Axial Flow fan:

Cascade of profiles; basic theoretical equations, head, energy, losses, efficiency; Multistage machines: Constructions, calculations, selection procedure with special reference to mining applications.

Reciprocating and Rotary Positive Displacement Pumps:

Basic theory of reciprocating pumps, indicator diagram, net positive suction head, capacity, power, application and constructional details of reciprocating pumps; Application, types, construction and main design features of rotary positive displacement pumps for dewatering.

Other Mine Pumps and Fans:

Construction and operation of slurry, submersible, air lift and mono pumps; features of main, auxiliary and booster fans. Installation and maintenance of pumps and fans.

Compressors:

Basic theory, classification and application of compressors used in mines; Construction and operation of single and multi-stage positive and non-positive displacement compressors

(reciprocating compressor, centrifugal and axial flow compressors, roots blower, vane compressor); Performance characteristics of compressors;
Capacity regulation of positive and non-positive displacement compressors;
Basic calculations on compressors.
Installation and maintenance of compressors.
Selection of compressors for mining application.

Reference Books

1. Pumps, Fans, Compressors V. M. Cherkassky Mir Publishers – Moscow
2. Mining Mechanical Engg. R. Khadzhikov, S. Butakov Mir Publishers – Moscow
3. Fans Bruno Eck Pergamon Press
4. Mine Fans Dr. P. K. Chackroborty CMPDIL – Ranchi
5. Mine Pumps Dr. P. K. Chackroborty CMPDIL – Ranchi
6. Fluid Mechanics & Fluid Machines S. K. Som, G. Biswas Tata-McGraw Hill

MMC 16108- OPEN PIT PRODUCTION MACHINES (3—0—0)

Introduction to Surface mining equipment:

Classification of equipment; system with different combination of excavator and transport equipment. Applicability of different surface mining equipment, Mechanics of rock cutting / loading by excavator bucket.

Prime movers used in surface mining equipment:

Turbo-charged diesel engine, construction, operation and maintenance of its subsystems, trouble shooting of the engine.

Classification, construction, operation and maintenance of various sub-systems of shovel, Dragline, Bucket wheel excavator, Scraper, Surface Miner, high wall mining equipment.

Unconventional mining equipment used in surface mining projects.

Selection criteria of open cast production equipment .

Safety aspects related to open cast production equipment.

References:

1. Recent Development of Heavy earth Moving machineries, A. De, Lovely Prakashan
2. Moving the Earth: Nicholes
3. On and with the Earth: J. Singh
4. Opencast Mining Unit Operations; V VRzhevsky; Mir Publishers; Moscow
5. Surface Mining Equipment; James W Martin
6. Construction Equipment; M Galperin, N Dombrovsky, L Mestechkin; Mir Publishers; Moscow
7. Machines for Moving the Earth; A N Zelenin, V I Balovnen, I P Kerov,; Oxinian Press Pvt Ltd; New Delhi

MMC 16104 - FLUID POWER & CONTROL (3—1—0)

Fluid properties and qualities; Hydraulic and Pneumatic symbols and Circuits.

Fluid Power fundamentals, Flow through conduits, orifices, minor losses, temperature rise and Pressure transients.

Theory, construction, operation and characteristics of Positive displacement Pumps and Motors; Flow and Torque losses and machine efficiencies.

Construction, operation and characteristics of pressure, flow and direction control valves.

Construction, operation and selection of Accumulators, Intensifiers, Hydraulic Cylinders.

Construction and design of hydraulic circuits for specific applications.

Electro-hydraulic Servo-Valve and its dynamics.

Theory, Construction and operation of Pneumatic actuators, valves and other accessories.

Basics of System Dynamics and Control; Application to a servo-valve motor open loop and closed loop drive systems; Servo-valve with linear actuators.

Introduction to the use of PLC (programmable logic control) for sequence control of hydraulic and pneumatic systems.

