ANNA UNIVERSITY TIRUCHIRAPPALLI
Tiruchirappalli – 620 024

Regulations 2008

Syllabus

B.E. MECHANICAL ENGINEERING

SEMESTER III

MA1201 – TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

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

L	T	P	C
3	1	0	4

UNIT I 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 II FOURIER TRANSFORMS **9**

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

UNIT III PARTIAL DIFFERENTIAL EQUATIONS **9**

Formation of partial differential equations – Lagrange's linear equation – Solutions of standard types of first order partial differential equations - Linear partial differential equations of second and higher order with constant coefficients.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS **9**

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

UNIT V Z -TRANSFORMS AND DIFFERENCE EQUATIONS **9**

Z-transforms – 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 BOOKS

1. Grewal, B.S., “Higher Engineering Mathematics”, 40th Edition, Khanna publishers, 2007.
2. Erwin Kreyszig, “Advanced Engineering Mathematics”, 8th Edition, Wiley India, 2007.

REFERENCES

1. Bali, N.P. and Manish Goyal, “A Textbook of Engineering Mathematics”, 7th Edition, Laxmi Publications (P) Ltd., 2007.
2. Ramana, B.V., “Higher Engineering Mathematics”, Tata Mc-GrawHill Publishing Company limited, 2007.
3. Glyn James, “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education, 2007.

PR1204 – MANUFACTURING TECHNOLOGY I

L	T	P	C
3	0	0	3

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 – Moulding machines – Types of moulding machines - Melting furnaces – Working principle of Special casting processes – Shell – investment casting – Ceramic mould – Lost Wax process – Pressure die casting – Centrifugal casting – CO_2 process – Sand Casting defects.

UNIT II JOINING PROCESSES 9

Fusion welding processes – Types of Gas welding – Equipments used – Flame characteristics – Filler and Flux materials - Arc welding equipments - Electrodes – Coating and specifications – Principles of Resistance welding – Spot/butt – Seam – Projection welding – Percusion welding – GS metal arc welding – Flux cored – Submerged arc welding – Electro slag welding – TIG welding – Principle and application of special welding processes – Plasma arc welding – Thermit welding – Electron beam welding – Friction welding – Diffusion welding – Weld defects – Brazing – Soldering process – Methods and process capabilities – Filler materials and fluxes – Types of Adhesive bonding.

UNIT III BULK DEFORMATION PROCESSES 9

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

UNIT IV SHEET METAL PROCESSES 9

Sheet metal characteristics – Typical shearing operations – Bending – Drawing operations – Stretch forming operations — Formability of sheet metal – Test methods – Working principle and application of special forming processes – Hydro forming – Rubber pad forming – Metal spinning – Introduction to Explosive forming – Magnetic pulse forming – Peen forming – Super plastic forming.

UNIT V MANUFACTURING OF PLASTIC COMPONENTS 9

Types of plastics – Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of – Injection moulding – Plunger and screw machines – Compression moulding – Transfer moulding – Typical industrial applications – Introduction to Blow moulding – Rotational moulding – Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics.

Total: 45

TEXT BOOKS

1. Hajra Choudhury, "Elements of Workshop Technology, Vol. I and II", Media Promotors Pvt Ltd., 2001
2. S.Gowri, P.Hariharan, and A.Suresh Babu, "Manufacturing Technology I", Pearson Education, 2008.

REFERENCES

1. B.S. Magendran Parashar & R.K. Mittal, "Elements of Manufacturing Processes", Prentice Hall of India, 2003.
2. P.N. Rao, "Manufacturing Technology", 2nd Edition, Tata McGraw-Hill Publishing Limited, 2002.
3. P.C. Sharma, "A Text Book of Production Technology", 4th Edition, S. Chand and Company, 2003.

ME1201 – ENGINEERING THERMODYNAMICS

(Common to Mechanical and Automobile)

L	T	P	C
3	1	0	4

UNIT I BASIC CONCEPTS AND FIRST LAW 9

Concept of continuum – macroscopic approach – Thermodynamic systems – closed –open – isolated – Thermodynamic Property – state – path and process – quasi-static process – work –modes of work – Zeroth law of thermodynamics – concept of temperature and heat – Concept of 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 equipments

UNIT II SECOND LAW 9

Second law of thermodynamics – Kelvin's and Clausius statements of second law – Reversibility and irreversibility – Carnot theorem – Carnot cycle – Reversed carnot cycle – efficiency – COP – Thermodynamic temperature scale – Clausius inequality – concept of entropy – entropy of ideal gas – principle of increase of entropy – availability.

UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE 9

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

UNIT IV IDEAL AND REAL GASES AND THERMODYNAMIC RELATIONS 9

Gas mixtures – Properties ideal and real gases – Equations of state – Avagadro's Law – Vander Waal's equation of state – compressability factor – compressability chart – Dalton's law of partial pressure – exact differentials – T-D relations – Maxwell's relations – Clausius Clapeyron equations – Joule –Thomson coefficient

UNIT V PSYCHROMETRY 9

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

L: 45 T: 15 Total: 60

(Standard thermodynamic tables, Mollier diagram, Psychrometric chart and Refrigerant property tables may be used)

TEXT BOOKS

1. Nag, P.K., "Engineering Thermodynamics", Tata McGraw-Hill, 1998.
2. Cengel, 'Thermodynamics – An Engineering Approach", 3rd Edition, Tata McGraw Hill, 2003.

REFERENCES

1. Holman, J.P., "Thermodynamics", 3rd Edition, McGraw-Hill, 1995.
2. Venwylen and Sontag, "Classical Thermodynamics", Wiley Eastern, 1987.
3. Arora, C.P., "Thermodynamics", Tata McGraw-Hill, 2003.

ME1202 – KINEMATICS OF MACHINERY

L	T	P	C
3	1	0	4

UNIT I BASICS OF MECHANISMS 7

Definitions – Link – Kinematic pair – Kinematic chain – Mechanism – Machine – Degree of Freedom – Mobility – Kutzbach criterion (Gruebler's equation) – Grashoff's law – Kinematic Inversions of four-bar chain and slider crank chain – Mechanical Advantage – Transmission angle

Description of common Mechanisms – Offset slider mechanism as quick return mechanisms – Pantograph – Straight line generators (Peaucellier and Watt mechanisms) – Steering gear for automobile – Hooke's joint – Toggle mechanism – Ratchets – Escapements – Indexing Mechanisms

UNIT II KINEMATIC ANALYSIS 10

Analysis of simple mechanisms (Single slider crank mechanism and four bar mechanism) – Graphical Methods for displacement – Velocity and Acceleration – Shaping machine mechanism – Coincident points – Coriolis acceleration – Analytical method of analysis of slider crank mechanism and four bar mechanism – Approximate analytical expression for displacement, velocity and acceleration of piston of reciprocating engine mechanism.

