

ANNA UNIVERSITY TIRUCHIRAPPALLI

Tiruchirappalli - 620 024

Regulations 2007

Syllabus

B.E. Mechanical Engineering

SEMESTER III

MA1201 – MATHEMATICS III

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(Common to all branches)

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

UNIT II FOURIER SERIES 9

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identity – Harmonic Analysis.

UNIT III BOUNDARY VALUE PROBLEMS 9

Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

UNIT IV FOURIER TRANSFORM 9

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z –TRANSFORM AND DIFFERENCE EQUATIONS 9

Z-Transform – Elementary properties – Inverse Z-Transform – Convolution theorem – Formation of difference equations – Solution of difference equations using Z-Transform.

L: 45 T: 15 Total: 60

TEXT BOOK

1. Grewal B.S., “Higher Engineering Mathematics”, Fortieth Edition, Khanna Publishers, 2007.

REFERENCES

1. Churchill R.V. and Brown J.W., “Fourier Series and Boundary Value Problems”, Fourth Edition, McGraw-Hill Book Co., 1987.
2. Veerarajan .T, “Engineering Mathematics III”, Third edition, Tata McGraw-Hill Education, 2007.
3. Kandasamy P., Thilagavathy K. and Gunavathy K., “Engineering Mathematics Volume III”, S. Chand & Company ltd., 1996.

ME1201 – MANUFACTURING TECHNOLOGY I

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UNIT I METAL CASTING PROCESSES 9

Sand casting – Sand moulds – Type of patterns – Pattern materials – Pattern allowances – Types of Moulding sand – Properties – Core making – Methods of Sand testing – Melting furnaces – Working principle of Special casting processes – Shell – Investment casting – Ceramic mould – Lost Wax process – Pressure die casting – Centrifugal casting – CO₂ process – Sand Casting defects.

UNIT II FABRICATION PROCESS 9

Principles and applications of Gas metal arc welding – Flux cored arc welding – Gas Tungsten arc welding – Submerged arc welding – Electro gas welding – Arc welding defects – Principle and application of special welding processes – Plasma arc welding – Thermit welding – Electron beam and Laser beam welding – Friction welding – Diffusion bonding – Principles of Resistance welding – Spot/Butt – Seam welding – Percussion welding.

UNIT III BULK DEFORMATION PROCESSES 9

Hot working and cold working of metals – Forging processes – Open and close die forging – Characteristics of the process – Rolling of metals – Flat strip rolling – Types of Rolling mills – Shape rolling operations – Defects in rolled parts – Principles of Extrusion – Types of Extrusion – Hot and Cold extrusion – Principle of rod and wire drawing.

UNIT IV SHEET METAL FORMING PROCESSES 9

Sheet metal characteristics – Typical shearing operations – bending and deep drawing operations – Stretch forming operations – Formability of sheet metal – Test methods – Working principle and application of special forming processes – Hydro forming – Metal spinning – Explosive forming – Magnetic pulse forming – Super plastic forming – Process characteristics and applications.

UNIT V FORMING AND SHAPING OF PLASTICS 9

Types of plastics – Moulding of Thermoplastics – Injection moulding – Blow moulding – Rotational moulding – Film blowing – Typical industrial applications – Processing of Thermosets – Working principles and typical applications of Compression moulding and Transfer moulding – Bonding of Thermoplastics : Fusion and solvent methods – Induction and Ultrasonic methods

Total: 45

TEXT BOOKS

1. Hajra Choudhury, “Elements of Workshop Technology”, Vol. I and II, Media Promotors Pvt. Ltd., 2001
2. Gowri, “Manufacturing Technology – 1”, Pearson Education, 2007.

REFERENCES

1. Serope Kalpajian, Steven R.Schmid, Manufacturing Engineering and Technology, Pearson Education, Inc. 2002 (Second Indian Reprint)
2. B.S. Magendran Parashar & R.K. Mittal, “Elements of Manufacturing Processes”, Prentice Hall of India, 2003.
3. P.N. Rao, “Manufacturing Technology”, Second Edition, Tata McGraw-Hill Publishing Limited, 2002.
4. P.C. Sharma, “A Text Book of Production Technology”, Fourth Edition, S.Chand and Company, 2003.

ME1202 – ENGINEERING THERMODYNAMICS

L T P
3 1 0

(Common to Mechanical / Production)

UNIT I BASIC CONCEPTS AND FIRST LAW 9

Basic concepts – concept of continuum – macroscopic approach – thermodynamic systems: closed, open and isolated – Property – State: path and process – quasi – static process – work – modes of work – Zeroth law of thermodynamics – Concepts of temperature – heat – ideal and real gases – First law of thermodynamics – application to closed and open systems – internal energy – specific heat capacities – enthalpy – steady flow process with reference to various thermal equipment

UNIT II SECOND LAW AND ENTROPY 9

Second law of thermodynamics – Kelvin’s and Clausius statements of second law – Reversibility and irreversibility – Carnot cycle – reversed carnot cycle – efficiency – Co-efficient of Performance – Thermodynamic temperature scale – Clausius inequality – concept of entropy – entropy of ideal gas – principle of increase of entropy – Carnot theorem.

UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE 9

Thermodynamic properties of pure substances in solid, liquid and vapour phases – phase rule – P-V, P-T, T-V, T-S and H-S diagrams – PVT surfaces – thermodynamic properties of steam. Calculations of work done and heat transfer in non-flow and flow processes – Standard Rankine cycle – Reheat and regenerative cycle

UNIT IV IDEAL & REAL GASES AND THERMO DYNAMIC RELATIONS 9

Gas mixtures – Properties of ideal and real gases – equation of state – Avogadro’s law – Vander Waal’s equation of state – compressibility – compressibility chart - Dalton’s law of partial pressure – Exact differentials – TDS relations – Maxwell relations – Clausius Clapeyron equations – Joule Thomson Coefficient.

UNIT V PSYCHROMETRY 9

Psychrometry and psychrometric charts – property calculations of air vapour mixtures – Psychrometric processes – Sensible heat exchange process – Latent heat exchange process – Adiabatic mixing – evaporative cooling – problems

L: 45 T: 15 Total: 60

(Use of standard thermodynamic tables, Mollier chart, Psychometric chart and Refrigerant property tables are permitted)

TEXT BOOKS

1. Nag P.K., “Engineering Thermodynamics”, Tata McGraw-Hill, 1998
2. Joel, “Basic Engineering Thermodynamics”, Fifth Edition, Pearson Education, 2008

REFERENCES

1. Cengel, “Thermodynamics” An Engineering Approach, Third Edition, Tata McGraw-Hill, 2003
2. Holman.J.P., “Thermodynamics”, Third Edition, McGraw-Hill, 1995
3. Venwylen and Sontag, “Classical Thermodynamics”, Wiley Eastern, 1987
4. Arora C.P, “ Thermodynamics”, Tata McGraw-Hill, 2003

CE1207 – FLUID MECHANICS AND MACHINERY

L T P
3 1 0

(Common to Aeronautical / Automobile / Mechanical / Production)

UNIT I BASIC CONCEPTS AND PROPERTIES 7

Fluid – definition – distinction between solid and fluid – Units and dimensions – Properties of fluids – density – specific weight – specific volume – specific gravity – temperature – viscosity – compressibility – vapour pressure – capillary and surface tension – Fluid statics: concept of fluid static pressure – absolute and gauge pressures – pressure measurements by manometers and pressure gauges.

UNIT II FLUID KINEMATICS AND FLUID DYNAMICS 10

Fluid Kinematics – Flow visualization – lines of flow – types of flow – velocity field and acceleration – continuity equation one and three dimensional differential forms – Equation of streamline – stream function – velocity potential function – circulation – flow net – fluid dynamics – equations of motion – Euler's equation along a streamline – Bernoulli's equation – applications – Venturi meter – Orifice meter – Pitot tube – dimensional analysis – Buckingham's π theorem – applications – similarity laws and models.

UNIT III INCOMPRESSIBLE FLUID FLOW 10

Viscous flow – Navier-Stoke's equation (Statement only) – Shear stress – pressure gradient relationship – laminar flow between parallel plates – Laminar flow through circular tubes (Hagen poiseulle's) – Hydraulic and energy gradient – flow through pipes – Darcy – Weisback's equation – pipe roughness –friction factor – Moody's diagram – minor losses – flow through pipes in series and in parallel – power transmission – Boundary layer flows – boundary layer thickness – boundary layer separation – drag and lift coefficients.

UNIT IV HYDRAULIC TURBINES 10

Fluid machines: definition and classification – exchange of energy – Euler's equation for turbo machines – Construction of velocity vector diagrams – head and specific work – components of energy transfer – degree of reaction – Hydro turbines: definition and classifications – Pelton turbine – Francis turbine – Propeller turbine – Kaplan turbine – working principles – velocity triangles – work done – specific speed – efficiencies – performance curve for turbines.

UNIT V HYDRAULIC PUMPS 8

Pumps: definition and classifications – Centrifugal pump: classifications, working principle, velocity triangles, specific speed, efficiency and performance curves – Reciprocating pump: classification – working principle – indicator diagram – work saved by air vessels and performance curves – cavitations in pumps – rotary pumps: working principles of gear and vane pumps

L: 45 T: 15 Total: 60

TEXT BOOKS

1. Streeter V.L., and Wylie E.B., “Fluid Mechanics”, McGraw-Hill, 1983
2. Bansal R.K., “Fluid Mechanics and Hydraulics Machines”, Fifth Edition, Laxmi publications (P) Ltd, 1995

REFERENCES

1. Vasandani, V.P., “Hydraulic Machines - Theory and Design”, Khanna Publishers, 1992
2. White F.M., “Fluid Mechanics”, Fifth Edition, Tata McGraw-Hill, 2003.
3. Ramamirtham S., "Fluid Mechanics and Hydraulics and Fluid Machines", Dhanpat Rai and Sons, 1998.

EE1210 – ELECTRICAL DRIVES AND CONTROLS

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(Common to Mechanical / Production)

UNIT I DC AND AC FUNDAMENTALS 9

Fundamentals of Electrical Engineering – Ohm’s Law – Kirchhoff’s laws – Mesh and Nodal Analysis – Magnetic Circuits – Electromagnetic Induction – Faraday’s Law – Lenz’s law – Self and Mutual Inductances – production of Alternating Voltage – RMS value – Average value – Form factor – Peak factor.

UNIT II DC MOTORS 9

Types of Electric Drives – factors influencing the choice of electrical drives – DC motors – Shunt – series and compound – Mechanical characteristics – Speed – Torque characteristics of various types of load and drive motors – Selection of power rating for drive motors.

UNIT III STARTING OF INDUCTION MOTORS 9

Three phase induction motors – Need for starting – Types of starters – Stator resistance or reactance – Rotor Resistance – Auto transformer and star delta starters – Slip power recovery – Starting of single phase induction motor.

UNIT IV CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C. DRIVES 9

Speed control of DC series and shunt motors – Armature and field control – Ward – Leonard control system – Using controlled rectifiers and DC choppers – applications.

UNIT V CONVENTIONAL AND SOLID STATE SPEED CONTROL OF A.C. DRIVES 9

Speed control of three phase induction motor – Voltage control – voltage / frequency control – slip power recovery scheme – Using inverters and AC voltage regulators – applications.

Total: 45

TEXT BOOKS

- 1 Nagrath I.J. & Kothari D.P, “Electrical Machines”, Tata McGraw-Hill, 1998
- 2 V.K Mehta, Rohit Mehta, “Basic Electrical Engineering”, S.Chand & Company Ltd.

REFERENCES

1. Pillai S.K, “A first course on Electric drives”, Wiley Eastern Limited, 1998
2. M.D Singh, K.B Khanchandani, “Power Electronics”, Tata McGraw-Hill, 1998
3. Vedam Subrahmaniam, “Electric Drives (concepts and applications)”, Tata McGraw-Hill, 2001

ME1203 – ENGINEERING MATERIALS AND METALLURGY

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(Common to Automobile / Mechanical / Production)

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9

Constitution of alloys – Solid solutions – substitutional and interstitial – compounds – Phase diagrams – Isomorphous – eutectic – eutectoid – peritectic and peritectoid reactions – Iron-Iron carbide equilibrium diagram – Classification of steel and cast Iron – Microstructure – properties and applications

UNIT II HEAT TREATMENT METHODS 9

Annealing – Full annealing – stress relief – re-crystallisation and spheroidizing – Normalising – Hardening and Tempering of steel – Isothermal transformation diagrams – TTT Diagram – Hardenability – Jominy end quench test – Case hardening – carburising – nitriding – cyaniding – carbonitriding – Flame and Induction hardening

UNIT III FERROUS AND NON FERROUS METALS 9

Effect of alloying additions on steel (Mn, Si, Cr, Mo, V, Ti & W) – Stainless and Tool steels – HSLA – maraging steels – Cast iron – Gray – White malleable – spheroidal graphite – Copper and Copper alloys – Brass – Bronze and Cupronickel – Aluminum and Al-Cu alloys – precipitation hardening treatment – Bearing alloys – Babbitt and Bi-Metals.

UNIT IV NON-METALLIC MATERIALS 9

Polymers – types of polymer – commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, ABS, PTFE Polymers – Urea and Phenol Formaldehydes – Engineering Ceramics – Properties and applications of Al_2O_3 , SiC, Si_3N_4 , PSZ and Sialon – Fibre and particulate reinforced composites

UNIT V MECHANICAL PROPERTIES AND TESTING 9

Mechanism of plastic deformation – slip and twinning – Types of fracture – Testing of materials under tension – compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell) Impact test Izod and charpy – fatigue and creep test

Total: 45

TEXT BOOKS

1. Kenneth G.Budinski and Michael K.Budinski, “Engineering Materials: Properties and Selection”, Eighth Edition, Pearson Education, 2006
2. Sydney H.Avner “Introduction to Physical Metallurgy”, McGraw Hill Book Company, 1994.

REFERENCES

1. William D Callsber, “Material Science and Engineering”, John Wiley and Sons, 1997.
2. Raghavan.V, “Introduction to Physical Metallurgy and Practice”, Prentice Hall of India, 1999.

ME1204 – MANUFACTURING TECHNOLOGY LABORATORY

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LIST OF EXERCISES

1. Two or More Metal Cutting Experiments
(Example: Shear Angle Measurement – Cutting Force Measurement – Cutting Temperature Measurement – Tool Wear Measurement – Life Measurement etc.)
2. One or More Exercises in Milling Machines
(Example: Milling Polygon Surfaces – Gear milling – Keyway milling – Helical Groove milling etc.)
3. Two or More Exercises in Grinding / Abrasive machining
(Example: Surface Grinding – Cylindrical Grinding – Centreless Grinding – Lapping – Honing etc.)
4. Two or More Exercises in Machining Components for Assembly of different fits.
(Example: Machining using Lathes – Shapers – Drilling – Milling – Grinding Machines etc.)
5. One or More Exercises in Capstan or Turret Lathes
6. One or More Exercises in Gear Machining
(Example: Gear Cutting – Gear Shaping – Gear Hobbing etc.)
7. One or More Exercises in CNC Machines
(Example: CNC Programming – CNC Tooling – CNC Machining etc.)