Reference Books:

1. Oil Hydraulic System, S. R. Majumder, Tata-McGraw Hill Publication
2. Pneumatic Systems, S. R. majumder, Tata-McGraw Hill Publication
3. Hydraulic Control Systems, Herbert E. Merritt, John Wiley & Sons
4. Hydraulic Control Systems, Noah D. Manring, John Wiley & Sons
5. Power Hydraulics, Pinches, Prentics hall Publication
6. Fluid power Circuits & Controls, Jhon S. Cundiff, CRC Press
7. Fundamentals of Fluid Power Controls, John Watton, Cambridge University Press
8. Fluid power Circuits & Controls, Jhon S. Cundiff, CRC Press
9. Fundamentals of Fluid Power Controls, John Watton, Cambridge University Press

MMC 16103 -- I C ENGINES (3—1--0)

Introduction: Internal and external combustion engines; classification and nomenclature of I. C. Engines, Thermodynamic analysis and comparison of air standard Otto, diesel and dual combustion cycles, engine performance parameters, deviation of actual engine cycle from ideal cycle.

Fuels: Conventional fuels for S.I. and C.I. engines, fuel properties and their influence of engine performance; octane and cetane rating of fuels, alternative fuels.

Carburetion and fuel Injection: Mixture requirements for various operating conditions in S.I. Engines; elementary carburetor, drawbacks of carburetor, petrol injection systems; single-point and multi-point fuel inject systems; requirements of a diesel injection system; types of diesel inject systems, injection pump and injectors, fuel filters.

Ignition systems: Requirements of ignition system; types of ignition systems, advancing ignition timing; spark plugs.

Combustion in I.C. Engines : Stages of combustion in S.I. Engines; factor influencing the ignition lag and flame speed; detonation and its effects on engines performance; influence of engine variables on detonation; pre-ignition; Stages of combustion in C.I. Engines; delay period; variables affecting delay period; knock in C.I. engines.

Lubrication and Cooling Systems: Functions of a lubricating system, Types of lubrication system; mist, wet sump and dry sump systems; properties of lubricating oil; Necessity of engine cooling; disadvantages of overcooling; cooling systems; air-cooling, water cooling; radiators.

Engine Testing and Performance: Measurement of various engine performance parameters; fuel and air consumption, brake power, indicated power and friction power, heat lost to coolant and exhaust gases; performance curves.

Engine emission and Control: Pollutants from SI and CI Engines; influence of operating parameter on emission; methods of emission control.

Supercharging: Objectives of supercharging, its advantages and application, performance of superchargers, Turbo charged engines, supercharging of SI and CI Engines, limitations of supercharging.

References:

1. The Internal Combustion Engines: C.F. Taylor & E.S. Taylor, Int. Textbook Co.
2. Internal Combustion Engine Fundamentals: J.B. Heywood, McGrawhill Book Co.
3. Fundamentals of Internal Combustion Engines: H.N. Gupta, PHI
4. Internal Combustion Engines: Shyam K. Agarwal, New Age International
5. A Text Book of Internal Combustion Engines: R K. Rajput, Laxmi Publ.
6. Internal Combustion Engines –V. Ganesan, Pub.-Tata McGraw-Hill.
7. A Course in Internal Combustion Engines - M.L.Mathur&R.P.Sharma, DhanpatRai
8. A Course in Internal Combustion Engines: Damkundwar by DhanpathRai& Sons

PRACTICALS

MMC 16204 – FLUID POWER AND CONTROL(0 - 0 – 3/2)

1. To develop different hydraulic circuits in hydraulic trainer
2. To study construction and operation of different types of pumps and valves
3. Performance investigation of hydrostatic transmission system both in open loop and closed loop conditions
4. Computer controlled hydraulic excavators
5. Performance investigation of the valve controlled and pumps controlled hydraulic systems
6. Energy saving hydraulic system using hydraulic accumulator
7. Study of hydraulic circuits used in hydraulic excavator.