UNIT III KINEMATICS OF CAMS 8

Classifications – Displacement diagrams – Parabolic, Simple harmonic and Cycloidal motions – Graphical construction of displacement diagrams and layout of plate cam profiles – Circular arc and tangent cams – Pressure angle and undercutting.

UNIT IV GEARS 10

Classification of gears – Gear tooth terminology – Fundamental law of toothed gearing and involute gearing – Length of path of contact and contact ratio – Interference and undercutting – Gear trains – Simple – Compound – Epicyclic gear trains – Differentials.

UNIT V FRICTION 10

Dry friction – Friction in screw jack – Pivot and collar friction – Plate clutches – Belt and rope drives – Block brakes – Band brakes

L: 45 T: 15 Total: 60

TEXT BOOKS

1. Ambekar, A.G., "Mechanism and Machine Theory", Prentice Hall of India, 2007.
2. Uicker, J.J., Pennock, G.R. and Shigley, J.E., "Theory of Machines and Mechanisms"(Indian Edition), Oxford University Press, 2003.

REFERENCES

1. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984.
2. Ramamurti, V., Mechanism and Machine Theory", 2nd Edition, Narosa Publishing House, 2005.
3. Ghosh, A. and Mallick, A.K., "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., 1998.

BIS Codes of Practice/Useful Websites

1. IS 2458 : 2001, Vocabulary of Gear Terms – Definitions Related to Geometry
2. IS 2467 : 2002 (ISO 701: 1998), International Gear Notation – Symbols for Geometric Data.
3. IS 5267 : 2002 Vocabulary of Gear Terms – Definitions Related to Worm Gear Geometry.
4. IS 5037 : Part 1 : 2004, Straight Bevel Gears for General Engineering and Heavy Engineering - Part 1: Basic Rack.
5. IS 5037 : Part 2 : 2004, Straight Bevel Gears for General Engineering and Heavy Engineering - Part 2: Module and Diametral Pitches.

Web site: www.howstuffworks.com

CE1208 – FLUID MECHANICS AND MACHINERY

(Common to Mechanical, Automobile, Aeronautical and Production)

L	T	P	C
3	1	0	4

UNIT I INTRODUCTION 9

Units & Dimensions – Properties of fluids – Specific gravity – Specific weight – Viscosity – Compressibility – Vapour pressure and gas laws – Capillarity and surface tension – Flow characteristics: concepts of system and control volume – Application of control volume to continuity equation – Energy equation – Momentum equation – Moment of momentum equation

UNIT II FLOW THROUGH CIRCULAR CONDUITS 9

Laminar flow through circular conduits and circular annuli – Boundary layer concepts – Boundary layer thickness – Hydraulic and energy gradient – Darcy – Weisbach equation – Friction factor and Moody diagram – Commercial pipes – Minor losses – Flow though pipes in series and in parallel

UNIT III DIMENSIONAL ANALYSIS 9

Dimension and units: Buckingham's Π theorem – Discussion on dimensionless parameters – Models and similitude – Applications of dimensionless parameters

UNIT IV ROTO DYNAMIC MACHINES 9

Homologues units – Specific speed – Elementary cascade theory – Theory of turbo machines – Euler's equation – Hydraulic efficiency – Velocity components at the entry and exit of the rotor – Velocity triangle for single stage radial flow and axial flow machines – Centrifugal pumps – Turbines – Performance curves for pumps and turbines

UNIT V POSITIVE DISPLACEMENT MACHINES 9

Reciprocating pumps – Indicator diagrams – Work saved by air vessels – Rotary pumps – Classification – Working and performance curves

L: 45 T: 15 Total: 60

TEXT BOOKS

1. Streeter, V.L. and Wylie, E.B., "Fluid Mechanics", McGraw Hill, 1983.
2. Radhakrishnan, E., "Fluid Mechanics", 2nd Edition, Prentice Hall of India, 2007.

REFERENCES

1. Ramamritham, S., "Fluid Mechanics, Hydraulics and Fluid Machines", Dhanpat Rai and Sons, 1988.
2. Kumar, K.L., "Engineering Fluid Mechanics", 7th Edition, Eurasia Publishing House (P) Ltd., 1995.
3. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", Laxmi Publications (P) Ltd., 2007.

EE1205 – ELECTRICAL DRIVES AND CONTROLS

(Common to Mechanical, Production and Petrochemical technology)

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION 9

Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – Heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors

UNIT II MOTOR CHARACTERISTICS 9

Mechanical characteristics – Speed –Torque characteristics of various types of load and drive motors – Braking of Electrical motors – DC motors – Shunt – Series – Compound – Single phase and three phase induction motors

UNIT III STARTING METHODS 9

Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors

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. Vedam Subramaniam, “Electric Drives (Concepts and Applications)”, Tata McGraw-Hill, 2001.
2. Nagrath, I.J. and Kothari, D.P., “Electrical Machines”, Tata McGraw-Hill, 1998.

REFERENCES

1. Pillai, S.K., “A First Course on Electric Drives”, Wiley Eastern Limited, 1998.
2. Singh, M.D. and Khanchandani, K.B., “Power Electronics”, Tata McGraw-Hill, 1998.
3 Partab, H., “Art and Science Utilisation of Electrical Energy”, Dhanpat Rai and Sons, 1994.

PR1205 – MANUFACTURING TECHNOLOGY LABORATORY I

L	T	P	C
0	0	3	2

UNIT I LATHE

1.1. Facing, plain turning and step turning

1.2. Taper turning using compound rest, Tailstock set over, etc

1.3. Single and Multi-start V thread, cutting and knurling

1.4. Boring and internal thread cutting.

UNIT II WELDING EXCERCISES

2.1. Horizontal, Vertical and Overhead welding.

2.2. Gas Cutting, Gas Welding

2.3. Brazing - for demonstration purpose

UNIT III SHEET METAL WORK

3.1. Fabrication of sheet metal tray

3.2. Fabrication of a funnel

UNIT IV PREPARATION OF SAND MOULD

4.1. Mould with solid, split patterns

4.2. Mould with loose-piece pattern

4.3. Mould with Core

UNIT V PLASTIC MOULDING

5.1 Injection Moulding- for demonstration purpose

Total Number of Periods: 45

LIST OF EQUIPMENTS

1.	**Centre Lathe with accessories**	15
2.	**Welding**	
2.1	Arc welding machine	04
2.2	Gas welding machine	01
2.3	Brazing machine	01
3.	**Sheet Metal Work facility**	
3.1	Hand Shear 300mm	01
3.2	Bench vice	05
3.3	Standard tools and calipers for sheet metal work	05
4	**Sand moulding Facility**	
4.1	Moulding Table	05
4.2	Moulding boxes, tools and patterns	05
5	**Plastic Moulding**	
5.1	Injection Moulding Machine	01

CE1211 – FLUID MECHANICS AND MACHINERY LABORATORY

(Common to Mechanical, Production, Aeronautical and Automobile)

L	T	P	C
0	0	3	2

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 Rotameter.
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.