Total: 45

CE1208 – FLUID MECHANICS AND MACHINERY LABORATORY

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LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump / submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

Total: 45

EE1211 – ELECTRICAL ENGINEERING LABORATORY

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LIST OF EXPERIMENTS

1. Load test on DC Shunt & DC Series motor
2. O.C.C & Load characteristics of DC Shunt and DC Series generator
3. Speed control of DC shunt motor (Armature – Field control)
4. Load test on single phase transformer
5. O.C & S.C Test on a single phase transformer
6. Regulation of an alternator by EMF & MMF methods.
7. V curves and inverted V curves of synchronous Motor
8. Load test on three phase squirrel cage Induction motor
9. Speed control of three phase slip ring Induction Motor
10. Load test on single phase Induction Motor.
11. Study of DC & AC Starters

Total: 45

SEMESTER IV

MA1251 – NUMERICAL METHODS

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UNIT I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 9

Linear interpolation methods (method of false position) – Newton’s method –Solution of linear system by Gaussian elimination and Gauss – Jordan methods – iterative methods: Gauss Jacobi and Gauss-Seidel methods – Inverse of a matrix by Gauss–Jordan method – Eigen value of a matrix by power method

UNIT II INTERPOLATION AND APPROXIMATION 9

Lagrangian Polynomials – Divided differences – Interpolating with a cubic spline – Newton's forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9

Derivatives from difference tables – Divided differences and finite differences – Numerical integration by Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Double integrals using trapezoidal and Simpson's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9

Single step Methods: Taylor Series method – Euler’s method – Modified and Improved Euler’s method – Fourth order Runge-Kutta method for solving first and second order equations – Multi-step methods: Milne’s and Adam’s predictor and corrector methods.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by implicit and explicit methods – one dimensional wave equation and two dimensional Laplace and Poisson equations.

L: 45 T: 15 Total: 60

TEXT BOOK

1. C.F. Gerald and P.O. Wheatley “Applied Numerical Analysis”, Sixth Edition, Pearson Education, 2005.

REFERENCES

1. M.K. Jain, S.R.K. Iyengar and R.K. Jain, “Numerical Methods for Scientific and Engineering Computation” Fourth Edition, New Age International Publishers, 2003.
2. M.K. Venkatraman, ‘Numerical Methods’, National Publication Company, 1991.
3. P. Kandasamy, K. Thilakavthy and K. Gunavathy, “Numerical Methods”, Second Edition, S.Chand & Co., 2003.

UNIT I GAS POWER CYCLES 9

Otto cycles – Diesel cycles – Dual cycles – Brayton cycles – calculation of mean effective pressure and air standard efficiency – actual and theoretical PV diagram of four stroke engines – actual and theoretical PV diagram of two stroke engines.

UNIT II INTERNAL COMBUSTION ENGINES 9

Classification of IC engine – IC engine components and functions – Comparison of two stroke and four stroke engines – Valve and port timing diagram – Fuel supply systems – Ignition Systems – Performance calculation – Comparison of petrol and diesel engine – Fuels – Air-fuel ratio calculation – Knocking and Detonation – Lubrication system and cooling system – Exhaust gas analysis – pollution control norms

UNIT III STEAM NOZZLES AND TURBINES 9

Flow of steam through nozzles – shapes of nozzles – effect of friction – critical pressure ratio – supersaturated flow – Impulse and reaction principles – compounding – velocity diagrams for simple and multistage turbines – speed regulations – governors and nozzle governors

UNIT IV AIR COMPRESSOR 9

Classification and working principle – work of compression with and without clearance – Volumetric efficiency – Isothermal efficiency and isentropic efficiency of reciprocating air compressors – Multistage air compressor and inter cooling – work of multistage air compressor – working principle of various types of rotary compressors

UNIT V REFRIGERATION AND AIR-CONDITIONING 9

Vapour compression Refrigeration cycle – super heat – sub cooling – performance calculations – Working principle of vapour absorption system: Ammonia – water and Lithium bromide – water systems – Comparison between vapour compression and absorption systems – Cooling load calculations – Concept of RSHF, GSHF and ESHF Air conditioning systems.

L: 45 T: 15 Total: 60

(Use of standard thermodynamic tables – Mollier chart – Psychometric chart and Refrigerant property tables are permitted in the examination)

TEXT BOOK

1. Rudramoorthy R, “Thermal Engineering”, Tata McGraw-Hill, 2003.

REFERENCES

1. Kothandaraman.C.P., Domkundwar. S and A.V.Domkundwar., “A course in Thermal Engineering”, Fifth Edition, Dhanpat Rai & Sons, 2002
2. Rajput, “Thermal Engineering”, S. Chand publishers, 2000.
3. Holman. J.P., “Thermodynamics”, McGraw-Hill, 1985
4. Rogers- Meyhew, “Engineering Thermodynamics”, ELBS, 1992

CE1258 – STRENGTH OF MATERIALS

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(Common to Automobile / Mechanical / Production)

UNIT I STRESS – STRAIN AND DEFORMATION OF SOLIDS 9

Rigid and Deformable bodies – Strength – Stiffness and Stability – Stresses: Tensile – Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

UNIT II BEAMS – LOADS AND STRESSES 9

Types of beams – Supports and Loads – Shear force and Bending Moment in beams: Cantilever, Simply supported and Overhanging beams – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Effect of shape of beam section on stress induced – Shear stresses in beams – Shear flow.

UNIT III TORSION 9

Analysis of torsion of circular bars – Shear stress distribution – Bars of Solid and hollow circular section – Stepped shaft – Twist and torsion stiffness – Compound shafts – Fixed and simply supported shafts – Application to close – coiled helical springs – Maximum shear stress in spring section including Wahl Factor – Deflection of helical coil springs under axial loads – Design of helical coil springs – stresses in helical coil springs under torsion loads

UNIT IV BEAM DEFLECTION 9

Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope: Double integration method – Macaulay Method – Moment-Area Method – Columns – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio – Rankine formula for columns

UNIT V ANALYSIS OF STRESSES IN TWO DIMENSIONS 9

Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr's circle for biaxial stresses – Maximum shear stress – Strain energy in bending and torsion.

L: 45 T: 15 Total: 60

TEXT BOOKS

1. Popov E.P, "Engineering Mechanics of Solids", Second Edition, Pearson Education, 2007.
2. Beer F. P. and Johnston R, "Mechanics of Materials", Third Edition, McGraw-Hill Book Co., 2002.

REFERENCES

1. Nash W.A, "Theory and problems in Strength of Materials", Schaum Outline Series, McGraw-Hill Book Co, 1995
2. Kazimi S.M.A, "Solid Mechanics", TataMcGraw-Hill Publishing Co, 1981
3. Ryder G.H, "Strength of Materials", Third Edition, Macmillan India Ltd., 2002

ME1252 – KINEMATICS OF MACHINERY

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UNIT I BASICS OF MECHANISMS

Degree of Freedom – Mobilit-Kutzbach criterion – Grashoff's law – Kinematic Inversions of 4-bar chain and slider crank chains – Mechanical Advantage – Transmission angle – Description of common Mechanisms – Single, Double and offset slider mechanisms – Quick return mechanisms – Ratchets and escapements – Indexing Mechanisms – Rocking Mechanisms – Straight line generators – Design of Crank-rocker Mechanisms.

UNIT II KINEMATICS 12

Displacement, velocity and acceleration – analysis in simple mechanisms – Graphical Method velocity and acceleration polygons – Kinematic analysis by Complex Algebra methods – Vector Approach – Computer applications in the kinematic analysis of simple mechanisms – Coincident points – Coriolis Acceleration.

UNIT III KINEMATICS OF CAM 8

Classifications – Displacement diagrams – parabolic, Simple harmonic and Cycloidal motions – Layout of plate cam profiles – Derivatives of Follower motion – High speed cams – circular arc and tangent cams – Standard cam motion – Pressure angle and undercutting.

UNIT IV GEARS 10

Spur gear Terminology and definitions – Fundamental Law of toothed gearing and involute gearing – Inter changeable gears – gear tooth action – Terminology – Interference and undercutting – Non standard gear teeth – Basics of Helical, Bevel, Worm, Rack and Pinion gears – Gear trains – Parallel axis – Epicyclic – Differentials

UNIT V FRICTION 8

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Friction clutches – Belt and rope drives – Friction aspects in Brakes – Friction in vehicle propulsion and braking

L: 45 T: 15 Total: 60

TEXT BOOKS

1. Sadhu Singh, "Theory of Machines", Second Edition, Pearson Education, 2006.
2. Rattan S.S, "Theory of Machines", Tata McGraw-Hill Publishing Company Ltd., 1998.

REFERENCES

1. Shigley J.E and Vicker J.J, "Theory of Machines and Mechanisms", McGraw-Hill, 1995
2. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984.
3. Ghosh A and A.K Mallick, "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., 1988.
4. Rao J.S and Dukkipati R.V, "Mechanism and Machine Theory", Wiley-Eastern Ltd., 1992.

STANDARDS

1. IS 2458: 2001- Vocabulary of Gear Terms – Definitions Related to Geometry
2. IS 3756: 2002- Method of Gear correction – Addendum modifications for External Cylindrical Gears with Parallel Axes.
3. IS 5267: 2002 Vocabulary of Gear Terms – Definitions Related to Worm Gear Geometry.
4. IS 12328: Part 1: 1988 Bevel Gear Systems Part – 1 Straight Bevel Gears.
5. IS 12328: Part 2: 1988 Bevel Gear Systems Part – 2 Spiral Bevel Gears.

ME1253 – MANUFACTURING TECHNOLOGY II

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UNIT I THEORY OF METAL CUTTING 8

Orthogonal and oblique cutting – Mechanism of chip formation – cutting tool materials – tool wear – tool life – surface finish – cutting fluids – Machinability index.

UNIT II CENTRE LATHE AND SPECIAL PURPOSE LATHES 10

Centre lathe – constructional features – cutting tools – various operations – taper turning methods – thread cutting methods – special attachments – machining time and power estimation – Capstan and turret lathes – automatic lathes – semi automatic – automats – single spindle : cutting off and swiss type – automatic screw type – multi spindle: cutting off and bar type

UNIT III SHAPING – MILLING AND DRILLING PROCESSES 10

Reciprocating machine tools – shaper – planer – slotter – Milling – types – milling cutters – Operations: Hole making – drilling – reaming – boring – tapping.

UNIT IV ABRASIVE CUTTING – BROACHING AND GEAR MANUFACTURING 10

Abrasive processes: grinding wheel – specifications and selection – types of grinding process – cylindrical grinding – surface grinding – centreless grinding – honing – lapping – super finishing – polishing and buffing – abrasive jet grinding – Broaching operations – push – pull – surface and continuous broaching – Gear Manufacturing – Cutting – forming – shaping and hobbing

UNIT V CNC MACHINE TOOLS AND PART PROGRAMMING 7

Numerical control machine tools – CNC: Turning Centre – Machining Centre – constructional details – special features – Part programming fundamentals – manual programming – computer assisted part programming – APT language.

Total: 45

TEXT BOOKS

1. Rao P.N., “Manufacturing Technology”, Metal Cutting and Machine Tools, Tata McGraw-Hill, 2003
2. Richard R. Kibbe, John E. Neely, Roland O. Merges and Warren J. White, “Machine Tool Practices”, Eighth Edition, Pearson Education, 2007.

REFERENCES

1. HMT, “Production Technology”, Tata McGraw-Hill, 1998.
2. P.C. Sharma, “A Text Book of Production Engineering”, Fourth Edition, S.Chand and Co.Ltd, 1993
3. Hajra Choudry, “Elements of Work Shop Technology”, Vol. II, Media Promoters, 2002

EC1260 – ELECTRONICS AND MICROPROCESSORS

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(Common to Automobile / Mechanical / Production)

UNIT I SEMICONDUCTORS AND RECTIFIERS 9

Classification of solids based on energy band theory – Intrinsic semiconductors – Extrinsic semiconductors – P type and N type – PN junction – Zenor effect – Zenor diode characteristics – Half wave and full wave rectifiers – Voltage regulation.

UNIT II TRANSISTORS AND AMPLIFIERS 12

Bipolar junction transistor – CB – CE – CC configuration and characteristics – Biasing circuits – Class A – B and C amplifiers – Field effect transistor – Configuration and characteristic of FET amplifier – SCR – Diac – Triac – UJT – Characteristics and simple applications – Switching transistors – Concept of feedback – Negative feedback – Application in temperature and motor speed control.

UNIT III DIGITAL ELECTRONICS 9

Binary number system – AND, OR, NOT, NAND and NOR circuits – Boolean algebra – Exclusive OR gate – Flip flops – Half and full adders – Registers – Counters – A/D and D/A conversion.

UNIT IV 8085 MICROPROCESSOR 9

Block diagram of microcomputer – Architecture of 8085 – Pin configuration – Instruction set – Addressing modes – Simple programs using arithmetic and logical operations.

UNIT V INTERFACING AND APPLICATIONS OF MICROPROCESSOR 6

Basic interfacing concepts – Interfacing of Input / Output devices – Applications of microprocessor Temperature control – Stepper motor control – traffic light control.

Total: 45

TEXT BOOKS

1. Milman and Halkias, “Integrated Electronics”, Tata McGraw-Hill publishers, 1995.
2. Ramesh Goankar, “Microprocessor Architecture”, Programming and Applications with 8085, Wiley Eastern, 1998.

REFERENCES

1. Malvino and Leach, “Digital Principles and Applications”, Tata McGraw-Hill, 1996
2. Mehta V.K, “Principles of Electronics”, S. Chand and Company Ltd, 1994
3. Douglas V.Hall, “Microprocessor and Interfacing”, Programming and Hardware, Tata McGraw-Hill, 1999.

ME1254 – THERMAL ENGINEERING LABORATORY

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LIST OF EXPERIMENTS

I.C ENGINE LABORATORY AND FUELS LABORATORY

1. Valve Timing and Port Timing Diagrams.
2. Performance Test on computerized IC engine test rig.
3. Heat Balance Test on 4 –stroke Diesel Engine.
4. Morse Test on Multi-cylinder Petrol Engine.
5. Retardation Test to find Frictional Power of a Diesel Engine.
6. Determination of Viscosity – Red Wood Viscometer.
7. Determination of Flash Point and Fire Point.

Total: 30

STEAM LABORATORY

1. Study of Steam Generators and Turbines.
2. Performance and Energy Balance Test on a Steam Generator.
3. Performance and Energy Balance Test on Steam Turbine.

Total: 15

LIST OF EXPERIMENTS

1. Tension test on a mild steel rod.
2. Double shear test on Mild steel and Aluminium rods.
3. Torsion test on mild steel rod.
4. Impact test on metal specimen.
5. Hardness test on metals – Brinnell and Rockwell Hardness Number.
6. Deflection test on beams.
7. Compression test on helical springs.
8. Strain Measurement using Rosette strain gauge.
9. Effect of hardening – Improvement in hardness and impact resistance of steels.
10. Tempering – Improvement Mechanical properties Comparison
 - (i) Unhardened specimen
 - (ii) Quenched Specimen and
 - (iii) Quenched and tempered specimen.
11. Microscopic Examination of Hardened samples and
 - (ii) Hardened and tempered samples.

Total: 45

LIST OF EXPERIMENTS

ELECTRONICS LABORATORY

1. VI Characteristics of PN Junction Diode
2. VI Characteristics of Zener Diode
3. Characteristics of CE Transistor
4. Characteristics of JFET
5. Characteristics of Uni Junction Transistor
6. RC or Wein Bridge Oscillator
7. Study of Logic Gates (Basic Gates)
8. Half Adder and Full Adder
9. Shift Registers and Counters
10. Operational Amplifier (Adder – Subtractor – Differentiator – Integrator – Inverting and Non – Inverting)

Total: 30

MICROPROCESSORS LABORATORY

1. Block Transfer
2. 8 bit Addition – Subtraction
3. Multiplication and Division
4. Maximum and Minimum of block of data
5. Sorting
6. Stepper Motor Interfacing

Total: 15

SEMESTER V

HS1201 – ENVIRONMENTAL SCIENCE AND ENGINEERING

L T P
3 0 0

UNIT I IMPORTANCE OF ENVIRONMENTAL STUDIES 9

Definition – Scope and Importance – Need for Public Awareness – Forest Resources – Water Resources – Mineral Resources – Land Resources – Energy Resources – Food Resources – Equitable use of Resources for Sustainable Lifestyles.