MMC 16203 – IC ENGINE (0-0-3/2)

1. To conduct a performance test on a-stroke diesel engine.
2. To conduct a performance test on a 4-stroke petrol engine.
3. To prepare heat balance sheet for a 4-stroke diesel engine.
4. Determine the brake power, indicated power, friction power and mechanical efficiency of a multi-cylinder petrol engine (Morse Test).
5. To study the effect of compression ratio on the performance of petrol/diesel engine.
6. To conduct performance test and to draw P-theta and P-V diagrams on a computerized petrol engine

MMC 16207 PUMPS, FANS & COMPRESSORS (0-0-3/2)

1. Study of different type of pumps used in mines
2. Study of different type of fans used in mines
3. Study of different type of compressors used in mines
4. Power, head, capacity and efficiency determination of pumps
5. Power, head, capacity and efficiency determination of fans
6. Power, head, capacity and efficiency determination of compressors

SEVENTH SEMESTER

THEORY

MMC 17203 UNDERGROUND PRODUCTION MACHINES (3-0-0)

Classification of machinery for production by drilling-blasting method and mechanical cutting in underground coal, metal and other mines; mechanics of rock cutting.

Introduction to Coal cutting machine;

Constructional and operational details of Shearers, Plough, AFC, Stage Loader; Power assessment and selection of coal wining and transport machineries;

Hydraulic Mining: Hydraulic breaking and transportation, type of jets and water pressure, factors affecting hydraulic breaking.

Constructional, operation and selection criteria of Roadheader, Dint header and Continuous Miner.

Supports: Classification of supports: Yield load and setting load; setting of steel arches, goaf post supports, friction props, hydraulic props, link bars, roof bolting and cable bolting;

Power supports: Different types and their construction and operation; Control of powered supports; hydraulic power packs;

Operational safety aspects related to the machines.

References:

1. Longwall Mining; Syd S. Peng, H. S. Chaing; Wiley Intersciences
2. Elements of Mining Technology; D. J. Deshmukh; VidyasewaPrakashan.
3. Longwall Machinery &Mechanisation; S. N. Mukherjee, A. M. Publishers, Dhanbad
4. Coal mining practices; I. C. F. Statham; Caxton Eastern Agencies, Kolkata
5. Modern Coal Mining Technology; S. K. Das; Geeta Book Stores.
6. Coal mines regulation; 1957; L. C. Kaku; Lovely Prakashan; Dhanbad
7. Metalliferous mines regulation; 1961; L. C. Kaku; Lovely Prakashan; Dhanbad

MEC 17102 MINE LEGISLATION & SAFETY (4-2-0)

Salient provision of the Mines & Minerals (Development & Regulation) Act, 1957 and Mineral Concession Rules, 1960; mineral conservation and development rules 1988.

The Mines Act, 1952; The Coal Mines Regulations, 1957; The Metalliferous Mines Regulations, 1961; The Mines Rules, 1955 and The Mines Rescue Rules, 1985; additional provisions of Indian electricity rules 1956 applicable to mines, vocational training rules 1966.

Occupational hazards in mining; Accident and their classification; Statistics of fatal and serious accidents; Frequency and severity rates of accidents; Cause-wise analysis; Basic causes of accident occurrence; Investigations into accidents and accident reports; Measures for improving safety in mines; Cost of accidents; Introduction to safety management system.

MMC17104 OPENPIT LOADING AND TRANSPORT MACHINES(3-0-0)

General construction and operation of Dumper, Dozer, ripper, Grader, Loader; Maintenance of loading and transport equipment; Detail of drive mechanisms, suspension systems, steering systems and braking systems of loading and transport equipment; Brief constructional features of crushers, screen, In-pit crushing system, Belt Conveyors, Cable Belt Conveyors, pipe and high Angle Belt Conveyors, Aerial Ropeway, capacity calculations.

Safety aspects related to openpit transport machines.