LIST OF EQUIPMENTS

(for a batch of 30 students)

1. Orifice meter setup
2. Venturi meter setup
3. Rotameter setup
4. Pipe Flow analysis setup
5. Centrifugal pump/submergible pump setup
6. Reciprocating pump setup
7. Gear pump setup
8. Pelton wheel setup
9. Francis turbine setup
10. Kaplan turbine setup

Quantity: one each.

Total Number of Periods: 45

EE1206 – ELECTRICAL ENGINEERING LABORATORY

(Common to Mechanical and Production)

L	T	P	C
0	0	3	2

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

LIST OF EQUIPMENTS

(for batch of 30 students)

	Equipment		No.
1.	DC Shunt motor	-	2
2.	DC Series motor	-	1
3.	DC shunt motor-DC Shunt Generator set	-	1
4.	DC Shunt motor-DC Series Generator set	-	1
5.	Single phase transformer	-	2
6.	Three phase alternator	-	2
7.	Three phase synchronous motor	-	1
8.	Three phase Squirrel cage Induction motor	-	1
9.	Three phase Slip ring Induction motor	-	1
10.	Single phase Induction motor	-	1

Total Number of Periods: 45

SEMESTER IV

MA1254 – STATISTICS AND NUMERICAL METHODS

(Common to Automobile, Mechanical and Production)

L	T	P	C
3	1	0	4

UNIT I TESTING OF HYPOTHESIS 9

Sampling distributions – Tests for single mean, proportion, difference of means (large and small samples) – Tests for single variance and equality of variances – Chi-square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS 9

Completely randomized design – Randomized block design – Latin square design - 2^2 - Factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9

Newton-Raphson method – Gauss elimination method – Pivoting – Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel – Matrix inversion by Gauss-Jordan method – Eigen values of a matrix by Power method.

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9

Lagrange's and Newton's divided difference interpolation – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal and Simpson's 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9

Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge-Kutta method for solving first and second order equations – Milne's predictor-corrector methods for solving first order equations – Finite difference methods for solving second order equation.

L: 45 T: 15 Total: 60

TEXT BOOKS

1. Johnson, R.A. and Gupta, C.B., "Miller and Freund's Probability and Statistics for Engineers", 7th Edition, Pearson Education Asia, 2007.
2. Grewal, B.S. and Grewal, J.S., "Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, 2004.

REFERENCES

1. Walpole, R.E., Myers, R.H., Myers, S.L. and Ye, K., "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education Asia, 2007.
2. Spiegel, M.R., Schiller, J. and Srinivasan, R.A., "Schaum's Outlines Probability and Statistics", Tata McGraw Hill, 2004.
3. Chapra, S.C. and Canale, R.P., "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, 2007

ME1251 – HEAT AND MASS TRANSFER

L	T	P	C
3	1	0	4

UNIT I CONDUCTION 11

Basic Concepts – Mechanism of heat transfer – Conduction, convection and radiation – Fourier law of conduction – General differential equation of heat 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 –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 – Heat exchanger analysis – LMTD Method and NTU – Effectiveness – Overall heat transfer coefficient – Fouling factors.

UNIT IV RADIATION 8

Basic concepts – Laws of radiation – Stefan Boltzman law – Kirchoffs 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

TEXT BOOKS

1. Sachdeva, R.C., "Fundamentals of Engineering Heat and Mass Transfer", New Age International, 1995.
2. Incropera, F.P. and DeWitt, D.P., "Fundamentals of Heat and Mass Transfer", John Wiley and Sons, 1998.

REFERENCES

1. Yadav, R., "Heat and Mass Transfer" Central Publishing House, 1995.
2. Ozisik, M.N., "Heat Transfer", McGraw-Hill Book Co., 1994.
3. Kothandaraman, C.P., "Fundamentals of Heat and Mass Transfer" New Age International, 1998.

ME1252 – MANUFACTURING TECHNOLOGY II

L	T	P	C
3	0	0	3

UNIT I THEORY OF METAL CUTTING 9

Introduction – Material removal processes – Types of machine tools – Theory of metal cutting – Chip formation – Orthogonal cutting – Cutting tool materials – Tool wear – Tool life – Surface finish – Cutting fluids.

UNIT II CENTRE LATHE AND SPECIAL PURPOSE LATHES 9

Centre lathe – Constructional features – Cutting tool geometry – Various operations – Taper turning methods – Thread cutting methods – Special attachments – Machining time and power estimation – Capstan and turret lathes – Automats – Single spindle – Swiss type – Automatic screw type – Multi spindle – Turret Indexing mechanism – Bar feed mechanism.

UNIT III OTHER MACHINE TOOLS 9

Reciprocating machine tools: shaper, planer and slotter – Milling: types, milling cutters, operations – Hole making – Drilling – Quill mechanism, reaming, boring, tapping – Sawing machine – Hack saw, band saw, circular saw – Broaching machines – Broach construction – Push, pull, surface and continuous broaching machines

UNIT IV ABRASIVE PROCESSES AND GEAR CUTTING 9

Abrasive processes – Grinding wheel – Specifications and selection – Types of grinding process – Cylindrical grinding – Surface grinding – Centre less grinding – Honing, lapping, super finishing, polishing and buffing – Abrasive jet machining – Gear cutting – Forming – Generation – Shaping – Hobbing.

UNIT V CNC MACHINE TOOLS AND PART PROGRAMMING 9

Numerical control (NC) machine tools – CNC – Types – constructional details, special features – Design considerations of CNC machines for improving machining accuracy – Structural members – Slide ways – Linear bearings – Ball screws – Spindle drives and feed drives – Part programming fundamentals – Manual programming – Computer assisted part programming – Turing and machining centre.

Total: 45

TEXT BOOKS

1. Hajra Choudry, “Elements of Work Shop Technology Vol. II”, Media Promoters. 2002.
2. H.M.T., “Production Technology”, Tata McGraw-Hill, 1998.

REFERENCES

1. Rao, P.N., “Manufacturing Technology, Metal Cutting and Machine Tools”, Tata McGraw–Hill, 2003.
2. Sharma, P.C., “A Text Book of Production Engineering”, 4th Edition, S. Chand and Co. Ltd, 1993.
3. Groover, M.P. and Zimers Jr., “CAD/CAM”, Prentice Hall of India Ltd., 2004.