UNIT II ECOSYSTEMS AND BIO DIVERSITY 9

Concept of Ecosystem – Structure and Function of an Ecosystem – Energy Flow in the Ecosystem – Food Chains – Food Webs – Ecological Pyramids – Definition of Bio-Diversity – Bio Geographical Classification in India – Value of Bio Diversity – Bio Diversity at Global – National and Local Levels – India as a Mega Diversity Nation – Hot Spots of Bio Diversity – Threats to Bio Diversity – Conservation of Bio Diversity.

UNIT III ENVIRONMENTAL POLLUTION 9

Definition – Causes and Effects of Environmental Pollution – Air Pollution – Water Pollution – Soil Pollution – Marine Pollution – Noise Pollution – Thermal Pollution – Nuclear Hazards – Solid Waste Management – Societal Role in Pollution Prevention – Environmental Disasters and Management.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 9

Unsustainable to Sustainable Development – Concept of Conservation – Water and Energy Conservation – Rain Water Harvesting – Climate Change – Global Warming – Acid Rain – Ozone Layer Depletion – Nuclear Accidents and Holocaust – Environmental Protection Act – Issues Involved in Enforcement of Environmental Legislation – Public Awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 9

Population Growth – Population Explosion – Family Welfare Programme – Environment and Human Health – Human Rights – Value Education – HIV / AIDS – Women and Child Welfare – Role of IT in Environment and Human Health

Total: 45

TEXT BOOKS

1. Gilbert M. Masters, “Introduction to Environmental Engineering and Science”, Second Edition, Pearson Education, 2004.
2. Miller T.G. Jr., “Environmental Science Working With the Earth”, Thomson Learning, 2001.
3. Trivedi R.K and P.K. Goel, “Introduction to Air Pollution”, Techno - Science Publications, 1998.

REFERENCES

1. Bharucha Erach, “The Biodiversity of India”, Mapin Publishing, 2006.
2. Trivedi R.K., “Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards”, Vol. I and II, Environ Media, 1998.
3. Cunningham W.P. Copper and T.H. Gorhani, “Environmental Encyclopedia”, Jaico Publication, 2001.

ME1301 – DYNAMICS OF MACHINERY

L T P
3 1 0

UNIT I FORCE ANALYSIS 10

Rigid Body dynamics in general plane motion – Equations of motion - Dynamic force analysis - Inertia force and Inertia torque – D’Alemberts principle - The principle of superposition - Dynamic Analysis in Reciprocating Engines – Gas Forces - Equivalent masses - Bearing loads - Crank shaft Torque - Turning moment diagrams - Fly wheels –Engine shaking Forces - Cam dynamics - Unbalance, Spring, Surge and Windup.

UNIT II BALANCING 9

Static and dynamic balancing - Balancing of rotating masses - Balancing a single cylinder Engine - Balancing Multi-cylinder Engines - Partial balancing in locomotive Engines - Balancing linkages - balancing machines

UNIT III FREE VIBRATION 10

Basic features of vibratory systems - idealized models - Basic elements and lumping of parameters - Degrees of freedom - Single degree of freedom - Free vibration - Equations of motion - natural frequency - Types of Damping - Damped vibration critical speeds of simple shaft - Torsional systems; Natural frequency of two and three rotor systems.

UNIT IV FORCED VIBRATION 6

Response to periodic forcing - Harmonic Forcing - Forcing caused by unbalance - Support motion – Force transmissibility and amplitude transmissibility - Vibration isolation.

UNIT V MECHANISMS FOR CONTROL 10

Governors - Types - Centrifugal governors - Gravity controlled and spring controlled centrifugal governors –Characteristics - Effect of friction - Controlling Force - other Governor mechanisms. Gyroscopes - Gyroscopic forces and Torques - Gyroscopic stabilization - Gyroscopic effects in Automobiles, ships and airplanes

L: 45 T: 15 Total: 60

TEXT BOOK

1. Rattan S.S., "Theory of Machines", Tata McGraw-Hill Publishing Company Ltd., 1994.

REFERENCES

1. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984.
2. Ghosh A. and Mallick A.K., "Theory of Mechanisms and Machines", Affiliated East-West Press Pvt. Ltd., 1988.
3. Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms", 3rd edition Oxford University Press 2006.
4. Rao J.S. and Dukkipati R.V., "Mechanism and Machine Theory ", Wiley-Eastern Limited, 1992.
5. John Hannah and Stephens R.C., "Mechanics of Machines", Viva low-Priced Student Edition, 1999.
6. Sadhu Singh “Theory of Machines”, Pearson Education, 2002.

ME1302 – DESIGN OF MACHINE ELEMENTS

L T P

3 1 0

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 9

Introduction to the design process - factor influencing machine design, selection of materials based on mechanical properties – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – Design of curved beams – crane hook and ‘C’ frame - Factor of safety - theories of failure – stress concentration – design for variable loading – Soderberg, Goodman and Gerber relations

UNIT II DESIGN OF SHAFTS AND COUPLINGS 9

Design of solid and hollow shafts based on strength, rigidity and critical speed – Design of keys and key ways - Design of rigid and flexible couplings – Introduction to gear and shock absorbing couplings - design of knuckle joints.

UNIT III DESIGN OF FASTNERS AND WELDED JOINTS 9

Threaded fastners - Design of bolted joints including eccentric loading – Design of welded joints for pressure vessels and structures - theory of bonded joints.

UNIT IV DESIGN OF SPRINGS AND LEVERS 9

Design of helical, leaf, disc and torsional springs under constant loads and varying loads – Concentric torsion springs - Belleville springs – Design of Levers.

UNIT V DESIGN OF BEARINGS AND FLYWHEELS 9

Design of bearings – sliding contact and rolling contact types. – Cubic mean load – Design of journal bearings – Mckees equation – Lubrication in journal bearings – calculation of bearing dimensions – Design of flywheels involving stresses in rim and arm.

L: 45 T: 15 Total: 60

Note: (Use of P S G Design Data Book is permitted in the University examination)

TEXT BOOKS

1. Juvinall R.C, and Marshek K.M, “Fundamentals of Machine Component Design”, Third Edition, John Wiley & Sons, 2002.
2. Bhandari V.B, “Design of Machine Elements”, Tata McGraw-Hill Book Co, 2003.

REFERENCES

1. Norton R.L, “Design of Machinery”, Tata McGraw-Hill Book Co, 2004.
2. Orthwein W, “Machine Component Design”, Jaico Publishing Co, 2003.
3. Ugural A.C, “Mechanical Design – An Integral Approach, McGraw-Hill Book Co, 2004.
4. Spotts M.F., Shoup T.E “Design of Machine Elements”, Pearson Education, 2004.

STANDARDS

- IS 10260: Part 1: 1982 Terms, definitions and classification of Plain bearings Part 1 : Construction.
- IS 10260: Part 1: 1982 Terms, definitions and classification of Plain bearings Part 2 : Friction and Wear.
- IS 10260: Part 1: 1982 Terms, definitions and classification of Plain bearings Part 3 : Lubrication.

UNIT I COMPRESSIBLE FLOW – FUNDAMENTALS 8

Energy and momentum equations for compressible fluid flows, various regions of flows, reference velocities, stagnation state, velocity of sound, critical states, Mach number, critical Mach number, types of waves, Mach cone, Mach angle, effect of Mach number on compressibility

UNIT II FLOW THROUGH VARIABLE AREA DUCTS 9

Isentropic flow through variable area ducts, T-S and H-S diagrams for nozzle and diffuser flows, area ratio as a function of Mach number, mass flow rate through nozzles and diffusers, effect of friction in flow through nozzles.

UNIT III FLOW THROUGH CONSTANT AREA DUCTS 10

Flow in constant area ducts with friction (Fanno flow) – Fanno curves and Fanno flow equation, variation of flow properties, variation of Mach number with duct length – Isothermal flow with friction in constant area ducts – Flow in constant area ducts with heat transfer (Rayleigh flow), Rayleigh line and Rayleigh flow equation, variation of flow properties, maximum heat transfer.

UNIT IV NORMAL SHOCK 8

Governing equations, variation of flow parameters like static pressure, static temperature, density, stagnation pressure and entropy across the normal shock, Prandtl - Meyer equation, impossibility of shock in subsonic flows, flow in convergent and divergent nozzle with shock, normal shock in Fanno and Rayleigh flows, flow with oblique shock (elementary treatment only).

UNIT V PROPULSION 10

Aircraft propulsion – types of jet engines – energy flow through jet engines, study of turbojet engine components – diffuser, compressor, combustion chamber, turbine and exhaust systems, performance of turbo jet engines – thrust, thrust power, propulsive and overall efficiencies, thrust augmentation in turbo jet engine, ram jet and pulse jet engines.

Rocket propulsion – rocket engines thrust equation – effective jet velocity specific impulse – rocket engine performance, solid and liquid propellants, comparison of different propulsion systems.

L: 45 T: 15 Total: 6

Note: (Use of approved gas tables is permitted in the University examination)s

TEXT BOOKS

1. Yahya. S.M., “Fundamental of Compressible Flow”, New Age International (P) Ltd., 1996.
2. Patrich.H. Oosthvizen, William E.Carscallen, “Compressible Fluid Flow”, McGraw-Hill, 1997

REFERENCES

1. Cohen. H., Rogers R.E.C and Sravanamutoo, “Gas Turbine Theory”, Addison Wesley Ltd., 1987.
2. Ganesan. V., “Gas Turbines”, Tata McGraw-Hill, 1999
3. Rathakrishnan.E, “Gas Dynamics”, Prentice Hall of India, 2001

ME1304 – ENGINEERING METROLOGY AND MEASUREMENTS
(Common to Mechanical and Automobile)

L T P
3 0 0

UNIT I CONCEPT OF MEASUREMENT

9

General concept – Generalised measurement system-Units and standards-measuring instruments- sensitivity, readability, range of accuracy, precision-static and dynamic response-repeatability-systematic and random errors-correction, calibration, interchangeability, limit gauges.

UNIT II LINEAR AND ANGULAR MEASUREMENT

9

Definition of metrology-Linear measuring instruments: Vernier, micrometer, interval measurement, Slip gauges and classification, interferometry, optical flats.

Comparators: Mechanical, pneumatic and electrical types, applications.

Angular measurements: -Sine bar, optical bevel protractor, angle Decker – Taper measurements.

UNIT III FORM MEASUREMENT

9

Measurement of screw threads-Thread gauges, floating carriage micrometer-measurement of gears-tooth thickness-constant chord and base tangent method-Gleason gear testing machine – radius measurements-surface finish, straightness, flatness and roundness measurements.

UNIT IV LASER AND ADVANCES IN METROLOGY

9

Precision instruments based on laser-Principles- laser interferometer-application in linear, angular measurements and machine tool metrology – Tool makers microscope – Optical profile projector.

Coordinate measuring machine (CMM) – Constructional features – types, applications – digital devices- computer aided inspection – vision system.

UNIT V MEASUREMENT OF POWER, FLOW AND TEMPERATURE RELATED PROPERTIES

9

Force, torque, power:-mechanical, pneumatic, hydraulic and electrical type-Flow measurement: Venturi, orifice, rotameter, pitot tube –Temperature: bimetallic strip, pressure thermometers, thermocouples, electrical resistance thermister – pyrometer.

Total: 45

TEXT BOOKS

1. Jain R.K., “Engineering Metrology”, Khanna Publishers, 1994.
2. Alan S. Morris, “The Essence of Measurement”, Prentice Hall of India, 1997

REFERENCES

1. Gupta S.C, “Engineering Metrology”, Dhanpat Rai Publications, 1984.
2. Jayal A.K, “Instrumentation and Mechanical Measurements”, Galgotia Publications 2000.
3. Beckwith T.G, and N. Lewis Buck, “Mechanical Measurements”, Addison Wesley, 1991.
4. Donald D Eckman, “Industrial Instrumentation”, Wiley Eastern, 1985.

UNIT I FLUID POWER SYSTEMS AND FUNDAMENTALS 9

Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids – General types of fluids – Fluid power symbols – Basics of Hydraulics-Applications of Pascals Law- Laminar and Turbulent flow – Reynold’s number – Darcy’s equation – Losses in pipe, valves and fittings.

UNIT II HYDRAULIC SYSTEM AND COMPONENTS 9

Sources of Hydraulic Power: Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps – pump performance – Variable displacement pumps – Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like tanden, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder, Rotary actuators – Fluid motors, Gear, Vane and Piston motors.

UNIT III DESIGN OF HYDRAULIC CIRCUITS 9

Construction of Control Components : Direction control valve – 3/2 way valve – 4/2 way valve – Shuttle valve – check valve – pressure control valve – pressure reducing valve, sequence valve, Flow control valve – Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram – Accumulators and Intensifiers : Types of accumulators – Accumulators circuits, sizing of accumulators, intensifier – Applications of Intensifier – Intensifier circuit.

UNIT IV PNEUMATIC SYSTEMS AND COMPONENTS 9

Pneumatic Components: Properties of air – Compressors – Filter, Regulator, Lubricator Unit – Air control valves, Quick exhaust valves, pneumatic actuators – Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Penumo hydraulic circuit, Sequential circuit design for simple applications using cascade method.

UNIT V DESIGN OF PNEUMATIC CIRCUITS 9

Servo systems – Hydro Mechanical servo systems, Electro-hydraulic servo systems and proportional valves – Fluidics – Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting.

Total: 45**TEXT BOOKS**

1. Anthony Esposito, “Fluid Power with Applications”, Pearson Education, 2000.
2. Majumdar S.R., “Oil Hydraulics”, Tata McGraw-Hill, 2000.

REFERENCES

1. Majumdar S.R., “Pneumatic Systems – Principles and Maintenance”, Tata McGraw Hill, 1995
2. Anthony Lal, “Oil hydraulics in the service of industry”, Allied publishers, 1982.
3. Michael J, Prinches and Ashby J. G, “Power Hydraulics”, Prentice Hall, 1989.
4. Dudelyt, A. Pease and John T. Pippenger, “Basic Fluid Power”, Prentice Hall, 1987.

LIST OF EXPERIMENTS

1. Governors - Determination of sensitivity, effort, etc. for Watt, Porter, Proell, Hartnell governors
2. Cam - Study of jump phenomenon and drawing profile of the cam.
3. Motorised Gyroscope-Verification of laws -Determination of gyroscopic couple.
4. Whirling of shaft-Determination of critical speed of shaft with concentrated loads.
5. Balancing of reciprocating masses.
6. Balancing of rotating masses.
7. Determination of moment of inertia by oscillation method for connecting rod and flywheel.
8. Vibrating system - Spring mass system-Determination of damping co-efficient of single degree of freedom system.
9. Determination of influence co-efficients for multidegree freedom suspension system.
10. Determination of transmissibility ratio - vibrating table.
11. Determination of torsional frequencies for compound pendulum and flywheel system with lumped Moment of inertia.
12. Transverse vibration –free- Beam. Determination of natural frequency and deflection of beam.