References:

1. Recent Development of Heavy earth Moving machineries, A. De, Lovely Prakashan
2. Moving the Earth: Nicholes
3. On and with the Earth: J. Singh
4. Opencast Mining Unit Operations; V VRzhevsky; Mir Publishers; Moscow
5. Surface Mining Equipment; James W Martin
6. Construction Equipment; M Galperin, N Dombrovsky, L Mestechkin; Mir Publishers; Moscow
7. Machines for Moving the Earth; A N Zelenin, V I Balovnen, I P Kerov,;Oxinian Press Pvt Ltd; New Delhi
8. Motor Grader; E G RoBinson; Mir Publishers; Moscow
9. Road Making Machineries; K Abrosimov, A Bromberg, F Katayer; Mir Publishers; Moscow
10. Conveying Machines-Part I and Part-II; A Spivakovosky, V Dyachkov; Mir Publishers; Moscow

ELECTIVE (ANY TWO)**MME 17108 TRIBOLOGY (3-0-0)**

Introduction-Tribological consideration in design

Tribological Elements – Sliding Bearing – Journal Bearings – Rolling contact bearing – Piston, piston ring liner etc.

Types of wear and their Mechanism – Wear in lubricated contact – Film lubrication

Elements of contact Mechanics – Thermal effects in surface contact – Contact between rough surface

Friction Lubrication wear in Clutch, Brake, Pneumatic Tyre, Mechanical Seal, drives etc.

Sliding Bearing – Thrust bearing – Journal Bearing – Application - selection – modern developments

Reference

1. Tribology in machine design -- By --T. A. Stolarski
2. Tribology & design; Edited by M. Hadfield, C. A. Brebbia, J. Seabra
3. Tribological Design of Machine Elements by D. Dowson , C.M. Taylor, M. Godet, D. Berthe

MME17111 BULK SOLIDS HANDLING EQUIPMENT (3--0--0)

Construction and operation of crushers- jaw, gyratory, cone, roll, hammer, ring granulator, feeder breaker, rotary breaker, in-pit crushers;

Construction and operation of feeders, screens, conventional belt conveyors, high angle conveyors, cable belt conveyor, chain conveyors, stackers, reclaimers, wagon loaders, bucket elevators, selection, productivity and power calculations.

Hydraulic and Pneumatic conveying systems.

References:

1. Mechanical conveyors for bulk solids; H Colijn; Elsevier Science Publishers.
2. Materials handling equipment; M P Alexandrov; MIR Publishers.
3. Good year handbook of belting, conveyor and elevator
4. Pneumatic conveying; H. A. Stoess; John Wiley & Sons.
5. Mineral Processing; G Tarjan; Akademiai Kiado.
6. Mineral processing; B. A. Wills; Pergamon Press.

MSR 17153 OPERATION RESEARCH (3--0--0)

Decision-making process, classification of decision-making situations, pay-off matrix, Opportunity cost matrix, Decision making under risk and uncertainty.

Operation research technique and mathematical modeling --- concept and applications in engineering and management problem solving; Principles of optimization, feasible and optimal solution.

Linear programming – model formulation and application; Graphical method of solution; Simplex algorithm; Concept of sensitivity analysis;

Transportation problem – formulation and solution; Introduction to assignment problems.

Queuing / Waiting line model – Characteristics and parameters; Application of queuing analysis in decision making.

Introduction to replacement analysis.

References:

1. Operations Research, Hamdy A Taha
2. Operations Research, F. S. Hillier and G. J. Liberman
3. Operations Research, A M Natarajan, P Balasubramani, and A Tamilarasi
4. Operations Research, S Kalavathy

MME17102 - FINITE ELEMENT ANALYSIS (3 — 0 — 0)

Principles of variation calculus.

Methods of Finite element analysis: stiffness method, potential energy and Rayleigh-Ritz method, Galerkin FE formulation, element formulation, and coordinate transformation, isoparametric formulation.

Applications: problems of structural mechanics and solid mechanics. Plane stress & plane stress problems, 3-D problems. Torsion, bending of plates and shells. FE formulations for vibrations, heat transfer and fluid flow problems.

Associated flowcharts and computer programming.