ME1253 – ENGINEERING MATERIALS AND METALLURGY

(Common to Mechanical, Automobile)

L	T	P	C
3	0	0	3

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9

Constitution of alloys – Solid solutions, substitutional and interstitial – Phase diagrams, isomorphous, eutectoid, eutectic, peritectic, and peritectroid reactions – Iron – Iron carbide equilibrium diagram – Classification of steel and cast iron, microstructure, properties and applications.

UNIT II HEAT TREATMENT 9

Definition – Full annealing, stress relief, recrystallisation and spheroidizing – Normalising, hardening and tempering of steel – Isothermal transformation diagrams – Cooling curves superimposed on I.T. diagram – CCR – Hardenability – Jominy end quench test – Austempering – Martempering – Case hardening – Carburising, nitriding, cyaniding, carbonitriding, flame and induction hardening – Application.

UNIT III MECHANICAL PROPERTIES AND TESTING 9

Mechanism of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Brinell hardness tests – Vickers hardness tests – Rockwell hardness tests – Impact test – Izod and Charpy, Fatigue and creep tests – Fracture toughness tests.

UNIT IV FERROUS AND NON FERROUS METALS 9

Effect of alloying elements on steel (Mn, Si, Cr, Mo, V, Ti and W) – Properties and applications of stainless and tool steels – HSLA – Maraging steels – Cast irons – Grey, white malleable, spheroidal – Graphite, alloy cast irons, copper and copper alloys – Brass, bronze and cupronickel – Aluminum and Al-Cu alloy – Precipitation hardening– Bearing alloys.

UNITV NON-METALLIC MATERIALS 9

Polymers – Types of polymer, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE Polymers – Urea and phenol formaldehydes – Engineering ceramics – Introduction to fibre reinforced plastics.

Total : 45

TEXT BOOKS

1. Callister, W.D., “Material Science and Engineering”, John Wiley and Sons 2007.
2. Avner, S.H., “Introduction to Physical Metallurgy”, McGraw Hill Book Company, 2007.

REFERENCES

1. Budinski, K.G. and Budinski, M.K., “Engineering Materials”, Prentice Hall of India, 2002.
2. Raghavan,V., “Materials Science and Engineering”, Prentice Hall India, 2007.
3. Dieter, G.E., “Mechanical Metallurgy”, Mc Graw Hill Book Company, 1988.

CE1259 – STRENGTH OF MATERIALS

(Common to Automobile, Mechanical, Marine and Production)

L	T	P	C
3	1	0	4

UNIT I STRESS, STRAIN 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, and 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", Prentice Hall of India, 1997.
2. Beer, F.P. and Johnston, R.," Mechanics of Materials", 3rd 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", Tata McGraw-Hill Publishing Co., 1981.
3. Timoshenko, S.P., "Elements of Strength of Materials", Tata McGraw-Hill, 1997.

EC1265 – ELECTRONICS AND MICROPROCESSORS

(Common to Automobile, Mechanical and Production)

L	T	P	C
3	0	0	3

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, 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 and 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 Dougles V. Hall, “Microprocessor and Interfacing, Programming and Hardware”, Tata McGraw-Hill, 1999.

ME1254 – MANUFACTURING TECHNOLOGY LABORATORY II

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS

1. Two or More Measurements in Metal Cutting Experiment (Example: Shear Angle, Cutting Force, Tool Wear etc.)
2. One or More Exercises in Shaper, Slotter, Planner, Drilling, Milling Machines
   (Example: Round to Square, Dovetail in shaper, Internal keyway cutting in Slotter, Round to square in Planner, Drilling, reaming and tapping in Drilling machine, Gear Milling and Keyway milling in Milling machine.)
3. Two or More Exercises in Grinding / Abrasive machining
   (Example: Surface Grinding, Cylindrical Grinding.)
4. Two or More Exercises in Assembly of Machined Components for different fits.
   (Example: Parts machined using Lathes, Shapers, Drilling, Milling, and Grinding Machines etc.)
5. One or More Exercises in Capstan or Turret Lathes
6. One or More Exercises in Gear Machining
   (Example: Gear Milling, Gear Hobbing etc.)

LIST OF EQUIPMENTS

(For a batch of 30 students)

1.	Centre Lathes	-	2 Nos.
2.	Turret and Capstan Lathes	-	1 No.
3.	Horizontal Milling Machine	-	1 No.
4.	Vertical Milling Machine	-	1 No.
5.	Surface Grinding Machine	-	1 No.
6.	Cylinderical Grinding Machine	-	1 No.
7.	Shaper	-	2 Nos.
8.	Slotter	-	1 No.
9.	Planner	-	1 No.
10.	Radial Drilling Machine	-	1 No.
11.	Tool Dynamometer	-	1 No.
12.	Gear Hobbing Machine	-	1 No.
13.	Tool Makers Microscope	-	1 No.

Total: 45

CE1260 – STRENGTH OF MATERIALS LABORATORY

(Common to Automobile, Mechanical and Production)

L	T	P	C
0	0	3	2

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.

LIST OF EQUIPMENTS

(for a batch of 30 students)

Universal Tensile Testing machine with double shear attachment – 40 Ton Capacity	1 No.
Torsion Testing Machine (60 NM Capacity)	1 No.
Impact Testing Machine (300 J Capacity)	1 No.
Brinell Hardness Testing Machine	1 No.
Rockwell Hardness Testing Machine	1 No.
Spring Testing Machine for tensile and compressive loads (2500 N)	1 No.
Metallurgical Microscopes	3 Nos.
Muffle Furnace (800 °C)	

Total: 45

ME1259 – COMPUTER AIDED MACHINE DRAWING LABORATORY

L	T	P	C
0	0	4	2

DRAWING STANDARDS

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.

2-D DRAWINGS

Limits, Fits – Tolerancing of individual dimensions – Specification of Fits – Manual Preparation of production drawings and reading of part and assembly drawings.

CAD PRACTICE (USING APPLICATION PACKAGES)

Drawing, Editing, Dimensioning, Plotting Commands, Layering Concepts, Hatching, Detailing, Assembly, basic principles of GDandT (geometric dimensioning and tolerancing)

ASSEMBLY DRAWING (MANUAL AND USING APPLICATION PACKAGES)

Manual parts drawing and preparation of assembled views given part details for components followed by practicing the same using CAD packages.