Total: 45

LIST OF EQUIPMENTS

(for a batch of 30 students)

1. Cam analyzer.
2. Motorised gyroscope.
3. Governor apparatus - Watt, Porter, Proell and Hartnell governors.
4. Whirling of shaft apparatus.
5. Dynamic balancing machine.
6. Static and dynamic balancing machine.
7. Vibrating table
8. Vibration test facilities apparatus

LIST OF EXPERIMENTS

1. Calibration of Vernier / Micrometer / Dial Gauge
2. Checking Dimensions of part using slip gauges
3. Measurements of Gear Tooth Dimensions
4. Measurement of Taper Angle using sine bar / tool makers microscope
5. Measurement of straightness and flatness
6. Measurement of thread parameters
7. Checking the limits of dimensional tolerances using comparators (Mechanical / Pneumatic / Electrical)
8. Measurement of Temperature using Thermocouple / Pyrometer
9. Measurement of Displacement (Strain Gauge / LVDT / Wheatstone Bridge)
10. Measurement of Force
11. Measurement of Torque
12. Measurement of Vibration / Shock

Total: 45

LIST OF EQUIPMENTS

(for a batch of 30 students)

1.	Micrometer / Dial micrometer	-	5
2.	Vernier Caliper / Dial vernier caliper	-	5
3.	Vernier Height Gauge	-	2
4.	Vernier Depth Gauge	-	2
5.	Slip Gauge Set	-	1
6.	Gear Tooth Vernier	-	1
7.	Sine Bar	-	2
8.	Bevel Protractor	-	1
9.	Floating Carriage Micrometer	-	1
10.	Profile Projector	-	1
11.	Mechanical / Electrical / Pneumatic Comparator	-	1
12.	Temperature Measuring Setup	-	1
13.	Displacement Measuring Setup	-	1
14.	Force Measuring Setup	-	1
15.	Torque Measuring Setup	-	1
16.	Vibration / Shock Measuring Setup	-	1

Optional Equipments

17.	Autocollimator	-	1
18.	Coordinate Measuring Machine	-	1
19.	Tool Makers Microscope	-	1
20.	Dial Gauge Calibration	-	1

ME1258 – COMPUTER AIDED MACHINE DRAWING PRACTICE

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UNIT I DRAWING STANDARDS 6

Code of practice for Engineering Drawing, BIS specifications – Welding symbols, riveted joints, keys, fasteners – Reference to hand book for the selection of standard components like bolts, nuts, screws, keys etc.

UNIT II INTRODUCTION TO DRAFTING SOFTWARE 6

Drawing, Editing, Dimensioning, Plotting Commands, Layering concepts, Limits, Fits and Tolerances.

UNIT III PREPARATION OF 2-D DRAWINGS 9

Orthographic views of standard machine components: Brackets, V Blocks, Stop Block, Screw threads and Threaded fasteners.

UNIT IV ASSEMBLY DRAWING (Preparation of assembled view) 24

Flange coupling – Plummer block bearing – Lathe Tailstock – Universal Joint – Machine vice – Stuffing box – Piston and connecting rod

Total: 45

REFERENCES

1. Bhatt.N.D. and Panchal.V.M., “Machine Drawing”, Thirty Eighth Edition, Charotar Publishing House, 2003.
2. P.S.G. Design Data Book.
3. Ellen Finkelstein, “AutoCAD 2004 Bible”, Wiley Publishing Inc, 2003.
4. Sham Tikoo, “ AutoCAD 2002 with Applications”, Tata McGraw-Hill Publishing Company, 2002.

LIST OF EQUIPMENTS AND SOFTWARE REQUIRED

(for a batch of 30 students)

- | | |
|-----------------------------|-----------|
| 1. Computer System | 30 |
| VGA Color Monitor | |
| Pentium IV Processor | |
| 40 GB HDD | |
| 1 GB RAM | |
| 2. Laser Printer | 01 |
| 3. Plotter (A2 size) | 01 |

Software

AutoCAD or Mechanical Desktop or Pro / E or CATIA or IDEAS **30 Licenses** or Solidworks

SEMESTER VI

MG1351 – PRINCIPLES OF MANAGEMENT

(Common to all Branches)

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3 0 0

UNIT I HISTORICAL DEVELOPMENT 9

Definition of management – Science or Art – Management and administration – Development of management thought – Contribution of Taylor and Fayol – Functions of management – Types of business organisation.

UNIT II PLANNING 9

Nature and purpose – Steps involved in planning – Objectives – Setting objectives – Process of managing by objectives – Strategies, policies and planning premises – Forecasting – Decision-making.

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – Organization chart – Structure and process – Departmentation by difference strategies – Line and staff authority – Benefits and limitations – De-centralization and delegation of authority – Staffing – Selection process – Techniques – HRD – Managerial effectiveness.

UNIT IV DIRECTING 9

Scope – Human factors – Creativity and innovation – Harmonizing objectives – Leadership – Types of leadership motivation – Hierarchy of needs – Motivation theories – Motivational techniques – Job enrichment – Communication – Process of communication – Barriers and breakdown – Effective communication – Electronic media in communication.

UNIT V CONTROLLING 9

System and process of controlling – Requirements for effective control – The Budget as control technique – Information technology in controlling – Use of computers in handling the information – Productivity – Problems and management – Control of overall performance – Direct and preventive control – Reporting – The Global environment – Globalization and liberalization – International management and global theory of management.

Total: 45

TEXT BOOKS

1. Kooritz, H. and Weihrich, H., “Essentials of Management”, Tata McGraw-Hill, 1998.
2. Massie, J.L., “Essentials of Management”, 4th Edition, Prentice Hall of India, 2003.

REFERENCES

1. Tripathy, P.C. and Reddy P.N., “Principles of Management”, Tata McGraw-Hill, 1999.
2. David, D. and Robbin Stephen, A., “Personnel and Human Resources Management”, Prentice Hall of India, 1996.
3. Stomer, J.A.F., Freeman R. E. and Gilbert, D.R., “Management”, 6th Edition, Pearson Education, 2004.

ME1351 – HEAT AND MASS TRANSFER

L T P
3 1 0

UNIT I CONDUCTION

11

Basic concepts – Mechanism of heat transfer – Conduction, convection and radiation – General differential equation of heat conduction – Fourier law of conduction – Cartesian and cylindrical coordinates – One dimensional steady state heat conduction – Conduction through plane wall, cylinders and spherical systems – Composite Systems – Conduction with internal heat generation – Extended surfaces – Unsteady heat conduction – Lumped analysis – Use of heislers chart.

UNIT II CONVECTION

10

Basic concepts – Convective heat transfer coefficients – Boundary layer concept – Types of convection – Forced convection – Dimensional analysis – External flow – Flow over plates, cylinders and spheres – Internal flow – Laminar and turbulent flow – Combined laminar and turbulent – Flow over bank of tubes – Free convection – Dimensional analysis – Flow over vertical plate, horizontal plate, inclined plate, cylinders and spheres.

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS 9

Nusselts theory of condensation-pool boiling, flow boiling, correlations in boiling and condensation – Types of heat exchangers – LMTD Method of heat exchanger analysis – effectiveness – NTU method of heat exchanger analysis – Overall heat transfer coefficient – fouling factors.

UNIT IV RADIATION

8

Basic concepts, laws of radiation – Stefan boltzman law, Kirchoff law – Black body radiation – Grey body radiation – Shape factor algebra – Electrical analogy – Radiation shields – Introduction to gas radiation.

UNIT V MASS TRANSFER

7

Basic concepts – Diffusion mass transfer – Fick's law of diffusion – Steady state molecular diffusion – Convective mass transfer – Momentum, heat and mass transfer analogy – Convective mass transfer correlations

L: 45 T: 15 Total: 60

Note: (Use of standard heat and mass transfer data book is permitted in the University examination)

TEXT BOOKS

1. Sachdeva, R.C., "Fundamentals of Engineering Heat and Mass Transfer", New Age International, 1995.
2. Yadav, R., "Heat and Mass Transfer", Central Publishing House, 1995.

REFERENCES

1. Nag, P.K., "Heat Transfer", Tata McGraw-Hill, 2002.
2. Holman, J.P., "Heat and Mass Transfer", Tata McGraw-Hill, 2000.
3. Incropera, F. P. and DeWitt, D.P., "Fundamentals of Heat and Mass Transfer", John Wiley and Sons, 1998.

ME1352 – DESIGN OF TRANSMISSION SYSTEMS

L T P
3 2 0

UNIT I DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLE 9

Selection of V belts and pulleys – Selection of flat belts and pulleys – Wire ropes and pulleys – Selection of transmission chains and sprockets – Design of pulleys and sprockets.

UNIT II SPUR GEARS AND PARALLEL AXIS HELICAL GEARS 9

Gear terminology – Speed ratios and number of teeth – Force analysis – Tooth stresses – Dynamic effects – Fatigue strength – Factor of safety – Gear materials – Module and face width – Power rating calculations based on strength and wear considerations – Parallel axis helical gears – Pressure angle in the normal and transverse plane – Equivalent number of teeth – Forces and stresses – Estimating the size of the helical gears – Herringbone gears.

UNIT III BEVEL, WORM AND CROSS HELICAL GEARS 9

Straight bevel gear: Tooth terminology, tooth forces and stresses – Equivalent number of teeth – Estimating the dimensions of pair of straight bevel gears – Worm Gear –Merits and demerits – Terminology – Thermal capacity, materials-forces and stresses – Efficiency – Estimating the size of the worm gear pair – Cross helical –Terminology – Helix angles – Estimating the size of the pair of cross helical gears.

UNIT IV DESIGN OF GEAR BOXES 9

Geometric progression – Standard step ratio – Ray diagram – Kinematics layout – Design of sliding mesh gear box – Constant mesh gear box – Design of multi speed gear box – Optimum gear box design.

UNIT V DESIGN OF CAM, CLUTCHES AND BRAKES 9

Cam Design: Types – Pressure angle and under cutting base circle determination – Forces and surface stresses – Design of plate clutches – Axial clutches – Cone clutches – Internal expanding rim clutches – Internal and external shoe brakes.

L: 45 T: 30 Total: 75

Note: (Usage of P.S.G Design Data Book is permitted in the University examination)

TEXT BOOKS

1. Jvinall, R. C. and Marshek K.M., “Fundamentals of Machine Component Design”, 3rd Edition, John Wiley and Sons, 2002.
2. Bhandari, V.B., “Design of Machine Elements”, Tata McGraw-Hill Publishing Company Ltd., 1994.

REFERENCES

1. Maitra, G.M. and Prasad, L.V., “Hand Book of Mechanical Design”, 2nd Edition, Tata McGraw-Hill, 1985.
2. Shigley, J.E. and Mischke, C.R., “Mechanical Engineering Design”, McGraw-Hill International Editions, 1989.
3. Prabhu. T.J., “Design of Transmission Elements”, Mani Offset, 2000.
4. CMTI Hand Book.

STANDARDS

IS 4460: Parts 1 to 3 : 1995, Gears – Spur and Helical Gears – Calculation of Load Capacity.

IS 7443: 2002, Methods of Load Rating of Worm Gears

IS 15151: 2002, Belt Drives – Pulleys and V-Ribbed belts for Industrial applications – PH, PJ, PK, PI and PM Profiles: Dimensions.

IS 2122: Part 1: 1973, Code of practice for selection, storage, installation and maintenance of belting for power transmission: Part 1 Flat Belt Drives.

IS 2122: Part 2: 1991, Code of practice for selection, storage, installation and maintenance of belting for power transmission: Part 2 V-Belt Drives.

AT1361 – AUTOMOBILE ENGINEERING
(Common to Mechanical and Production-Elective)

L T P
3 0 0

UNIT I VEHICLE STRUCTURE AND ENGINES 10

Types of automobiles – Vehicle construction – Chassis – Frame and body-aerodynamics – Components of engine – Their forms, functions and materials – Review of cooling and lubrication systems in engine – Turbo chargers – Engine emission control by 3-way catalytic controller – Electronic engine management system.

UNIT II ENGINE AUXILIARY SYSTEMS 10

Carburetor– Working principle – Electronic fuel injection system – Mono-point and multi- point injection systems – Construction, operation and maintenance of lead acid battery – Electrical systems – Battery generator – Starting motor and drives – Lighting and ignition (Battery, magneto coil and electronic type) – Regulators – Cut outs.

UNIT III TRANSMISSION SYSTEMS 10

Clutch – Types and construction – Gear boxes, manual and automatic – Simple floor mounted shift mechanism – Over drives – Transfer box fluid flywheel – Torque converters – Propeller shaft – Slip joint – Universal joints – Differential and rear axle – Hotchkiss drive and torque tube drive.

UNIT IV STEERING, BRAKES AND SUSPENSION 10

Wheels and tyres – Wheel alignment parameters – Steering geometry and types of steering gear box – Power steering – Types of front axle – Suspension systems – Braking systems – Types and construction – Diagonal braking system – Antilock braking system.

UNIT V ALTERNATIVE ENERGY SOURCES 5

Use of natural gas, LPG, bio-diesel, gasohol and hydrogen in automobiles – Electric and hybrid vehicles – Fuel cells – Emission and euro standards.

Note: Practical training in dismantling and assembling of engine parts transmission system should be given to the students

Total: 45

TEXT BOOKS

1. Sethi, H.M., “Automobile Technology”, Tata McGraw-Hill, 2003.
2. Kirpal Singh, “Automobile Engineering”, Vol.1 and 2”, Standard Publishers, 2002.

REFERENCES

1. Crouse and Anglin “Automotive Mechanism”, 9th Edition, Tata McGraw-Hill, 2003.
2. Newton, Steeds and Garet, “Motor Vehicles”, Butterworth Publishers, 1989.
3. Srinivasan. S., “Automotive Mechanics”, 2nd Edition, Tata McGraw-Hill, 2003.

ME1353 – POWER PLANT ENGINEERING

L T P
3 0 0

UNIT I INTRODUCTION TO POWER PLANTS AND BOILERS 9

Layout of steam, hydel, diesel, MHD, nuclear and gas turbine power plants – Combined power cycles – Comparison and selection – Load duration curves.

Steam boilers and cycles – High pressure and super critical boilers – Fluidised bed boilers

UNIT II STEAM POWER PLANT 9

Fuel and ash handling – Combustion equipment for burning coal – Mechanical stokers – Pulveriser – Electrostatic precipitator – Draught – Different types – Surface condenser types – Cooling towers

UNIT III NUCLEAR AND HYDEL POWER PLANTS 9

Nuclear energy – Fission – Fusion reaction – Types of reactors – Pressurized water reactor – Boiling water reactor – Waste disposal – Safety.

Hydel power plant – Essential elements – Selection of turbines – Governing of turbines – Micro hydel developments.

UNIT IV DIESEL AND GAS TURBINE POWER PLANT 9

Types of diesel plants components – Selection of engine type – Applications gas turbine power plant – Fuels – Gas – Turbine material – Open and closed cycles – Reheating – Regeneration and Inter-cooling – Combined cycle.

UNIT V OTHER POWER PLANTS AND ECONOMICS OF POWER PLANTS 9

Geo thermal – OTEC – Tidel – Pumped storage – Solar thermal central receiver system – Cost of electric energy – Fixed and operating costs – Energy rates – Types of tariffs – Economics of load sharing – Comparison of economics of various power plants.

Total: 45

TEXT BOOKS

1. Nag, P.K., “Power Plant Engineering”, Tata McGraw-Hill, 1998.
2. Arora, S.C., and Domkundwar. S., “A Course in Power Plant Engineering”, Dhanpatrai, 2001.

REFERENCES

1. EI- Wakil, M.M., “Power Plant Technology”, McGraw-Hill, 1984.
2. Rai, G.D., “Introduction to Power Plant Technology”, Khanna Publishers, 1995.
3. Nagpal, G.R., “Power Plant Engineering”, Khanna Publishers, 1998.

LIST OF EXPERIMENTS

HEAT TRANSFER

30

1. Thermal conductivity measurement by guarded plate method
2. Thermal conductivity of pipe insulation using lagged pipe apparatus
3. Natural convection heat transfer from a vertical cylinder
4. Forced convection inside tube
5. Heat transfer from pin-fin (natural and forced convection modes)
6. Determination of Stefan-Boltzmann constant
7. Determination of emissivity of a grey surface
8. Effectiveness of Parallel/counter flow heat exchanger

REFRIGERATION AND AIR CONDITIONING

15

1. Determination of COP of a refrigeration system
2. Experiments on air-conditioning system
3. Performance test on single/two stage reciprocating air compressor.