References:

1. Introduction to Finite Elements in Engineering, T. R. Chandrupatla & A. D. Belegundu, 2nd Ed., PHI, 2001.
2. An Introduction to the Finite Element Method, Reddy, J. N., 2005.
3. The Finite Element Method, O. C. Zienkiewicz, 3rd Ed., McGraw-Hill, 1997.
4. The Finite Element Method in Engineering, S. S. Rao, 2nd Ed., Elmsford, Pergamon, 1989.
5. Introduction to the Finite Element Method: A Numerical Method for Engineering Analysis, Desai, C. S. and Abel, J. F., 1972

MME17105 – MECHANICAL VIBRATION (3—0--0)

Free and Forced vibration of single degree of freedom system with and without damping concept of phase plane. Response of single degree of freedom system to impulse, periodic and non-periodic excitation. Multi degree of freedom free, forced, undamped and damped vibration; Multi degree of freedom systems- exact analysis and numerical methods; Vibration in continuous systems; Vibration isolation, absorption and measurements in industrial machines

References:

1. Vibration fundamentals and practices; Clarence W. de Silva; CRC Press.
2. Vibrations and noise for engineers; Kewal Pujara; Dhanpat Rai & Sons.
3. Theory of vibrations with applications; William T Thomson; CBC Publishers & Distributors.
4. Vibrations, waves and acoustics; D Chattopadhyay, P C Rakshit; Books & Allied (P) Ltd.
5. Elements of vibration analysis; Leonard Meirovitch; McGraw-Hill International Editions.
6. Textbook of mechanical vibrations; Rao V Dukkipati, J Srinivas; Prentice Hall of India Pvt. Ltd.

MEE 17102 – ROCK EXCAVATION ENGINEERING (3-0-0)

Scope and importance of rock excavation engineering in mining and construction industries; Physico-mechanical and geotechnical properties of rocks vis-à-vis excavation method; Selection of excavation method; Rock breaking processes – primary, secondary and tertiary.

Advances in drilling equipment; Design and operating parameters of surface and underground drilling; Evaluation of drill performance; Mechanism of bit wear; Bit selection;; Economics of drilling.

Explosives and their selection criteria for rock excavation; Blast design for surface excavations and optimization; Advanced blast initiation systems; Blast performance evaluation; Cast blasting; Techno-economic and safety aspects of surface and underground blasting; Advances in blast design for underground excavations; Contour blasting; Computer aided blast design; Under water drilling and blasting

Theories of rock tool interaction for surface excavation machineries – rippers, dozers, scrapers, BWE, surface miners, auger drills; Theories of rock tool interaction for underground excavation machineries – ploughs, shearers, roadheaders; continuous miners, tunnel boring machines; Selection criteria for cutting tools;; Advanced rock cutting techniques; High pressure water jet assisted cutting.

Recent developments in rock excavation machineries.

PRACTICALS**MMC 17203 MINING MACHINERY LAB-I (0 - 0 - 3)**

1. To study the construction and operation of turbo-charged diesel engine used in open-pit equipment.
2. Dismantling and assembly of Jack Hammer Drill Machines.
3. Determination of Torsional Rigidity of steel Wires.
4. Determination of Fatigue Strength of Steel Wires.
5. Determination of Breaking Strength of Steel Wire Ropes.
6. Study of Longwall Face layout & Related Equipment

7. Estimation of Discharge Rate in Bunkers with different Hopper Angles.

EIGHTH SEMESTER

THEORY

MMC 18104 MAINTENANCE ENGINEERING (3-0-0)

Maintenance – Key to reliability & productivity. Basic elements of maintenance system – inspection, planning & scheduling, job execution, record keeping, data analysis, learning & improvement.

Basic definitions, preventive, operating and shutdown maintenance; Condition based maintenance and condition monitoring. Application of preventive maintenance for system of equipment.

Vibration and signature analysis; causes; remedy in rotating machinery. Fluid analysis for condition monitoring, various methods of fluid analysis.

Non-destructive testing, principle methods such as dye-penetrant, magnetic particle testing and ultrasonic tests.

Lubrication: Introduction to lubrication engineering, types, classification of lubricants with their properties and characteristics. Bearing lubrication technique for minimization of friction and wear.

Science of friction and wear; Different types of wear, such as abrasive, corrosive, seizure, scoring, scuffing, pitting, spalling, adhesive, etc. and techniques for minimization of wear.