Suggested Assemblies:

Shaft couplings – Plummer block – Screw jack – Lathe Tailstock – Universal Joint – Machine Vice – Stuffing box – Safety Valves - Non-return valves – Connecting rod – Piston and crank shaft – Multi plate clutch – Preparation of Bill of materials and tolerance data sheet

Total: 45

Use of standard CAD application packages is recommended from the point of view of requirement by industries. However to encourage our national efforts in indigenous development of software packages with focus on open source, students may be encouraged to work with "Collab CAD Software", developed by:

National Informatics Centre (CAD Group), Govt. of India, A-Block,

C.G.O. Complex, Lodhi Road, New Delhi 110003, 2003.

www.collabcad.com

REFERENCES

1. Bhatt, N.D. and Panchal,V.M., "Machine Drawing", 38th Edition, Charotar Publishing House, 2003.
2. "P.S.G. Design Databook", Coimbatore.
3. Luzadder, Warren, J. and Jon. D.M., "Fundamentals of Engineering Drawing", 11th Edition, Prentice Hall India, 2001.

EQUIPMENT NEEDED (FOR A BATCH OF 30 STUDENTS)

1.	**Computer System** 17" Graphics Terminal Pentium IV Processor 80 GB HDD 1 GB RAM Advanced graphics accelerator	**30**
2.	**Laser Printer**	**01**
3.	**Plotter (A2 size)**	**01**

Software

30 seats of latest/recent versions of AutoCAD/CATIA/SOLIDWORKS/SOLID EDGE/NX/PRO-E/COLLABCAD or equivalent software

SEMESTER V

ENVIRONMENTAL SCIENCE AND ENGINEERING

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

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 10

Definition, scope and importance – Need for public awareness – Forest resources: use and over-exploitation – Deforestation – Case studies – Timber extraction, mining, dams and their ground water – Floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: use effects on forests and tribal people – Water resources: use and over-utilization of surface and exploitation – Environmental effects of extracting and using mineral resources – Case studies – Food resources: world food problems – Changes caused by agriculture and overgrazing – Effects of modern agriculture – Fertilizer-pesticide problems – Water logging – Salinity – Case studies – Energy resources: growing energy needs, renewable and non renewable energy sources – Use of alternate energy sources – Case studies – Land resources: land as a resource, land degradation, man induced landslides, soil erosion and desertification – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles – Field study of local area to document environmental assets – River / forest / grassland / hill / mountain.

UNIT II ECOSYSTEMS AND BIODIVERSITY 14

Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity – Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife and man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds

Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT III ENVIRONMENTAL POLLUTION 8

Definition – Causes, effects and control measures of: (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards – Solid waste management: causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

Field study of local polluted site – urban / rural / industrial / agricultural

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – Urban problems related to energy – Water conservation – Rain water harvesting – Watershed management – Resettlement and rehabilitation of people; its problems and concerns – Case studies – Environmental ethics: issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust – Case studies – Wasteland reclamation – Consumerism and waste products – Environment protection act – Air (prevention and control of pollution) act – Water (prevention and control of pollution) act – Wildlife protection act – Forest conservation act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth – Variation among nations – Population explosion – Family welfare programme – Environment and human health – Human rights – Value education – HIV / AIDS – Women and child welfare – Role of information technology in environment and human health – Case studies.

Total: 45

TEXT BOOKS

1. Masters, G.M., "Introduction to Environmental Engineering and Science", 2nd Edition, Pearson Education Pvt. Ltd., 2004.
2. Trivedi, R.K. and Goe, P.K., "Introduction to Air Pollution", Techno-Science Publications, 2003.

REFERENCES

1. Bharucha Erach, "The Biodiversity of India", Mapin Publishing Pvt. Ltd., India,
2. Cunningham, Cooper, W.P. and Gorhani, T.H., "Environmental Encyclopedia", Jaico Publications, 2001.
3. Wager, K.D., "Environmental Management", W.B. Saunders Co., Philadelphia, 1998.

DYNAMICS OF MACHINERY

L	T	P	C
3	1	0	4

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 BOOKS

1. Rattan, S.S., "Theory of Machines", Tata McGraw-Hill Publishing Company Ltd., 1994.
2. Shigley, J.E. and Uicker, J.J., "Theory of Machines and Mechanisms", McGraw-Hill Inc., 1995.

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. John Hannah and Stephens, R.C., "Mechanics of Machines", Viva low-Priced Student Edition, 1999.

DESIGN OF MACHINE ELEMENTS

L	T	P	C
3	1	0	4

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", 3rd Edition, John Wiley and 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. and 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.

GAS DYNAMICS AND JET PROPULSION

L	T	P	C
3	1	0	4

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: 60

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

TEXT BOOKS

1. Yahya, S.M., “Fundamental of Compressible Flow”, New Age International (P) Ltd., 1996.
2. Oosthvizen, P.H. and Carscallen, W.E., “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.

ENGINEERING METROLOGY AND MEASUREMENTS

(Common to Mechanical and Automobile)

L	T	P	C
3	0	0	3

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 and limit gauges**.**

UNIT II LINEAR AND ANGULAR MEASUREMENT 9

Definition of metrology – Linear measuring instruments: Vernier, micrometer, interval measurement – Slip gauges and classification – Interferometery – 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 and electrical resistance thermister – Pyrometers.

Total: 45

TEXT BOOKS

1. Jain, R.K., “Engineering Metrology”, Khanna Publishers, 1994.
2. Morris, A.S., “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 Lewis Buck, N., “Mechanical Measurements”, Addison Wesley, 1991.
4. Eckman, D.D., “Industrial Instrumentation”, Wiley Eastern, 1985.

APPLIED HYDRAULICS AND PNEUMATICS

L	T	P	C
3	0	0	3

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. Harry, L. and Stevart, D.B., "Practical guide to fluid power", Taraoeala Sons and Port Ltd, 1976.
4. Michael J. Prinches and Ashby, J.G., "Power Hydraulics", Prentice Hall, 1989.

DYNAMICS LABORATORY

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS

1. Governors – Det ermination 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 EQUIPMENT

(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

METROLOGY AND MEASUREMENT LABORATORY

L	T	P	C
0	0	3	2

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 EQUIPMENT

(for a batch of 30 students)

1.	Micrometer / Dial micro meter	-	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

THERMAL ENGINEERING LABORATORY I

L	T	P	C
0	0	3	2

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 & 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 EQUIPMENT

(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.

SEMESTER VI

PRINCIPLES OF MANAGEMENT

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

L	T	P	C
3	0	0	3

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 organization.

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 – Decentralization 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. Harold Kooritz and Heinz Weihrich, “Essentials of Management”, Tata McGraw-Hill, 1998.
2. Tripathy, P.C and Reddy, P.N., “Principles of Management”, Tata McGraw-Hill, 1999.

REFERENCES

1. Decenzo David, Robbin Stephen, A., “Personnel and Human Resources Management”, Prentice Hall of India, 1996.
2. Stomer, J.A.F., Freeman, R.E. and Gilbert, D.R., “Management”, 6th Edition, Pearson Education, 2004.
3. Fraidoon Mazda, “Engineering Management”, Addison Wesley, 2000.