Total: 45

LIST OF EQUIPMENTS

(for a batch of 30 students)

- | | | |
|-----|--|---------|
| 1. | Guarded plate apparatus | – 1 No. |
| 2. | Lagged pipe apparatus | – 1 No. |
| 3. | Natural convection-vertical cylinder apparatus | – 1 No. |
| 4. | Forced convection inside tube apparatus | – 1 No. |
| 5. | Pin-fin apparatus | – 1 No. |
| 6. | Stefan-Boltzmann apparatus | – 1 No. |
| 7. | Emissivity measurement apparatus | – 1 No. |
| 8. | Parallel/counter flow heat exchanger apparatus | – 1 No. |
| 9. | Single/two stage reciprocating air compressor. | – 1 No. |
| 10. | Refrigeration test rig | – 1 No. |
| 11. | Air-conditioning test rig | – 1 No. |

ME1355 – CAD/CAM LABORATORY

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0 0 3

LIST OF EXPERIMENTS

- A) COMPUTER AIDED DESIGN (CAD) 15**
1. 3D Part modeling – protrusion, cut, sweep, draft, loft, blend, rib
 2. Editing – Move, Pattern, Mirror, Round, Chamfer
 3. Assembly – creating assembly from parts – assembly constraints
 4. Conversion of 3D solid model to 2D drawing - different views, sections, isometric view and dimensioning
 5. Introduction to Surface Modeling and Sheet metal
 6. Introduction to File Import, Export – DXF, IGES, STL, STEP
 7. 3D modeling of machine elements like Flanged coupling, screw jack etc.
- Note:** Any one of the 3D MODELING software like Pro/E, IDEAS, CATIA, UNIGRAPHICS, AutoCAD to be used.
- B) COMPUTER AIDED MANUFACTURING (CAM) 21**
- 1. MANUAL PART PROGRAMMING (Using G and M Codes) in CNC lathe**
 - 1.1 Part programming for Linear and Circular interpolation, Chamfering and Grooving
 - 1.2 Part programming using standard canned cycles for Turning, Facing, Taper turning and Thread cutting
 - 2. MANUAL PART PROGRAMMING (using G and M codes) in CNC milling**
 - 2.1 Part programming for Linear and Circular interpolation and Contour motions.
 - 2.2 Part programming involving canned cycles for Drilling, Peck drilling, pockets and Boring.
- C) SIMULATION AND NC CODE GENERATION 9**
- NC code generation using CAD / CAM softwares - Post processing for standard CNC Controls like FANUC, Hiedenhain etc.

Total: 45

LIST OF EQUIPMENTS FOR CAD /CAM LABORATORY
(for a batch of 30 students)

I. HARDWARES

- | | | |
|----|---|---------|
| 1. | Computer server | 1 No. |
| 2. | Computer systems (Pentium IV with 1 GB Ram) networked to the server | 30 Nos. |
| 3. | A0 size plotter | 2 Nos. |
| 4. | Laser Printer | 2 Nos. |
| 5. | Trainer CNC lathe | 2 Nos. |
| 6. | Trainer CNC milling | 2 No |

II. SOFTWARES

- | | | |
|----|--|---------------|
| 1. | CAD/CAM Software
(Pro –E or IDEAS or Uni-graphics or CATIA) | – 20 licenses |
| 2. | CAM Software
(CNC programming and tool path simulation for FANUC,
Sinumeric and Heiden controller) | – 20 licenses |

ME1356 – DESIGN AND FABRICATION PROJECT
(Common to Mechanical and Production)

L T P
0 0 4

The objective of this project work is to provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems.

The students in convenient groups of not more than 4 members have to take one small item for design and fabrication. Every project work shall have a guide who is the member of the faculty of the institution.

The item chosen may be small machine elements (Example-screw jack, coupling, machine vice, cam and follower, governor etc), attachment to machine tools, tooling (jigs, fixtures etc), small gear box, automotive appliances, agricultural implements, simple heat exchangers, small pumps, hydraulic /pneumatic devices etc.

The students are required to design and fabricate the chosen item with a novel idea in the college and demonstrate its working apart from submitting the project report. The report should contain assembly drawing, parts drawings, process charts, related to fabrication and cost estimation.

Total: 60

ELECTIVE I

ME1001 / PR1001 – UNCONVENTIONAL MACHINING PROCESS

(Common to Mechanical and Production)

L T P
3 0 0

UNIT I	INTRODUCTION	5
Unconventional machining process – Need – Classification – Brief overview of all techniques – Merits and Demerits.		
UNIT II	MECHANICAL ENERGY BASED PROCESSES	10
Abrasive jet machining – Water jet machining – Ultrasonic machining (AJM, WJM and USM) – Working principles – Equipment used – Process parameters – MRR–Variation in techniques used – Applications.		
UNIT III	ELECTRICAL ENERGY BASED PROCESSES	8
Electric Discharge Machining (EDM) – Working principles – Equipments – Process parameters – MRR – Electrode / Tool – Power Circuits – Tool wear – Dielectric – Flushing – Wire cut EDM – Applications.		
UNIT IV	CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES	12
Chemical Machining (CHM) – Electro-Chemical Machining (ECM) – Etchants – Maskant – Techniques of applying maskants – Process parameters – MRR – Applications. Principles of ECM – Equipments – MRR – Electrical circuit – Process parameters – ECG and ECH applications.		
UNIT V	THERMAL ENERGY BASED PROCESSES	10
Laser Beam Machining (LBM) – Plasma Arc Machining (PAM) – Electron Beam Machining (EBM) – Principles – Equipment – Types – Beam control techniques – Applications.		

Total: 45

TEXT BOOK

1. Vijay K. Jain, “Advanced Machining Processes”, Allied Publishers Pvt. Ltd., 2002.
2. Benedict, G.F., “Non Traditional Manufacturing Processes”, Marcel Dekker Inc., 1987.

REFERENCES

1. Pandey, P.C. and Shan, H.S., “Modern Machining Processes”, Tata McGraw-Hill, 1980.
2. Mc Geough, “Advanced Methods of Machining”, Chapman and Hall, 1998.
3. Garmo, P.D., Black, J.T. and Kohser, R.A., “Material and Processes in Manufacturing”, 8th Edition, Prentice Hall of India, 2001.

ME1003 – REFRIGERATION AND AIR-CONDITIONING

L T P
3 0 0

UNIT I REFRIGERATION CYCLE 9

Review of thermodynamic principles of refrigeration – Concept of aircraft refrigeration system – Vapour compression refrigeration cycle – Use of P-H charts – Multistage and multiple evaporator systems – Cascade system – COP comparison – Vapor absorption refrigeration system – Ammonia water and lithium bromide water systems – Steam jet refrigeration system.

UNIT II REFRIGERANTS, SYSTEM COMPONENTS AND BALANCING 9

Compressors – Reciprocating and rotary (elementary treatment.) – Condensers – Evaporators – Cooling towers – Refrigerants – Properties – Selection of refrigerants – Alternate Refrigerants – Refrigeration plant controls – Testing and charging of refrigeration units – Balancing of system components – Applications to refrigeration systems – Ice plant – food storage plants – Milk – Chilling plants – Refrigerated cargo ships.

UNIT III PSYCHROMETRY 9

Psychrometric processes – Use of psychrometric charts – Grand and Room Sensible Heat Factors – bypass factor – Requirements of comfort air conditioning – Comfort charts – Factors governing optimum effective temperature, recommended design conditions and ventilation standards.

UNIT IV COOLING LOAD CALCULATIONS 9

Types of load – Design of space cooling load – Heat transmission through building – Solar radiation – Infiltration – Internal heat sources (sensible and latent) – Outside air and fresh air load – Estimation of total load – Domestic, commercial and industrial systems – Central air conditioning systems.

UNIT V AIRCONDITIONING 9

Air conditioning equipments – Air cleaning and air filters – Humidifiers – Dehumidifiers – Air washers – Condenser – Cooling tower and spray ponds – Elementary treatment of duct design – Air distribution system – Thermal insulation of air conditioning systems – Applications: Car, industry, stores, and public buildings.

Total: 45

TEXT BOOKS

1. Manohar Prasad, "Refrigeration and Air Conditioning", Wiley Eastern Ltd., 1983.
2. Arora, C.P., "Refrigeration and Air Conditioning", Tata McGraw-Hill, 1988.

REFERENCES

1. Dossat, R.J., "Principles of Refrigeration", Pearson Education, 1997.
2. Jordon and Prister, "Refrigeration and Air Conditioning", Prentice Hall of India Pvt Ltd., 1985.
3. Stoecker, N.F. and Jones., "Refrigeration and Air Conditioning", TMH, 1981.

ME1004 – VIBRATION AND NOISE CONTROL

(Common to Mechanical and Automobile)

L T P
3 0 0

UNIT I BASICS OF VIBRATION 9

Introduction – Classification of vibration: Free and forced vibration, undamped and damped vibration – Linear and non linear vibration – Response of damped and undamped systems under harmonic force – Analysis of single degree and two degree of freedom systems – Torsional vibration – Determination of natural frequencies.

UNIT II BASICS OF NOISE 9

Introduction – Amplitude, frequency, wavelength and sound pressure level – Addition, subtraction and averaging decibel levels – Noise dose level, legislation, measurement and analysis of noise – Measurement environment – Equipment – Frequency analysis – Tracking analysis – Sound quality analysis.

UNIT III AUTOMOTIVE NOISE SOURCES 9

Noise characteristics of engines – Engine overall noise levels – Assessment of combustion noise – Assessment of mechanical noise – Engine radiated noise – Intake and exhaust noise – Engine accessory contributed noise – Transmission noise – Aerodynamic noise – Tyre noise – Brake noise.

UNIT IV CONTROL TECHNIQUES 9

Vibration isolation – Tuned absorbers – Un-tuned viscous dampers – Damping treatments – Application dynamic forces generated by IC engines – Engine isolation – Crank shaft damping – Modal analysis of the mass elastic model shock absorbers.

UNIT V SOURCE OF NOISE AND CONTROL 9

Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures – Automotive noise control principles – Sound in enclosures – Sound energy absorption – Sound transmission through barriers

Total: 45

TEXT BOOKS

1. Rao, S.S., “Mechanical Vibrations”, Pearson Education, 2004.
2. Pujara, K., “Vibrations and Noise for Engineers”, Dhanpat Rai and Sons, 1992.

REFERENCES

1. Challen, B. and Baranescu, R., “Diesel Engine Reference Book”, 2nd Edition, SAE International, 1999.
2. Julian Happian-Smith, “An Introduction to Modern Vehicle Design”, Butterworth-Heinemann, 2004.
3. Fenton, J., “Handbook of Automotive Body Construction and Design Analysis”, Professional Engineering Publishing, 1998.

ME1005 – RENEWABLE SOURCES OF ENERGY
(Common to Mechanical and Production)

L T P
3 0 0

UNIT I ENERGY AND ENVIRONMENT 9

Primary energy sources – World energy resources – Indian energy scenario – Energy cycle of the earth – Environmental aspects of energy utilisation, CO₂ emissions and global warming – Renewable energy resources and their importance – Potential impacts of harnessing the different renewable energy resources.

UNIT II SOLAR ENERGY 9

Principles of solar energy collection – Solar radiation – Measurements – Instruments – Data and Estimation – Types of collectors – Characteristics and design principles of different type of collectors – Performance of collectors – Testing of collectors – Solar thermal applications – Water heaters and air heaters – Performance and applications – Simple calculations – Solar cooling – Solar drying – Solar ponds – Solar tower concept – Solar furnace.

UNIT III WIND, TIDAL AND GEO THERMAL ENERGY 9

Energy from the wind – General theory of windmills – Types of windmills – Design aspects of horizontal axis windmills – Applications – Energy from tides and waves – Working principles of tidal plants and ocean thermal energy conversion plants – Power from geothermal energy – Principle of working of geothermal power plants.

UNIT IV BIO ENERGY 9

Energy from bio mass and bio gas plants – Various types – Design principles of biogas plants – Applications – Energy from wastes – Waste burning power plants – Utilization of industrial and Municipal wastes – Energy from the agricultural wastes.

UNIT V OTHER RENEWABLE ENERGY SOURCES 9

Direct energy conversion (Description, principle of working and basic design aspects only) – Magneto hydrodynamic systems (MHD) – Thermoelectric generators – Thermionic generators – Fuel cells – Solar cells – Types – EMF generated power output – Losses and Efficiency – Applications – Hydrogen conversion and storage systems

Total : 45

TEXT BOOK

1. Rai, G.D., “Non conventional Energy Sources”, Khanna Publishers, 1999.
2. Sukhatme, S.P., “Solar Energy”, 2nd Edition, TMH, 2003

REFERENCES

1. Sulton, “Direct Energy Conversion”, McGraw-Hill, 1966.
2. Duffie and Beckmann, “Solar Energy Thermal Processes”, John Wiley, 1974.
3. Garg, H. P. and Prakash, J., “Solar Energy - Fundamentals and Applications”, TMH, 1997.

ME1006 – QUALITY CONTROL AND RELIABILITY ENGINEERING

(Common to Mechanical, Automobile and Production- VI semester core)

L T P
3 0 0

UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES 10

Introduction – Definition of quality – Basic concept of quality – Definition of SQC – Benefits and limitation of SQC – Quality assurance – Quality cost–Variation in process– Factors – Process capability – Process capability studies and simple problems – Theory of control chart – Uses of control chart – Control chart for variables – X chart, R chart and σ chart.

UNIT II PROCESS CONTROL FOR ATTRIBUTES 8

Control chart for attributes – Control chart for proportion or fraction defectives – p-chart and np chart – Control chart for defects – C and U charts – State of control and process out of control identification in charts.

UNIT III ACCEPTANCE SAMPLING 9

Lot by lot sampling – Types – Probability of acceptance in single, double, multiple sampling techniques – O.C. curves – Producer's risk and consumer's risk – AQL, LTPD, AOQL concepts – Standard sampling plans for AQL and LTPD – Uses of standard sampling plans.

UNIT IV LIFE TESTING - RELIABILITY 9

Life testing – Objective – Failure data analysis – Mean failure rate – Mean time to failure – mean time between failure – Hazard rate – System reliability – Series, parallel and mixed configuration – Simple problems – Maintainability and availability – Simple problems – Acceptance sampling based on reliability test – O.C Curves.

UNIT V QUALITY AND RELIABILITY 9

Reliability improvements – Techniques – Use of pareto analysis – Design for reliability – Redundancy unit and standby redundancy – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles.

Total: 45

Note : Use of approved statistical table permitted in the examination.

TEXT BOOKS

1. Grant, Eugene, L., "Statistical Quality Control", McGraw-Hill, 1996.
2. Srinath, L.S., "Reliability Engineering", Affiliated East West Press, 1991 .

REFERENCES

1. Monohar Mahajan, "Statistical Quality Control", Dhanpat Rai and Sons, 2001.
2. Gupta, R.C., "Statistical Quality Control", Khanna Publishers, 1997.
3. Besterfield, D.H., "Quality Control", Prentice Hall, 1993.
4. Sharma, S.C., "Inspection Quality Control and Reliability", Khanna Publishers, 1998.

SEMESTER VII

TOTAL QUALITY MANAGEMENT

(Common to Aeronautical, Automobile, Mechanical and Production)

L T P
3 0 0

UNIT I INTRODUCTION 9

Definition of quality – Dimensions of quality – Quality planning – Quality costs – Analysis techniques for quality costs – Basic concepts of Total Quality Management – Historical review – Principles of TQM – Leadership – Concepts – Role of senior management – Quality Council – Quality statements – Strategic planning – Deming philosophy – Barriers to TQM Implementation.