Data collection and analysis, Introduction to computer-aided maintenance management system.

References:

1. Industrial Maintenance – H.P.Garg
2. Ind. Maint. Management – S.K.Srivastava

MMC18105 - UNDERGROUND LOADING AND TRANSPORT MACHINES (3-1-0)

Mine winders – classification, description, headgear structure, ropes, rope capels, cage and skip, mechanical and electrical braking, safety devices, duty cycle, capacity and power calculations; Rope haulage: Types, constructional features, operation, application, maintenance, haulage calculations.

Mine locomotives: Types, construction, operation, application, maintenance, locomotive calculations,

Conveyors: Types, Main and extensible belt conveyors, AFC conveyors, stage loaders, power calculations.

Mine Track : Track work, turns, crossings, pit-top and pit-bottom layouts, switch points and tipplers.

Mechanical Loaders : Classification and application of loaders, Construction and operations of Scraper loader, Rocker Shovel, Load haul dumper, Auto loader, LPDT, SDL, Shuttle cars.

Safety aspects of the loading and Transport Equipment.

Reference books:

- 1.Elements of Mining Technology; D. J. Deshmukh; VidyasewaPrakashan
- 2.Mine, Pumps, Haulage & Winding; S. Ghatak; Coalfield Publishers, Asansol
- 3.Conveying machines; Part I & II; A. Spivakovsky, V. Dyachkov; Mir Publishers, Moscow
- 4.Coal mines regulation; 1957; L. C. Kaku; Lovely Prakashan; Dhanbad
- 5.Metalliferous mines regulation; 1961; L. C. Kaku; Lovely Prakashan; Dhanbad
- 6.Coal mining practices; I. C. F. Statham; Caxton Eastern Agencies, Kolkata
- 7.Mine Winder; P. K. Chackraborty; CMPDIL , Ranchi

MME 18103 – AUTOMOBILE ENGINEERING (3 – 1 – 0)

Introduction: Basic structure, general layout and type of automotive vehicles, Frameless and unitary construction; position of power unit.

Power Unit: Power requirements - motion resistance and power loss, tractive effort and vehicle performance curves; selection of power unit and engine performance characteristics; pollution due to vehicle emission and exhaust emission control system.

Chassis and Suspension: Loads on the frame, considerations of strength and stiffness, different types of chassis and their construction; engine mounting on the chassis, Need of Suspension System, Types of Suspension; factors influencing ride comfort, conventional and independent suspension systems; shock absorbers and stabilizers; wheels and tyres.

Transmission system: Basic requirements and standard transmission systems; constructional features of automobile clutch, gear box, differential, front and rear axles; overdrives, propeller shaft, universal joint and torque tube drive; Rear wheel vs front wheel drive, principle of automatic transmission.

Steering System: Requirement and steering geometry; castor action, camber and king pin angle, toe-in of front wheels, steering linkages and steering gears; wheel alignment; power steering.

Braking System: General braking requirements; Mechanical, hydraulic, vacuum power and servo brakes; Weight transfer during braking and stopping distances.

Electric System: Conventional (coil and magneto) and transistorized ignition systems; Charging, capacity ratings and battery testing; starter motor and drive arrangements : voltage and current regulation; lighting and accessory systems.

Safety and comfort systems

Maintenance: Preventive maintenance, trouble shooting and rectification in different systems; engine turning and servicing

References:

1. A Textbook of Automobile Engineering – R. K. Rajput, Laxmi Publ. (P) Ltd.
2. Automotive Mechanics – W. H. Crouse & D. Anglin, Tata McGraw Hill
3. Automobile Engg. (Vol. 1 & 2) – K. M. Gupta, Umesh Publications
4. Automobile Engineering – K M Moeed, S K Kataria & Sons

ELECTIVE (ANY TWO)

MME 18102 -- AUTOMATION AND ROBOTICS (3 — 0 — 0)

Automation: basic concepts, automatic handling of parts using relays, positioned limit switches, Line transfer, Rotary transfer of Geneva mechanism, Electro-hydraulic or pneumatic systems.