THERMAL ENGINEERING

L	T	P	C
3	1	0	4

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 BOOKS

1. Rudramoorthy R, “Thermal Engineering”, Tata McGraw-Hill, 2003.
2. Rogers- Meyhew, “Engineering Thermodynamics”, ELBS, 1992

REFERENCES

1. Kothandaraman, C.P., Domkundwar, S. and Domkundwar, A.V., “A Course in Thermal Engineering”, 5th Edition, Dhanpat Rai and Sons, 2002.
2. Rajput, “Thermal Engineering”, S. Chand Publishers, 2000**.**
3. Holman, J.P., “Thermodynamics”, McGraw-Hill, 1985.

DESIGN OF TRANSMISSION SYSTEMS

L	T	P	C
3	2	0	4

UNIT I DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLE ELEMENTS 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 bear 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. Juvinall, 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.

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, Pl 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.

AUTOMOBILE ENGINEERING

(Common to Mechanical and Production-Elective)

L	T	P	C
3	0	0	3

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.
4. Joseph Heitner, “Automotive Mechanics”, 2nd Edition, East-West Press, 1999.

POWER PLANT ENGINEERING

L	T	P	C
3	0	0	3

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

REFERENCES

1. Nagpal, G.R., “Power Plant Engineering”, Hanna Publishers, 1998.
2. Ramalingam, K.K., “Power Plant Engineering”, Scitech Publications, 2002.
3. Rai, G.D., “Introduction to Power Plant Technology”, Khanna Publishers, 1995.
4. Rajput, R.K., “Power Plant Engineering”, Laxmi Publications, 1995.

THERMAL ENGINEERING LABORATORY II

L	T	P	C
0	0	3	2

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

CAD/CAM LABORATORY

L	T	P	C
0	0	3	2

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, Pocket 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 EQUIPMENT FOR CAD /CAM LAB

(for a batch of 30 students)

I . HARDWARES

1.	**Computer server**	**– 1 No.**
2.	Computer systems (Pentium IV with 1GB 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 Nos

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

DESIGN AND FABRICATION PROJECT

(Common to Mechanical and Production)

L	T	P	C
0	0	4	2

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 and cost estimation relating to fabrication.

SEMESTER VII

TOTAL QUALITY MANAGEMENT

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

L	T	P	C
3	0	0	3

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. Besterfiled, D.H. “Total Quality Management”, Pearson Education, Inc. 2003.
1. Zeiri., “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

REFERENCES

2. Evans, J. R., and Lidsay, W.M., “The Management and Control of Quality”, 5th Edition, South-Western (Thomson Learning), 2002.
3. Oakland.J.S. “Total Quality Management”, Butterworth – Hcinemann Ltd., Oxford, 1989.
4. Narayana V. and Sreenivasan, N.S., “Quality Management – Concepts and Tasks”, New Age International, 1996.

FINITE ELEMENT ANALYSIS

(Common to Mechanical and Automobile)

L	T	P	C
3	1	0	4

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 palne strain conditions – Triangular elements – Element stiffness matrix – Force vector – Galarkin approach – Stress calculation – Temperature effects – Dynamics – Mass matrixes.

UNIT IV AXISYMMETRIC 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 quadrilaterals 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. Hutton, D.V., “Fundamentals of Finite Element Analysis”, McGraw-Hill International Edition, 2004.

REFERENCES

1. Logan, D.L., “A First course in the Finite Element Method”, 3rd Edition, Thomson Learning, 2002.
2. Cook, R.D., David, S. and Plesha, M.M.E., “Concepts and Applications of Finite Element Analysis”, 4th Edition, 2003.
3. Reddy, J.N., “An Introduction to Finite Element Method”, McGraw-Hill International Student Edition, 1985.

MECHATRONICS

(Common to Mechanical and Production)

L	T	P	C
3	1	0	4

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, 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, transnational, electromechanical, hydraulic and 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.

L: 45 T: 15 Total: 60

TEXT BOOKS

1. Bolton, W., “Mechatronics”, 2nd Edition, Pearson Education, 1999.
2. Kamm, L.J., “Understanding Electro–Mechanical Engineering”, An Introduction to Mechatronics, Prentice – Hall of India Pvt., Ltd., 2000.

REFERENCES

1. Histand, M.B. and Alciatore, D.G., “Introduction to Mechatronics and Measurement Systems”, McGraw-Hill International Editions, 2000.
2. Bradley D.A., Dawson D., Buru N.C. and Loader, A.J., “Mechatronics”, Chapman and Hall, 1993.
3. Dan Necsulesu, “Mechatronics”, Pearson Education Asia, 2002.

COMPUTER INTEGRATED MANUFACTURING

(Common to Mechanical, Production and Aeronautical)

L	T	P	C
3	1	0	4

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.

L: 45 T: 15 Total: 60

TEXT BOOK

1. Groover, M.P., “Automation, Production Systems and Computer Integrated Manufacturing”, Pearson Education, 2001.
2. Radhakrishnan, P., Subramanyan S. and Raju V., “CAD/CAM/CIM”, 2nd Edition, New Age International (P) Ltd, 2000.

REFERENCES

1. Yorem Koren, “Computer Integrated Manufacturing System”, McGraw-Hill, 1983.
2. Ranky, Paul, G., “Computer Integrated Manufacturing”, Prentice Hall International, 1986.
3. Groover, M.P., and Emory Zimmers Jr., “CAD/CAM", Prentice Hall of India Pvt. Ltd., 1998.

COMPUTER AIDED SIMULATION AND ANALYSIS LABORATORY

L	T	P	C
0	0	3	2

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
10. Convective heat transfer analysis of a 2D component

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)

L	T	P	C
0	0	3	2

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

COMMUNICATION AND SOFT SKILLS LABORATORY

L	T	P	C
0	0	3	2

The aim of the course is two-fold: to enable the students to develop communication skills in the language laboratory and to arrange discussions for developing soft skills in the lab and/or the classroom. Each lab session shall last for three periods.

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.)

For a detailed plan, refer to the topics given below;

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.

RESOURCES

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 and Tony Garside, Essential Telephoning in English (Audio CD**),** Cambridge: Cambridge University Press, 2002
4. Hari Mohan Prasad and 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 and et al "Developing Soft Skills", 4th Edition, New Delhi, Pearson Education, 2009.

Total: 60

SEMESTER VIII

ENGINEERING ECONOMICS AND COST ANALYSIS

(Common to Mechanical, Production and Automobile)

L	T	P	C
3	0	0	3

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 – 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 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 all 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. Smith, G.W., “Engineering Economy”, Lowa State Press, 1973.