UNIT II TQM PRINCIPLES 9

Customer satisfaction – Customer perception of quality – Customer complaints – Service quality – Customer retention – Employee involvement – Motivation, empowerment, teams, recognition and reward – Performance appraisal – Benefits – Continuous process improvement – Juran trilogy – PDSA cycle – 5S – Kaizen – Supplier partnership – Partnering – Sourcing – Supplier selection – Supplier rating – Relationship development – Performance measures – Basic concepts – Strategy – Performance measure.

UNIT III STATISTICAL PROCESS CONTROL (SPC) 9

The seven tools of quality – Statistical fundamentals – Measures of central tendency and dispersion – Population and sample – Normal curve – Control charts for variables and attributes – Process capability – Concept of six sigma – New seven management tools.

UNIT IV TQM TOOLS 9

Benchmarking – Reasons to benchmark – Benchmarking process – Quality Function Deployment (QFD) – House of quality – QFD process – Benefits – Taguchi quality loss function – Total Productive Maintenance (TPM) – Concept – Improvement needs – FMEA – Stages of FMEA.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 and other quality systems – ISO 9000:2000 quality system – Elements – Implementation of quality system – Documentation – Quality auditing – TS 16949 – ISO 14000 – Concept, requirements and benefits.

Total : 45

TEXT BOOKS

1. Dale H. Besterfield, "Total Quality Management", Pearson Education, Inc. 2003.
2. James R. Evans and William M. Lidsay, "The Management and Control of Quality", 5th Edition, South-Western, 2002.

REFERENCES

1. Feigenbaum, A.V., "Total Quality Management", McGraw Hill, 1991.
2. Oakland, J.S., "Total Quality Management", Butterworth Heineman, 1989.
3. Narayana V. and Sreenivasan, N.S., "Quality Management – Concepts and Tasks", New Age International, 1996.
4. Zeiri, "Total Quality Management for Engineers", Wood Head Publishers, 1991.

FINITE ELEMENT ANALYSIS
(Common to Automobile and Mechanical)

L T P
3 1 0

UNIT I INTRODUCTION 9

Historical background – Matrix approach – Application to the continuum – Discretisation – Matrix algebra – Gaussian elimination – Governing equations for continuum – Classical Techniques in FEM – Weighted residual method – Ritz method.

UNIT II ONE DIMENSIONAL PROBLEMS 9

Finite element modeling – Coordinates and shape functions – Potential energy approach – Galarkin approach – Assembly of stiffness matrix and load vector – Finite element equations – Quadratic shape functions – Applications to plane trusses

UNIT III TWO DIMENSIONAL CONTINUUM 9

Introduction – Finite element modelling – Scalar valued problem – Poisson equation – Laplace equation – Plane stress and plane strain conditions – Triangular elements – Element stiffness matrix – Force vector – Galarkin approach – Stress calculation – Temperature effects – Dynamics – Mass matrices.

UNIT IV AXI-SYMMETRIC CONTINUUM 9

Axi-symmetric formulation – Element stiffness matrix and force vector – Galarkin approach – Body forces and temperature effects – Stress calculations – Boundary conditions – Applications to cylinders under internal or external pressures – Rotating discs.

UNIT V ISOPARAMETRIC ELEMENTS FOR TWO DIMENSIONAL CONTINUUM 9

Isoperimetric formulation – The four node quadrilateral – Shape functions – Element stiffness matrix and force vector – Numerical integration – Element Stiffness matrix – Stress calculations – Four node quadrilateral for axi-symmetric problems.

L:45 T:15 Total : 60

TEXT BOOKS

1. Chandrupatla, T.R. and Belegundu, A.D., “Introduction to Finite Elements in Engineering”, 3rd Edition, Pearson Education, 2002.
2. David V. Hutton, “Fundamentals of Finite Element Analysis”, McGraw-Hill International Edition, 2004.

REFERENCES

1. Rao, S.S., “The Finite Element Method in Engineering”, Pergammon Press, 1989.
2. Logan, D.L., “A First Course in the Finite Element Method”, 3rd Edition, Thomson Learning, 2002.
3. Robert D. Cook, David S. Malkucs and Michael E. Plesha, “Concepts and Applications of Finite Element Analysis” 4th Edition, 2003.
4. Reddy, J.N., “An Introduction to Finite Element Method”, McGraw-Hill International Student Edition, 1985.
5. Zienkiewicz, O.C. and Taylor, R.L., “The Finite Element Methods, Vol.1”, “The Basic Formulation and Linear Problems, Vol.1”, 5th Edition, Butterworth Heineman, 2000.

MECHATRONICS

(Common to Mechanical and Production- VI Semester)

L T P
3 0 0

UNIT I MECHATRONICS, SENSORS AND TRANSDUCERS 9

Introduction to mechatronics systems – Measurement systems – Control systems – Microprocessor based controllers.

Sensors and transducers – Performance terminology – Sensors for displacement, position and proximity, velocity, motion, force, fluid pressure, liquid flow, liquid level, temperature and light sensors – Selection of sensors

UNIT II ACTUATION SYSTEMS 9

Mechanical actuation systems – Cams – Gear trains – Ratchet and pawl – Belt and chain drives – Bearings – Electrical actuation systems – Mechanical switches – Solid state Switches – Solenoids – D.C Motors – A.C Motors – Stepper motors.

UNIT III SYSTEM MODELS AND CONTROLLERS 9

Building blocks of Mechanical, Electrical, Fluid and Thermal Systems – Rotational systems – Transnational systems – Electromechanical systems – Hydraulic system– Mechanical systems.

Continuous and discrete process controllers – Control mode – Two-Step mode – Proportional mode – Derivative mode – Integral mode – PID controllers – Digital controllers – Velocity control – Adaptive control – Digital logic control – Micro processors control.

UNIT IV PROGRAMMING LOGIC CONTROLLERS 9

Programmable logic controllers – Basic structure – Input / Output processing – Programming – Mnemonics – Timers, internal relays and counters – Shift registers – Master and jump controls – Data handling – Analogs Input / Output – Selection of a PLC problem.

UNIT V DESIGN OF MECHATRONICS SYSTEM 9

Stages in designing mechatronics systems – Traditional and mechatronic design - Possible design solutions – Case studies of mechatronics systems – Pick and place robot – Automatic car park systems – Engine management systems.

Total : 45

TEXT BOOKS

1. Bolton, W., “Mechatronics”, 2nd Edition, Pearson Education, 1999.
2. Michael B. Histan and David G. Alciatore, “Introduction to Mechatronics and Measurement Systems”, McGraw-Hill International Editions, 2000.

REFERENCES

1. Bradley, D. A., Dawson, D., Buru N.C. and Loader, A.J, “Mechatronics”, Chapman and Hall, 1993.
2. Dan Neculescu, “Mechatronics”, Pearson Education Asia, 2002.
3. Lawrence J. Kamm, “Understanding Electro – Mechanical Engineering”, An Introduction to Mechatronics, Prentice Hall of India Pvt. Ltd., 2000.
4. Nitaigour Premchand Mahadik, “Mechatronics”, Tata McGraw-Hill Publishing Company Ltd, 2003.

COMPUTER INTEGRATED MANUFACTURING

(Common to Aeronautical, Mechanical and Production)

L T P
3 0 0

UNIT I INTRODUCTION 8

The meaning and origin of CIM – The changing manufacturing and management scene – External communication – Islands of automation and software – Dedicated and open systems – Manufacturing automation protocol – Product related activities of a company – Marketing engineering – Production planning – Plant operations – Physical distribution – Business and financial management.

UNIT II GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING 10

History of group technology – Role of G.T. in CAD/CAM integration – Part families – Classification and coding – DCLASS and MICLASS and OPITZ coding systems – Facility design using G.T. – Benefits of G.T. – Cellular manufacturing.

Process planning – Role of process planning in CAD/CAM integration – Approaches to computer aided process planning – Variant approach and generative approaches – CAPP and CMPP process planning systems.

UNIT III SHOP FLOOR CONTROL AND INTRODUCTION OF FMS 9

Shop floor control – Phases – Factory data collection system – Automatic identification methods – Bar code technology – Automated data collection system.

FMS – Components of FMS – Types – FMS workstation – Material handling and storage systems – FMS layout – Computer control systems – Application and benefits.

UNIT IV CIM IMPLEMENTATION AND DATA COMMUNICATION 10

CIM and company strategy – System modeling tools – IDEF models – Activity cycle diagram – CIM open system architecture (CIMOSA) – Manufacturing enterprise wheel – CIM architecture – Product data management – CIM implementation software – Communication fundamentals – Local area networks – Topology - LAN implementations – Network management and installations.

UNIT V OPEN SYSTEM AND DATABASE FOR CIM 8

Open systems – Open system inter connection – Manufacturing automations protocol and technical office protocol (MAP /TOP)

Development of databases – Database terminology – Architecture of database systems – Data modeling and data associations – Relational data bases – Database operators – Advantages of data base and relational database.

Total: 45

TEXT BOOKS

1. Mikell P. Groover, "Automation, Production Systems and Computer Integrated Manufacturing", Pearson Education, 2001.
2. Yoram Koren, "Computer Integrated Manufacturing System", McGraw-Hill, 1983.

REFERENCES

1. Ranky, Paul, G., "Computer Integrated Manufacturing", Prentice Hall International, 1986.
2. Roger Hanman, "Computer Intergrated Manufacturing", Addison Wesley, 1997.
3. Mikell P. Groover and Emory Zimmers Jr., "CAD/CAM", Prentice Hall of India Pvt. Ltd., 1998.
4. Radhakrishnan, P., Subramanyan, S. and Raju, V., "CAD/CAM/CIM", 2nd Edition, New Age International (P) Ltd., 2000.

COMPUTER AIDED SIMULATION AND ANALYSIS LABORATORY

L T P
0 0 3

LIST OF EXPERIMENTS

- A. Simulation 15**
1. Simulation of Air conditioning system with condenser temperature and evaporator temperatures as input to get COP using C /MAT Lab.
 2. Simulation of Hydraulic / Pneumatic cylinder using C / MAT Lab.
 3. Simulation of cam and follower mechanism using C / MAT Lab.

Analysis (Simple Treatment only) 30

1. Stress analysis of a plate with a circular hole.
2. Stress analysis of rectangular L bracket
3. Stress analysis of an axi-symmetric component
4. Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
5. Mode frequency analysis of a 2 D component
6. Mode frequency analysis of beams (Cantilever, Simply supported, Fixed ends)
7. Harmonic analysis of a 2D component
8. Thermal stress analysis of a 2D component - Static
9. Conductive heat transfer analysis of a 2D component - Static
10. Convective heat transfer analysis of a 2D component - Static

Total : 45

LIST OF EQUIPMENTS

(for a batch of 30 students)

Computer System 30

17" VGA Color Monitor
Pentium IV Processor
40 GB HDD
256 MB RAM

Color Desk Jet Printer 01

Software

ANSYS Version 7 or latest 15 licenses
C / MATLAB 15 licenses

MECHATRONICS LABORATORY
(Common to Mechanical and Production VI Semester)

L T P
0 0 3

LIST OF EXPERIMENTS

1. Design and testing of fluid power circuits to control
 - i. Velocity
 - ii. direction and
 - iii. force of single and double acting actuators

2. Design of circuits with logic sequence using Electro pneumatic trainer kits.
3. Simulation of basic Hydraulic, Pneumatic and Electric circuits using software.
4. Circuits with multiple cylinder sequences in Electro pneumatic using PLC.
5. Servo controller interfacing for open loop
6. Servo controller interfacing for closed loop
7. PID controller interfacing
8. Stepper motor interfacing with 8051 Micro controller
 - i. full step resolution
 - ii. half step resolution

9. Modeling and analysis of basic electrical, hydraulic and pneumatic systems using LAB VIEW
10. Computerized data logging system with control for process variables like pressure flow and temperature.

Total: 45

LIST OF EQUIPMENT

(for a batch of 30 students)

1. Basic Pneumatic Trainer Kit with manual and electrical controls - 1 each
2. Basic Pneumatic Trainer Kit with PLC control - 1 No.
3. HYDROSIM and PNEUMOSIM Software / Automation studio - 10 sets.
4. 8051 - Microcontroller kit with stepper motor and drive circuit LABVIEW software - 2 sets
5. LAB VIEW software with Sensors to measure Pressure, Flow rate, direction, speed, velocity and force. - 2 sets

HS1301 – COMMUNICATION AND SOFT SKILLS LABORATORY
(Common to All Branches)

L T P
1 0 3

UNIT I LISTENING AND SPEAKING PRACTICE IN COMMUNICATIVE FUNCTIONS

Introductions and meetings – Talking about studies and/ or job – Expressing likes and dislikes – Describing daily routines and current activities – Talking about past states and events – Talking about future plans and intentions – Expressing preferences – Giving reasons – Expressing opinions, agreement and disagreement – Seeking and giving advice – Making suggestions.

UNIT II SPEAKING APPLICATIONS

Making an oral presentation – Preparing the presentation – Performing the presentation – Beginning – Language – Visual aids and body language – Voice – Ending – Questions – Telephone conversations – Group discussion and interview.

UNIT III UNDERSTANDING AND PREPARING FOR INTERNATIONAL ENGLISH LANGUAGE EXAMINATIONS

International English Language Testing System (IELTS) – Test of English as a Foreign Language (TOEFL) – Business English Certificate (BEC).

UNIT IV SOFT SKILLS (1)

Preparing for and dealing with change – Motivation, goal-setting and self-esteem – Managing time and stress – Career and life planning – Team work – Leadership traits.

UNIT V SOFT SKILLS (2)

Multiple intelligences – Learning styles and personality typing – Critical and creative thinking – People, cultures and self – Intercultural communication.

REFERENCES

1. Kamalesh Sadanand, and Susheela Punitha, “Spoken English: A Foundation Course” for Speakers of Indian Languages, Part 2 Audio CD, Hyderabad: Orient Longman, 2008.
2. Malcome Goodale, “Professional Presentations”, (VCD) New Delhi, Cambridge University Press, 2005.
3. Barbara Garside, Tony Garside, “Essential Telephoning in English” (Audio CD), Cambridge, Cambridge University Press, 2002.
4. Hari Mohan Prasad, Rajnish Mohan, “How to Prepare for Group Discussion and Interview” (Audio Cassette) Tata McGraw-Hill Publishing.
5. “International English Language Testing System Practice Tests”, CUP.
6. “Business English Certificate Materials”, Cambridge University Press.
7. “Understanding the TOEFL”, Educational Testing Services, Princeton, US.
8. Interactive Multimedia Programs on Managing Time and Stress.
9. Robert M. Sherfield, “Developing Soft Skills” New Delhi: Pearson Education, 4th Edition, 2009.

L: 15 P: 45 Total: 60

List of activities that are to be carried out:

(15 sessions x 3 periods = 45)

Lab session # 1: Listening and speaking practice exercises with communicative functions. Learning material: the ACD of Spoken English: A Foundation Course for Speakers of Indian Languages (Orient Longman, 2008)

Lab session # 2: Practice with more advanced communicative functions. Learning material: the ACD of Spoken English: A Foundation Course for Speakers of Indian Languages (Orient Longman, 2008)

Lab session # 3: Pronunciation exercises with Oxford Advanced Learners' Dictionary of Current English or any other standard Dictionary

Lab session # 4: Making an oral presentation in English. Learning Material: Professional Presentations VCD (Cambridge University Press)

Lab session # 5: Listening to telephone conversations in English and completing the tasks. Learning material: Essential Telephoning in English ACD (Cambridge University Press)

Lab session # 6: Giving an exposure to and practice with model group discussion and interviews. Learning material: How to Prepare for Group Discussion and Interview Audio Cassette (McGraw-Hill)

Lab session # 7: Giving insights into the format and the task types in the IELTS (International English Language Testing System). Learning Material: Objective IELTS, Intermediate Level (CUP)

Lab session # 8: Understanding the format and the task types in the TOEFL (Test of English as a Foreign Language). Learning Material: Understanding the TOEFL (Educational Testing Services, Princeton)

Lab session # 9: Administering the BEC (Business English Certificate) Diagnostic Test. Learning Material: BEC Practice Materials (British Council, Chennai)

Lab session # 10: Completing the steps involved in Career, Life Planning and Change Management. Learning Material: Developing Soft Skills (Pearson Education)

Lab session # 11: Setting goals and objectives exercises. Learning Material: Developing Soft Skills (Pearson Education)

Lab session # 12: Prioritizing and time planning exercises. Learning Material: Managing Time Multimedia Program CD

Lab session # 13: Taking a Personality Typing/ Psychometric Test Learning Material: 200 Psychometric Test prepared by the CUIC, Anna University Chennai

Lab session # 14: Critical and creative thinking exercises.