Robot definition, robot anatomy; robot classifications and specifications.

Robot kinematics: forward and reverse transformation, homogeneous transformations.

Robot actuators and control: Pneumatic, hydraulic, electrical drives and controls

Robot end-effectors: mechanical, magnetic and vacuum grippers, gripping forces and design features of grippers.

Robot sensors: different types of contact and non-contact sensors; Robot vision and their interfaces;

Robot languages and programming techniques

Applications of Robots: Robots in materials handling, machine loading/unloading, inspection, welding, spray-painting and finish coating, and assembly, etc.

References:

1. Industrial Robotic Technology - Programming and Application by M.P. Groover et. al., McGraw-Hill
2. Robotics for Engineers by Y. Koren, McGraw-Hill.
3. Robotics Technology and Flexible Automation by S.R. Deb, TMH.
4. Robotics: Control, Sensing, Vision and Intelligence, K. S. Fu, R. C. Gonzalez, C. S. G. Lee, McGraw-Hill International Editions, 1987.
5. Introduction to Robotics, J. J. Craig.

MME18106 –Micro-Electro-Mechanical-Systems (MEMS) (3-0-0)

Introduction to MEMS & materials, fabrication processes, MEMS sensors and actuators, scaling issues in MEMS, electro mechanics, modelling and design techniques, packaging and reliability, measurement techniques for MEMS.

References:

1. MEMS: introduction and fundamentals by Mohamed Gad-el-Hak –
2. MEMS mechanical sensors by Stephen Beeby
3. Microsensors, MEMS, and smart devices by Julian W. Gardner, V. K. Varadan, Osama Wadelkarim
4. MEMS and microsystems: design, manufacture, and nanoscale engineering- Tai-Ran Hsu
5. MEMS by N P Mahalik

MME 18111 MINERAL PROCESSING EQUIPMENT(3-0-0)

Construction and operation of crushers- jaw, gyratory, cone, roll, hammer, ring granulator, rotary breaker, screens, grinding mills, jigs, flotation machines, thickeners, filters, centrifuges, separators; Flow sheets of beneficiation plants; Selection of mineral processing equipment;

References:

1. Elements of Mineral Dressing; B A Wills; Pergamon Publishers
2. Handbook of Mineral Dressing; A F Taggart; Wiley; New York
3. Principles of Mineral Dressing; A M Gaudin; McGraw Hill
4. Introduction to Mineral Processing; E G Kelly et al; Wiley; New York
5. Coal Preparation Technology; Vol-I; D G Osborne; Graham & Trotman Ltd
6. Road Making Machinery; K Abrosimov et al; Mir Publishers

MME 18105 Plant Layout and Mechanical Handling (3-0-0)

Mechanical handling equipment for handling unit load and bulk materials – classification, application and selection.

Material handling systems – parameters affecting design and operation.

Design and construction of various components of mechanical handling devices like wire ropes, chains, drums, sheaves, sprockets, hooks, shackles, grabs, ladles, arresting gears, brakes, gears and power transmission, couplings, motive power units – diesel and electric.

Winches, pulley blocks, capstan, lifting electromagnets, grab buckets and conveyors.

Mobile jib cranes – different types, EOT cranes, pillar cranes, lower cranes, gantry cranes, radial cranes.

Hoist, travel and slew mechanisms of mechanical handling equipment. Stability of mobile cranes. Programmable and flexible load handling devices, automation in the handling of materials.

References:

1. Material Handling equipment, N. Rudenko, Peace Publishers.
2. Conveyors and Related Equipment, Spivakowsky and V. Dyachkov, Peace Publishers.
3. Material Handling, R. John Immer, McGraw Hill & Co.
4. Material Handling equipment, D. O. Haynes, Chilton & Co.
5. Handbook of Material Handling, H. Bolz.
6. Introduction to Materials Handling, Sidhartha Ray, New Age International Publishers

MEE - 18101 INNOVATIVE MINING SYSTEMS (3-0-0)

Technological innovations - technology, invention, innovation, research and development, basic types, technology life cycle

System concepts – system concepts for innovation mining, methods for simulating creativity in an organization and current technological needs; Basics of system dynamics; Value engineering and just in time (JIT) possible applications.