REFERENCES

1. Park, C.S., “Contemporary Engineering Economics”, Prentice Hall of India, 2002.
2. Newman, D.G. and Lavelle, J.P., “Engineering Economics and analysis”, Engineering Press, 2002.
3. Degarmo, E.P., Sullivan, W.G. and Canada, J.R, “Engineering Economy”, Macmillan, 1984.
4. Grant, E.L., Ireson, W.G. and Leavenworth, R.S., “Principles of Engineering Economy”, Ronald Press, 1976.

PROJECT WORK

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

L	T	P	C
0	0	6	6

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 SEMESTER VI

UNCONVENTIONAL MACHINING PROCESS

(Common to Mechanical and Production)

L	T	P	C
3	0	0	3

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 (AJM) – Water Jet Machining (WJM) – Ultrasonic Machining (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 BOOKS

1. Jain, V.K., "Advanced Machining Processes", Allied Publishers Pvt. Ltd., 2002.
2. Paul De Garmo, J.T.Black, and Ronald.A.Kohser, "Material and Processes in Manufacturing", 8th Edition, Prentice Hall of India Pvt. Ltd., 2001.

REFERENCES

1. Benedict, G.F., "Nontraditional Manufacturing Processes", Marcel Dekker Inc., 1987.
2. Pandey, P.C. and Shan, H.S., "Modern Machining Processes", Tata McGraw-Hill, 1980.
3. Mc Geough, "Advanced Methods of Machining", Chapman and Hall, 1998.

MARKETING MANAGEMENT

(Common to Mechanical and Production)

L	T	P	C
3	0	0	3

UNIT I MARKETING PROCESS 9

Definition – Marketing process, dynamics, needs, wants and demands – Marketing concepts – Environment – Mix – Types – Philosophies – Selling versus marketing – Organizations – industrial versus consumer marketing – Consumer goods – Industrial goods and product hierarchy.

UNIT II BUYING BEHAVIOUR AND MARKET SEGMENTATION 9

Cultural – Demographic factors – Motives – Types – Buying decisions – Segmentation factors – Demographic – Psycho graphic and geographic segmentation – Process and patterns.

UNIT III PRODUCT PRICING AND MARKETING RESEARCH 9

Objectives, pricing, decisions and pricing methods – Pricing management – Introduction – uses – Process of marketing research.

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION 9

Components of marketing plan-strategy formulations and the marketing process – Implementations – Portfolio analysis – BCG – GEC grids.

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION 9

Characteristics, impact, goals, types and sales promotions – Point of purchase – Unique selling proposition – Characteristics, wholesaling, retailing, channel design, logistics and modern trends in retailing – Case studies.

Total: 45

TEXT BOOKS

1. Ramasamy and Namakumari, “Marketing Environment: Planning, Implementation and Control the Indian Context”, 1990.
2. Govindarajan, M., “Industrial Marketing Management”, Vikas Publishing Pvt. Ltd., 2003.

REFERENCES

1. Philip Kolter, “Marketing Management”, Pearson Education, 2001.
2. Green Paul, E. and Donald Tull, “Research for marketing decisions”, Prentice Hall of India, 1975.
3. Tull, D.S. and Hawkins, “Marketing Reasearch”, Prentice Hall of India, 1997.
4. Philip Kotler and Gary Armstrong “Principles of Marketing”, Prentice Hall of India, 2000.
5. Skinner, S.J., “Marketing”, All India Publishers and Distributes Ltd., 1998.

REFRIGERATION AND AIR CONDITIONING

L	T	P	C
3	0	0	3

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.

VIBRATION AND NOISE CONTROL

(Common to Mechanical and Automobile)

L	T	P	C
3	0	0	3

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 – Untuned 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. Kewal Pujara, “Vibrations and Noise for Engineers”, Dhanpat Rai and Sons, 1992.

REFERENCES

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

RENEWABLE SOURCES OF ENERGY

(Common to Mechanical and Production)

L	T	P	C
3	0	0	3

UNIT I ENERGY AND ENVIRONMENT 9

Primary energy sources – World energy resources – Indian energy scenario – Energy cycle of the earth – Environmental aspects of energy utilization, CO_2 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 and applications – Hydrogen conversion and storage systems.

Total: 45

TEXT BOOKS

1. Rai, G.D., “Non conventional Energy sources”, Khanna Publishers, 1999.
2. Desai, A.V., “Non-conventional Energy”, Wiley Eastern Ltd, 1990.

REFERENCES

1. Sukhatme, S.P., “Solar Energy”, 2nd Edition, TMH, 2003
2. Sulton, “Direct Energy Conversion”, McGraw-Hill, 1966.
3. Duffie and Beckmann, “Solar Energy Thermal Processes”, John Wiley, 1974.
4. Garg, H.P. and Prakash, J., “Solar Energy - Fundamentals and Applications”, TMH, 1997.

NUMERICAL METHODS

(Common to Mechanical, Production, Automobile, and IV Semester core for Metallurgy Mechatronics and Aeronautical)

L	T	P	C
3	1	0	4

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9

Solution of equation – Fixed point iteration: x=g(x) method – Newton's method – Solution of linear system by Gaussian elimination and Gauss – Jordon methods – Iterative methods – Gauss – Seidel methods – Inverse of a matrix by Gauss Jordon method – Eigenvalue of a matrix by power method and by Jacobi method for symmetric matrix.

UNIT II INTERPOLATION AND APPROXIMATION 9

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

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9

Differentiation using interpolation formulae – Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two and Three point Gaussian quadrature formulas – Double integrals using trapezoidal and simpsons's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9

Single step methods – Taylor series method – Euler methods for First order Runge-Kutta method for solving first and second order equations – Multistep 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 explicit and implicit methods – One dimensional wave equation and two dimensional laplace and poisson equations.

L: 45 T: 15 Total: 60

TEXT BOOKS

1. Veerarjan, T. and Ramachandran, T., "Numerical Mehods with Programming in C", 2nd Edition, Tata McGraw Hill, 2007.
2. Sankar Rao, K., "Numerical Methods for Scientisits and Engineers", 3rd Edition, Princtice Hall of India, 2007.

REFERENCES

1. Kandasamy, P., Thilagavathy, K. and Gunavathy, K., "Numerical Methods", S.Chand Co. Ltd., 2003.
2. Gerald, C.F. and White, P.O., "Applied Numerical Analysis", Pearson Education, 1994.

QUALITY CONTROL AND RELIABILITY ENGINEERING

(Common to Automobile, Mechanical and Production)

L	T	P	C
3	0	0	3

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 and 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 RELIABLITY 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. Sharma, S.C., "Inspection Quality Control and Reliability", Khanna Publishers, 1998.
4. Danny Samson, "Manufacturing and Operations Strategy", Prentice Hall, 1991.