Lab session # 15: Improving body language and cross-cultural communication with pictures. Learning material: Body Language (S. Chand and Co.)

SEMESTER VIII

ENGINEERING ECONOMICS AND COST ANALYSIS

(Common to Automobile, Mechanical and Production)

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UNIT I INTRODUCTION TO ECONOMICS 8

Introduction to economics – Flow in an economy – Law of supply and demand – Concept of engineering economics – Engineering efficiency – Economic efficiency – Scope of engineering economics – Element of costs – Marginal cost – Marginal revenue – Sunk cost – Opportunity cost – Break-even analysis – V ratio – Elementary economic Analysis – Material selection for product design selection for a product – Process planning.

UNIT II VALUE ENGINEERING 10

Make or buy decision – Value engineering – Function, aims and value engineering procedure – Interest formulae and their applications – Time value of money – Single payment compound amount factor – Single payment present worth factor – Equal payment series sinking fund factor – Equal payment series payment present worth factor- Equal payment series capital recovery factor – Uniform gradient series annual equivalent factor – Effective interest rate – Examples in all methods.

UNIT III CASH FLOW 9

Methods of comparison of alternatives – Present worth method (Revenue dominated cash flow diagram) – Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram) – Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram) – Rate of return method – Examples in all the methods.

UNIT IV REPLACEMENT AND MAINTENANCE ANALYSIS 9

Replacement and maintenance analysis – Types of maintenance – Types of replacement problem – Determination of economic life of an asset – Replacement of an asset with a new asset – Capital recovery with return and concept of challenger and defender – Simple probabilistic model for items which fail completely.

UNIT V DEPRECIATION 9

Depreciation – Introduction – Straight line method of depreciation – Declining balance method of depreciation-Sum of the years digits method of depreciation – Sinking fund method of depreciation / Annuity method of depreciation – Service output method of depreciation – Evaluation of public alternatives – Introduction – Examples – Inflation adjusted decisions – Procedure to adjust inflation – Examples on comparison of alternatives and determination of economic life of asset.

Total: 45

TEXT BOOKS

1. Panneer Selvam, R., "Engineering Economics", Prentice Hall of India Ltd., 2001.
2. Chan S. Park, "Contemporary Engineering Economics", Prentice Hall of India, 2002.

REFERENCES

1. Donald G. Newman and Jerome P. Lavelle, "Engineering Economics and Analysis" Engineering Press, 2002.
2. Degarmo, E.P., Sullivan, W.G. and Canada, J.R., "Engineering Economy", Macmillan, 1984.
3. Grant, E.L., Ireson, W.G. and Leavenworth, R.S., "Principles of Engineering Economy", Ronald Press, 1976.
4. Smith, G.W., "Engineering Economy", Iowa State Press, 1973.

PROJECT WORK

(Common to all Branches)

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OBJECTIVE

The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present periodical seminars on the progress made in the project.

Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as per specified guidelines.

The continuous assessment shall be made as prescribed in the regulations (vide clause 10.3 of Regulations 2004 for B.E., B.Tech. programmes)

ELECTIVES FOR VII SEMESTER

PROCESS PLANNING AND COST ESTIMATION

(Common to Mechanical and Production)

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UNIT I WORK STUDY AND ERGONOMICS 9

Method study – Definition – Objectives – Motion economy – Principles – Tools and Techniques – Applications – Work measurements – Purpose – Use – Procedure – Tools and techniques – Standard time – Ergonomics – Principles – Applications.

UNIT II PROCESS PLANNING 9

Definition – Objective – Scope – Approaches to process planning – Process planning activities – Finished part requirements – Operating sequences – Machine selection – Material selection parameters – Set of documents for process planning – Developing manufacturing logic and knowledge – Production time calculation – Selection of cost optimal processes.

UNIT III INTRODUCTION TO COST ESTIMATION 7

Objective of cost estimation – Costing – Cost accounting – Classification of cost – Elements of cost – Simple problems.

UNIT IV COST ESTIMATION 8

Types of estimates – Methods of estimates – Data requirements and sources – Collection of cost – Allowances in estimation.

UNIT V PRODUCTION COST ESTIMATION 2

Estimation of material cost, labour cost and over heads – Allocation of overheads – Estimation for different types of jobs manufactured by casting, forging, welding and machining.

Total : 45

TEXT BOOKS

1. Sinha, B.P., "Mechanical Estimating and Costing", Tata McGraw-Hill, Publishing Co., 1995.
2. Phillip F. Ostwalal and Jairo Munez, "Manufacturing Processes and Systems", 9th Edition, John Wiley, 1998.

REFERENCES

1. Russell, R.S. and Tailor, B.W., "Operations Management", 4th Edition, PHI, 2003.
2. Chitale, A.V. and Gupta, R.C., "Product Design and Manufacturing", 2nd Edition, PHI, 2002.

ROBOTICS

(Common to Automobile, Mechanical and Production)

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UNIT I FUNDAMENTALS OF ROBOT 7

Robot – Definition – Robot anatomy – Co-ordinate systems, work envelope, types and classification – Specifications – Pitch, yaw, roll, joint notations, speed of motion and pay load – Robot parts and their functions – Need for robots – Different applications

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 10

Pneumatic drives – Hydraulic drives – Mechanical drives – Electrical drives – D.C. servo motors – Stepper motor – A.C. servo motors – Salient features – Applications and comparison of all these drives – End effectors – Grippers – Mechanical grippers, Pneumatic and Hydraulic grippers – Magnetic grippers – Vacuum grippers – Two fingered and three Fingered grippers – Internal grippers and External Grippers – Selection and design considerations

UNIT III SENSORS AND MACHINE VISION 10

Requirements of a sensor – Principles and applications of the following types of sensors – Position of sensors (Piezo electric sensor, LVDT, Resolvers, Optical encoders, Pneumatic position sensors) – Range sensors (Triangulation principle, Structured, Lighting approach, Time of flight range finders, Laser range meters) – Proximity sensors (Inductive, Hall effect, Capacitive, Ultrasonic and Optical proximity sensors) – Touch sensors (Binary Sensors, Analog sensors) – Wrist sensors – Compliance sensors – Slip sensors

Camera, Frame grabber, Sensing and digitizing image data – Signal conversion, Image storage and Lighting techniques – Image processing and analysis – Data reduction, Segmentation, Feature extraction, Object recognition and other algorithms – Applications – Inspection, Identification, Visual serving and Navigation.

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING 10

Forward kinematics, Inverse kinematics and Differences – Forward kinematics and Reverse kinematics of Manipulators with two, three degrees of freedom (In 2 Dimensional) – Four degrees of freedom (In 3 dimensional) – Deviations and problems

Teach pendant programming – Lead through programming – Robot programming Languages – VAL programming – Motion commands, sensor commands, end effector commands and simple programs

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS 8

RGV – AGV – Implementation of robots in industries – Various steps – Safety considerations for robot operations – Economic analysis of robots – Pay back method – EUAC method – Rate of return method.

Total: 45

TEXT BOOK

1. Groover, M.P., “Industrial Robotics – Technology, Programming and Applications”, McGraw-Hill, 2001.
2. Fu, K.S., Gonzalz. R.C. and Lee C.S.G., “Robotics Control, Sensing, Vision and Intelligence”, McGraw-Hill Book Co., 1987.

REFERENCES

1. Yoram Koren, “Robotics for Engineers”, McGraw-Hill Book Co., 1992.
2. Janakiraman, P.A., “Robotics and Image Processing”, Tata McGraw-Hill, 1995.

DESIGN OF JIGS, FIXTURES AND PRESS TOOLS

(Common to Automobile and Mechanical)

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UNIT I PURPOSE TYPES AND FUNCTIONS OF JIGS AND FIXTURES 8

Tool design objectives – Production devices – Inspection devices – Materials used in Jigs and Fixtures – Types of Jigs – Types of Fixtures – Mechanical actuation – Pneumatic and hydraulic actuation – Analysis of clamping force – Tolerance and error analysis.

UNIT II JIGS 9

Drill bushes – Different types of jigs: plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs-Automatic drill jigs-Rack and pinion operated – Air operated jigs components – Design and development of jigs for given components.

UNIT III FIXTURES 9

General principles of boring, lathe, milling and broaching fixtures – Grinding, planning and shaping fixtures – Assembly, inspection and welding fixtures – Modular fixtures – Design and development of fixtures for given component.

UNIT IV PRESS WORKING TERMINOLOGIES, ELEMENTS OF DIES AND STRIP LAY OUT 10

Press working terminology – Presses and press accessories – Computation of capacities and tonnage requirements – Elements of progressive combination and compound dies: Die block – Die shoe – Bolster plate, punch plate, punch holder, guide pins and bushes – Strippers – Knockouts – Stops – Pilots – Selection of standard die sets strip lay out – Strip lay out calculations

UNIT V DESIGN AND DEVELOPMENT OF DIES 9

Design and development of progressive and compound dies for blanking and piercing operations – Bending dies – Development of bending dies – Forming and drawing dies – Development of drawing dies – Design considerations in forging, extrusion, casting and plastic dies

Total: 45

(Use of approved design data book is permitted)

TEXT BOOKS

1. Edward G. Hoffman, "Jigs and Fixture Design", Thomson – Delmar Learning, 2004.
2. Donaldson, C., "Tool Design", Tata McGraw-Hill, 1986.

REFERENCES

1. Kempster, "Jigs and Fixtures Design", The English Language Book Society, 1978.
2. Joshi, P.H., "Jigs and Fixtures", 2nd Edition, Tata McGraw-Hill Publishing Company Limited, 2004.
3. Hiram E. Grant, "Jigs and Fixture", Tata McGraw-Hill, 2003.
4. "Design Data Handbook", PSG College of Technology, Coimbatore.

COMPUTATIONAL FLUID DYNAMICS

(Common to Aeronautical and Mechanical)

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UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 9

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for turbulent flow – Turbulence, Kinetic and Energy equations – Mathematical behavior of PDEs on CFD: Elliptic, Parabolic and Hyperbolic equations.

UNIT II DISCRETIZATION AND SOLUTION METHODOLOGIES 9

Methods of deriving the discretization equations – Taylor series formulation – Finite difference method – Control volume formulation – Spectral method.

Solution methodologies: Direct and iterative methods, Thomas algorithm, Relaxation method and Alternating direction implicit method.

UNIT III HEAT CONDUCTION 9

Finite difference and finite volume formulation of steady/transient one-dimensional conduction equation – Source term linearization – Incorporating boundary conditions – Finite volume formulations for two and three dimensional conduction problems.

UNIT IV CONVECTION AND DIFFUSION 9

Finite volume formulation of steady state one-dimensional convection and diffusion problems – Central, upwind, hybrid and power-law schemes – Discretization equations for two dimensional convection and diffusion.

UNIT V CALCULATION OF FLOW FIELD 9

Representation of the pressure – Gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and velocity corrections – Pressure – Correction equation, simple algorithm and its variants – Turbulence models: mixing length model and Two equation (k- ϵ) models.

Total: 45

TEXT BOOKS

1. Versteeg, H.K, and Malalasekera, W., “An Introduction to Computational Fluid Dynamics: The Finite Volume Method”, Longman, 1998.
2. Ghoshdastidar, P.S., "Computer Simulation of Flow and Heat Transfer", Tata McGraw-Hill Publishing Company Ltd., 1998.

REFERENCES

1. Patankar, S.V., “Numerical Heat Transfer and Fluid Flow”, McGraw-Hill, 2004.
2. Muralidhar, K. and Sundarajan, T., “Computational Fluid Flow and Heat Transfer”, Narosa Publishing House, 1995.
3. Bose, T.K., “Numerical Fluid Dynamics”, Narosa Publishing House, 1997.
4. Muralidhar, K. and Biswas, “Advanced Engineering Fluid Mechanics”, Narosa Publishing House, 1996.
5. Anderson, J.D., “Computational Fluid Dynamics – The Basics with Applications”, 1995.

MODERN CONCEPTS OF ENGINEERING DESIGN

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UNIT I PRODUCT DESIGN PROCESS 9

Importance of product design – Design process – Design considerations – Morphology of design – Marketing organisation for design – Computer aided engineering – Codes and standards – Design review – Technological innovation and design process – Product and process cycles – Societal considerations in design.

UNIT II PRODUCT PLANNING AND SPECIFICATION 9

Opportunities identification – Evaluation – Resource allocation – Pre-project planning – Customer need identification – Establishing target specification – Setting the final specification.

UNIT III CONCEPT GENERATION, SELECTION AND TESTING 9

Activity of concept generation – Clarification of problem – External and internal searches – Concept exploration – Result analysis – Overview of selection methodologies – Concept screening – Concept scoring – Concept testing – Choice of survey population – Survey formats – Measurement of customer response – Interpretation and analysis of results.

UNIT IV PRODUCT ARCHITECTURE, INDUSTRIAL DESIGN, DESIGN FOR MANUFACTURE AND PROTOTYPING 9

Product architecture – Implications – Establishment – Platform planning – System level design – Need for industrial design and its impact – The Industrial design process and its management – Assessment of quality – Overview of Design for Manufacture process – Steps in DFM – Basics principles of prototyping – Prototyping technologies – Planning for prototypes.

UNIT V ROBUST DESIGN AND PRODUCT DEVELOPMENT ECONOMICS AND INTELLECTUAL PROPERTY RIGHTS 9

Design of experiments – Steps in the robust design process – Elements of economic analysis – Steps in economic analysis process – Overview of patents – Utility patents – Steps in preparing disclosure.

Total: 45

TEXT BOOKS

1. Ulrich, K.T. and Eppinger, S.D., “Product Design and Development”, McGraw-Hill Book Company, International Edition, 2003.
2. Dieter, G.E., “Engineering Design”, McGraw-Hill Book Company, International Edition, 2000.

REFERENCES

1. Ullman, D.G., “The Mechanical Design Process”, 3rd Edition, McGraw-Hill Book Co, 2003.
3. Otto, K.N. and Wood, K.L., “Product Design-Techniques in Reverse Engineering and New product Development”, Pearson Education, 2004.
4. Yousef Haik, “Engineering Design Process”, Vikas Publishing House, 1999.

THERMAL TURBOMACHINES

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UNIT I INTRODUCTION TO TURBO MACHINES 9

Turbines, pumps, compressors, fans and blowers – Stages of turbo machines – Energy transfer between fluid and rotor – Stage velocity triangles – Thermal Turbo machines – Classification – General energy equation – Modified to turbo machines – Compression and expansion process – Velocity triangles – Work – T-S and H-S diagram – Total-to-Total and Total-to-Static efficiencies – Dimensional analysis – Non dimensional parameters of compressible flow Turbo machines – Similarity laws, applications and limitations.