Innovation in mine lighting – solar light and fan; Underground illumination

Innovation in mining operations – Innovations in unit operations in surface and underground mining including the developments of mine supports, excavation techniques and ventilation systems, development in hard rock mining

New frontiers of mining – mining in deep sea, outer space and Antarctica, oil mining, extraction of coal bed methane

Remote monitoring of longwall support performance using tele-monitoring device

Automation and Robotics – Development of robotic systems, different types and possible contributions

Micro-seismic monitoring technique – Real time stability monitoring of mine stability and rock mass behavior using micro-seismic techniques

Ground penetration radar (GPR) – Use GPR in mining as potential tool for investigations in mines

Environmental friendly non-blasting techniques – Use of rock breaking compounds, water jet cutting, rock splitters

MEE 18105 – UNDERGROUND SPACE TECHNOLOGY (3-0-0)

Introduction – Natural caves, archeological caves and their construction, tunnels for various purposes like road, rail and hydropower tunnels

Need for underground space – congestion in cities and its impact on development of social infrastructure for transport, water and power supply, separation of pedestrian and motorized vehicles and its movements, storage of materials, defence facilities including civil shelters

Engineering utilities – hydropower tunnels and caverns, underground storage for LPG and crude oil

Geo-engineering investigations – topographic and geological survey, auguring, drilling, soil and rock sampling and testing, preparing sub-surface geological cross section, geo-radar use and data analysis for shallow tunnels, geophysical investigations to probe deeper sub-surface features, physic-mechanical properties and collection of rock mechanical data

Planning and design – assessment of behavior of tunneling media, deformation modulus and rock pressure assessment, determination of appropriate size and shape, design of openings in rocks with the help of field data, instrumentation and monitoring, numerical modeling to assess stability

Support design and stabilization techniques for underground tunnels and caverns – steel supports, rock bolts, shotcrete, wire mesh, chainlink fabric and fibre reinforced shotcrete and other ground consolidation/grouting techniques

Other storage – grain storage and advantages/disadvantages, underground cold storage and cellar for foods and beverages

Nuclear waste disposal – conditions for waste disposal, effort of radioactivity and heat on surrounding rocks, conceptual design of a nuclear waste disposal facility

Modern developments – underground ring roads/bypasses in mega cities, metro, parking lots, shopping centres, submerged and floating tunnels, underground libraries, museums, dwelling units and resorts.

MMC18203

Mining Machinery Lab-II

1. Estimation of Discharge Rate in Electro-magnetic Vibrating feeder for different materials.
2. To find out the angle of friction for different materials.
3. Study of Belt Conveyor, Screw feeder and Mechanical Feeders.
4. Steel wire rope capping.
5. Study of coal drill and wagon drill.
6. Study of different drill bits.

7. Study of computer controlled hydraulic excavator

CAPSULE COURSES (For Non-Departmental Students)

SIXTH SEMESTER

MMR16101 Mining Machinery I (3 1 0)

Classification, application, constructional features of drilling machines used in underground coal and metal mining, coal cutters, shearer, plough, continuous miner, road header and dirt header, loading and transport equipment, man riding systems, free steered vehicles.

Classification and constructional difference of different types of winders, mechanics of winding, power calculation, rope selection, inspection and maintenance. Safety features and automatic contrivances.

Classification, construction and selection steps for mine dewatering pumps.

SEVENTH SEMESTER

MMR17101 Mining Machinery II (3 1 0)

Construction and operation of blast hole drills, rippers, rope shovels, hydraulic shovels, scraper, dragline, dumpers, wheel loaders, dozers, graders. Surface miners, Bucket with Excavator.

High capacity belt conveyors – constructional detail and selection procedures, in-pit crushing and conveying system..

Aerial rope ways – classification, layout and constructional features.

Classification, application and constructional features of crushers, breakers and feeders.