UNIT II CENTRIFUGAL FANS AND BLOWERS 9

Definition, selection and classifications – Types of balding design – Velocity triangles – Stage parameters – Flow analysis in impeller blades – Design parameter – Volute and diffusers – Efficiencies and losses – Fan noises – Causes and remedial measures – Centrifugal Compressors: Constructional details – Stage velocity triangles – Stage work – Stage pressure rise – Stage efficiency – Degree of reaction – Slip factor – H-S diagram – Efficiencies – Performance characteristics.

UNIT III AXIAL FANS AND PROPELLERS 9

Definition and classifications – Stage parameters – Types of fan stages – Performance characteristics – Cascade of blades – Cascade tunnel – Blade geometry – Cascade variables – Energy transfer and loss in terms of lift and drag – Axial Flow Compressors: definition and classifications – Constructional details – Stage velocity triangles – Stage work – Stage pressure rise – H-S diagram – Stage efficiencies and losses – Degree of reaction – Radial equilibrium – Surging and Stalling – Performance characteristics.

UNIT IV AXIAL FLOW TURBINES 9

Construction details – 90° IFR turbine – Stage work – Stage velocity triangles – Stage pressure rise – Impulse and reaction stage – Effect of degree of reaction – H-S diagram – Efficiencies and losses – Performance characteristics.

UNIT V RADIAL FLOW TURBINES AND WIND TURBINES 9

Constructional details – Stage velocity triangles – H-S diagram – Stage efficiencies and losses – Performance characteristics – Wind turbines: definition and classifications – Constructional details – Horizontal axis wind turbine – Power developed – Axial thrust – Efficiency.

Total : 45

TEXT BOOKS

1. Yahya, S.H., “Turbines, Compressors and Fans”, Tata McGraw-Hill Publishing Company, 1996.
2. Dixon, S.L., “Fluid Mechanics, Thermodynamics of Turbo-machines”, 2nd Edition, Pergamon Press, 1990.

REFERENCES

1. Kadambi, V. and Manohar Prasad, “An Introduction to Energy Conversion - Vol. III”, Turbo-machines, Wiley Eastern India Ltd, 1977.
2. Shepherd D.H., “Principles of Turbomachinery”, The Macmillan Company, 1969.

COMPOSITE MATERIALS

(Common to Automobile, Mechanical and Production)

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UNIT I INTRODUCTION TO COMPOSITES 8

Fundamentals of composites – Need for composites – Enhancement of properties – Classification of composites – Matrix: Polymer matrix composites (PMC) – Metal matrix composites (MMC) – Ceramic matrix composites (CMC) – Reinforcement – Particle reinforced composites – Fibre reinforced composites – Applications of various types of composites.

UNIT II POLYMER MATRIX COMPOSITES 12

Polymer matrix resins – Thermosetting resins – Thermoplastic resins – Reinforcement fibres – Rovings – Woven fabrics – Non woven random mats – Various types of fibres – PMC processes – Hand lay up processes – Spray up processes – Compression moulding – Reinforced reaction injection moulding – Resin transfer moulding – Pultrusion – Filament winding – Injection moulding – Fibre reinforced plastics (FRP) – Glass fibre reinforced plastics (GRP).

UNIT III METAL MATRIX COMPOSITES 9

Characteristics of MMC – Various types of metal matrix composites Alloy vs MMC – Advantages of MMC – Limitations of MMC – Metal matrix – Reinforcements – Particles – fibres – Effect of reinforcement – Volume fraction – Rule of mixtures – Processing of MMC – Powder metallurgy process – Diffusion bonding – Stir casting – Squeeze casting.

UNIT IV CERAMIC MATRIX COMPOSITES 9

Engineering ceramic materials – Properties – Advantages – Limitations – Monolithic ceramics – Need for CMC – Ceramic matrix – Various types of ceramic matrix composites – Oxide ceramics – Non oxide ceramics – Aluminium oxide – Silicon nitride – Reinforcements – Particles – Fibres – Whiskers – Sintering – Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing).

UNIT V ADVANCES IN COMPOSITES 7

Carbon/carbon composites – Advantages of carbon matrix – Limitations of carbon matrix Carbon fibre – Chemical vapour deposition of carbon on carbon fibre perform – Sol gel technique – Composites for aerospace applications.

Total: 45

TEXT BOOKS

1. Mathews, F.L. and Rawlings, R.D., “Composite materials: Engineering and Science”, 1st Edition, Chapman and Hall, 1994.
2. Chawla, K.K., “Composite Materials”, Springer – Verlag, 1987.

REFERENCES

1. Clyne, T.W. and Withers, P.J., “Introduction to Metal Matrix Composites”, Cambridge University Press, 1993.
2. Strong, A.B., “Fundamentals of Composite Manufacturing”, SME, 1989.
3. Sharma, S.C., “Composite Materials”, Narosa Publications, 2000.

ELECTIVES FOR VIII SEMESTER

PRODUCTION PLANNING AND CONTROL

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UNIT I INTRODUCTION

9

Objectives and benefits of planning and control – Functions of production control – Types of production, job, batch and continuous – Product development and design – Marketing aspect – Functional aspects – Operational aspect – Durability and dependability aspect – Aesthetic aspect – Profit consideration – Standardization, simplification and specialization – Break even analysis – Economics of a new design.

UNIT II WORK STUDY

9

Method study – Basic procedure – Selection – Recording of process – Critical analysis – Development – Implementation – Micro motion and macro motion study – Work measurement – Techniques of work measurement – Time study – Production study – Work sampling – Synthesis from standard data – Predetermined motion time standards.

UNIT III PRODUCT PLANNING AND PROCESS PLANNING

9

Product planning – Extending the original product information – Value analysis – Problems in lack of product planning – Process planning and routing – Pre requisite information needed for process planning – Steps in process planning – Quantity determination in batch production – Machine capacity and balancing – Analysis of process capabilities in a multi product system.

UNIT IV PRODUCTION SCHEDULING

9

Production Control Systems – Loading and scheduling – Master Scheduling – Scheduling rules – Gantt charts – Perpetual loading – Basic scheduling problems – Line of balance – Flow production scheduling – Batch production scheduling – Product sequencing – Production Control systems – Periodic batch control – Material requirement planning kanban – Dispatching – Progress reporting and expediting – Manufacturing lead time – Techniques for aligning completion times and due dates.

UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PPC

9

Inventory control – Purpose of holding stock – Effect of demand on inventories – Ordering procedures – Two bin system – Ordering cycle system – Determination of Economic order quantity and economic lot size – ABC analysis – Recorder procedure – Introduction to computer integrated production planning systems – Elements of JUST IN TIME SYSTEMS – Fundamentals of MRP II and ERP.

Total: 45

TEXT BOOK

1. Martand Telsang, “Industrial Engineering and Production Management”, 1st Edition, S. Chand and Company, 2000.
2. Samson Eilon, “Elements of Production Planning and Control”, Universal Book Corporation, 1984.

REFERENCES

1. Elwood S. Buffa, and Rakesh K. Sarin, “Modern Production / Operations Management”, 8th Edition, John Wiley and Sons, 2000.
2. Jain, K.C. and Aggarwal, L.N., “Production Planning Control and Industrial Management”, Khanna Publishers, 1990.
3. Nair, N.G., “Production and Operations Management”, Tata McGraw-Hill, 1996.
4. Chary, S.N., “Theory and Problems in Production and Operations Management”, Tata McGraw Hill, 1995.
5. Hajra Choudhury, S.K, Nirjhar Roy and Hajra Choudhury, A.K., “Production Management”, Media Promoters and Publishers Pvt. Ltd., 1998.

ADVANCED STRENGTH OF MATERIALS

L T P
3 0 0

UNIT I ANALYSIS OF PLATES 8

Mathematical modeling of plates with normal loads – Point and distributed loads – Support conditions – Rectangular plates – Stresses along coordinate axes – Plate deformations – Axisymmetric plates – Radial and tangential stresses – Plate deflections.

UNIT II THICK CYLINDERS AND SPHERES 10

Equilibrium and compatibility conditions – Lamé's Theorem – Boundary conditions – Distribution of radial and tangential stresses – Compound cylinders – Interference fits – Stresses due to temperature distributions.

UNIT III ROTATING DISCS 10

Lame-Clayperon Theorem – Radial and tangential stresses in discs due to centrifugal effects – Boundary conditions – Solid and hollow discs – Interference fit on shafts – Strengthening of the hub – Residual stresses – Autofrettege – Discs of variable thickness – Disc profile for uniform strength.

UNIT IV BEAMS ON ELASTIC FOUNDATION 8

Infinite beam subjected to concentrated load – Boundary Conditions – Infinite beam subjected to a distributed load segment – Triangular load – Semi infinite beam subjected to loads at the ends and concentrated load near the ends – Short beams.

UNIT V CURVED BEAMS AND CONTACT STRESSES 9

Analysis of stresses in beams with large curvature – Stress distribution in curved beams – Stresses in crane hooks and C clamps – Contact Stresses – Hertz equation for contact stresses – Applications to rolling contact elements.

Total: 45

TEXT BOOKS

1. Boresi, A.P. and Schmidt, R.J., "Advanced Mechanics of Materials", 6th Edition, John Wiley and Sons, 2003.
2. Dally, J.W. and Riley, W.F., "Experimental Stress Analysis", John Wiley and Sons, 2003.

REFERENCES

1. Burr, A. H. and Cheatham, J.B., "Mechanical Analysis and Design", 2nd Edition, Prentice Hall of India, 2001.
2. Den-Hartog J.P., "Strength of Materials", John Wiley and Sons, 2001.

PRODUCT DESIGN AND COSTING

(Common to Automobile, Mechanical and Production)

L T P
3 0 0

UNIT I PRODUCT DESIGN AND DEVELOPMENT 8

Principles of creativity in design – Integrated product development and concurrent engineering – Product analysis – Criteria for product design – Market research – Design for customer and design for manufacture – Product life cycle.

UNIT II ECONOMICS OF DESIGN 9

Breaks even point – Selection of optimal materials and processes – Material layout planning – Value analysis – Re-engineering and its impact on product development.

UNIT III PRODUCT MODELING 9

Product modeling – Definition of concept – Fundamental issues – Role and basic requirement of process chains and product models – Types of product models – Model standardization efforts – Types of process chains – Industrial demands

UNIT IV PRODUCT COSTING 10

Bill of materials – Outline Process charts – Concepts of operational standard time – Work measurement by analytical estimation and synthesis of time – Budgets times – Labor cost and material cost at every stage of manufacture – W.I.P. costing

UNIT V RECENT ADVANCES AND CONCEPTS IN PRODUCT DESIGN 9

Fundamentals of FEM and its significance to product design – Product life cycle management – Intelligent information system – Concept of knowledge based product and process design.

Total: 45

TEXT BOOKS

1. Sameul Eilon, “Elements of Production Planning and Control”, McMillan and Company, 1962.
2. Jones, S.W., “Product Dosing and Process Selection”, Butterworth Publications, 1973.
3. Karl T. Ulrich and Stephen D. Eppinger, “Product Design and Development”, McGraw-Hill, 1994.

REFERENCES

1. Harry Nystrom, “Creativity and Innovation”, John Wiley and Sons, 1979.
2. George E. Dieter, “Engineering Design – Materials and Process Approach”, Tata McGraw-Hill, 1991.
3. Donald E. Carter, “Concurrent Engineering”, Addison Wesley, 1992.

OPERATIONS RESEARCH

(Common to Automobile and Mechanical)

L T P
3 0 0

UNIT I LINEAR MODEL 9

The phases of OR study – Formation of an L.P model – Graphical solution – Simplex algorithm – Artificial variables technique – Big M method – Two phase method.

UNIT II TRANSPORTATION PROBLEM 9

Optimal solution by north west corner method – Least cost method – Vogels approximation method – Optimality test – MOBI method.

Assignment problem – Formulation – Hungarian method – Unbalanced assignment problem.

UNIT III NETWORK MODELS 9

Shortest route – Minimal spanning tree – Maximum flow models – Project network – CPM and PERT network – Critical path scheduling.

UNIT IV REPLACEMENT MODELS 9

Replacement of items that deteriorate with time – Value of money changing with time – Not charging with time – Optimum replacement policy – Individual and group replacement – Sequencing problem: models with n jobs with 2 machines – Problem with n jobs with 3 machines.

UNIT V QUEUING THEORY 9

Queuing models – Queuing systems and structures – Notation – Parameter – Single server and multiserver models – Poisson input – Exponential service – Constant rate service – Infinite population.

Total: 45

TEXT BOOK

1. Taha, H.A, “Operation Research”, 6th Edition, Pearson Education, 2003.
2. Hira and Gupta, “Introduction to Operations Research”, S.Chand and Co., 2002.

REFERENCES

1. Hira and Gupta, “Problems in Operations Research”, S.Chand and Co, 2002.
2. Panneerselvam, “Operations Research”, Prentice Hall of India, 2003.
3. Wagner, “Operations Research”, Prentice Hall of India, 2000.

MAINTENANCE ENGINEERING
(Common to Mechanical and Production)

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UNIT I PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING 10

Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity – Importance and benefits of sound Maintenance systems – Reliability and machine availability – MTBF, MTTR and MWT – Factors of availability – Maintenance organization – Maintenance economics.

UNIT II MAINTENANCE POLICIES – PREVENTIVE MAINTENANCE 9

Maintenance categories – Comparative merits of each category – Preventive maintenance – Maintenance schedules – Repair cycle – Principles and methods of lubrication – TPM.

UNIT III CONDITION MONITORING 9

Condition Monitoring – Cost comparison with and without CM – On-load testing and off-load testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear-debris analysis

UNIT IV REPAIR METHODS FOR BASIC MACHINE ELEMENTS 10

Repair methods for beds, slideways, spindles, gears, lead screws and bearings – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location.

UNIT V REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT 8

Repair methods for material handling equipment – Equipment records – Job order systems – Use of computers in maintenance.

Total: 45

TEXT BOOKS

1. Srivastava, S.K., “Industrial Maintenance Management”, S. Chand and Co., 1981.
2. Bhattacharya, S.N., “Installation, Servicing and Maintenance”, S. Chand and Co., 1995.

REFERENCES

1. White, E.N., “Maintenance Planning”, Documentation, Gower Press, 1979.
2. Garg, M.R., “Industrial Maintenance”, S. Chand and Co., 1986.
3. Higgins, L.R., “Maintenance Engineering Hand Book”, 5th Edition, McGraw Hill, 1988.
4. Armstrong, “Condition Monitoring”, BSIRSA, 1988.
5. Davies, “Handbook of Condition Monitoring”, Chapman and Hall, 1996.

PROFESSIONAL ETHICS AND HUMAN VALUES

(Common to Aeronautical, Automobile, Marine, Mechanical and Production)

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UNIT I HUMAN VALUES 10

Morals, values and ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issued – Types of inquiry – Moral dilemmas – Moral autonomy – Kohlberg's theory – Gilligan's theory – Consensus and controversy – Models of Professional Roles – Theories about right action – Self-interest – Customs and religion – Uses of ethical theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation – Engineers as responsible experimenters – Codes of ethics – A balanced outlook on law – The challenger case study.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and risk – Assessment of safety and risk – Risk benefit analysis and reducing risk – The Three Mile Island and Chernobyl case studies

Collegiality and loyalty – Respect for authority – Collective bargaining – Confidentiality – Conflicts of interest – Occupational crime – Professional rights – Employee rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V GLOBAL ISSUES 8

Multinational corporations – Environmental ethics – Computer ethics – Weapons development – Engineers as managers – Consulting engineers – Engineers as expert witnesses and advisors – Moral leadership – Sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE), India, etc.

Total: 45

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, 1996.
2. Govindarajan, M., Natarajan, S. and Senthil Kumar, V.S., "Engineering Ethics", Prentice Hall of India, 2004.

REFERENCES

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, 2004.
2. John R. Boatright, "Ethics and the Conduct of Business", Pearson Education, 2003.
3. Edmund G. Seebauer and Robert L. Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, 2001.