LECTIVES FOR SEMESTER VII

PROCESS PLANNING AND COST ESTIMATION

(Common to Mechanical and Production)

L	T	P	C
3	0	0	3

UNIT I WORK STUDY AND ERGONOMICS 9

Method study – Definition – Objectives – Motion economy – Principles – Tools and techniques – Applications – Work measurements – Purpose – Uses – 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 BOOK

1. Sinha, B.P., “Mechanical Estimating and Costing”, Tata McGraw-Hill, Publishing Co., 1995.

REFERENCES

1. Ostwalal, P.F. and Jairo Munez, "Manufacturing Processes and Systems", 9th Edition, John Wiley, 1998.
2. Russell, R.S. and Tailor, B.W., “Operations Management”, 4th Edition, PHI, 2003.
3. Chitale, A.V. and Gupta, R.C., "Product Design and Manufacturing", 2nd Edition, PHI, 2002.

ROBOTICS

(Common to Mechanical, Automobile and Production)

L	T	P	C
3	0	0	3

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 and 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 – Lighting techniques – Image processing and analysis – Data reduction – Segmentation – Feature extraction – Object recognition – Other algorithms – Applications – Inspection, identification, visual serving and navigation.

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING 10

Forward kinematics – Inverse kinematics – Differences: Forward kinematics and Reverse kinematics of manipulators with two and 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 effecter commands – 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 and Rate of return method.

Total: 45

TEXT BOOK

1. Groover, M.P., “Industrial Robotics – Technology, Programming and Applications”, McGraw-Hill, 2001.

REFERENCES

1. Fu, K.S., Gonzalz, R.C. and Lee C.S.G., “Robotics Control, Sensing, Vision and Intelligence”, McGraw-Hill Book Co., 1987.
2. Yoram Koren, “Robotics for Engineers”, McGraw-Hill Book Co., 1992.
3. Janakiraman, P.A., “Robotics and Image Processing”, Tata McGraw-Hill, 1995.

DESIGN OF JIGS, FIXTURES AND PRESS TOOLS

(Common to Mechanical, Automobile and Production)

L	T	P	C
3	0	0	3

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 and 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. Hoffman, E.G., “Jigs and Fixture Design”, Thomson – Delmar Learning, 2004.
2. Donaldson, C., “Tool Design”, Tata McGraw-Hill, 1986.

REFERENCES

1. Joshi, P.H., “Jigs and Fixtures”, 2nd Edition, Tata McGraw-Hill Publishing Company Limited, 2004.
2. “Fundamentals of Tool Design”, CEEE Edition, ASTME, 1983.
3. “Design Data Handbook”, PSG College of Technology, Coimbatore.

NUCLEAR ENGINEERING

L	T	P	C
3	0	0	3

UNIT I NUCLEAR PHYSICS 9

Nuclear model of an atom – Equivalence of mass and energy – Binding – Radio activity – Half life – Neutron interactions – Cross sections.

UNIT II NUCLEAR REACTIONS AND REACTION MATERIALS 9

Mechanism of nuclear fission and fusion – Radio activity – Chain reactions – Critical mass and composition – Nuclear fuel cycles and its characteristics – Uranium production and purification – Zirconium, thorium, beryllium.

UNIT III REPROCESSING 9

Reprocessing: Nuclear fuel cycles – Spent fuel characteristics – Role of solvent extraction in reprocessing – Solvent extraction equipment.

UNIT IV NUCLEAR REACTOR 9

Nuclear reactors: Types of fast breeding reactors – Design and construction of fast breeding reactors – Heat transfer techniques in nuclear reactors – Reactor shielding – Fusion reactors.

UNIT V SAFETY AND DISPOSAL 9

Safety and disposal: Nuclear plant safety-safety systems – Changes and consequences of accident – Criteria for safety – Nuclear waste – Types of waste and its disposal – Radiation hazards and their prevention – Weapons proliferation.

Total: 45

TEXT BOOKS

1. Cannoly, T.J., “Fundamentals of nuclear Engineering”, John Wiley, 1978.
2. Nag. P.K., Power Plant Engineering, 2nd Edition, Tata McGraw-Hill, 2002.

REFERENCES

1. Collier, J.G., and Hewitt, G.F., “Introduction to Nuclear Power”, Hemisphere Publishing, 1987.
2. Wakil, M.M.El., “Power Plant Technology”, McGraw-Hill International, 1984.

COMPUTATIONAL FLUID DYNAMICS

(Common to Mechanical and Aeronautical)

L	T	P	C
3	0	0	3

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 –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 – 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 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 – 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.

MODERN CONCEPTS OF ENGINEERING DESIGN

L	T	P	C
3	0	0	3

UNIT I PRODUCT DESIGN PROCESS 9

Importance of product design – Design process – Design considerations – Morphology of design – Marketing organization 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. Yousef Haik, “Engineering Design Process” Vikas Publishing House, 1999.

REFERENCES

1. Dieter, G.E., “Engineering Design”, McGraw-Hill Book Company, International Edition, 2000.
2. 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.

THERMAL TURBO MACHINES

L	T	P	C
3	0	0	3

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 blading 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 Mechanical, Production and Automobile)

L	T	P	C
3	0	0	3

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 SEMESTER VIII

PRODUCTION PLANNING AND CONTROL

L	T	P	C
3	0	0	3

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 and basic procedure – Selection – Recording of process – Citical analysis and 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 BOOKS

1. Martand Telsang, “Industrial Engineering and Production Management”, 1st Edition, S. Chand and Company, 2000.
2. Hajra Choudhury, S.K., Nirjhar Roy and Hajra Choudhury, A.K., “Production Management”, Media Promoters and Publishers Pvt. Ltd., 1998.

REFERENCES

1. Buffa, E.S. and Sarin, R.K., “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.

ADVANCED STRENGTH OF MATERIALS

L	T	P	C
3	0	0	3

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 – Axi-symmetric plates – Radial and tangential stresses – Plate deflections.

UNIT II THICK CYLINDERS AND SPHERES 10

Equilibrium and compatibility conditions – Lame'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 Mechanical, Production and Automobile)

L	T	P	C
3	0	0	3

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. Jones, S.W., “Product Dosing and Process Selection”, Butterworth Publications, 1973.
2. Ulrich, K.T. and Eppinger, S.D., “Product Design and Development”, McGraw-Hill, 1994.

REFERENCES

1. Sameul Eilon, “Elements of Production Planning and Control”, McMillan and Company, 1962.
2. Harry Nystrom, “Creativity and Innovation”, John Wiley and Sons, 1979.
3. Dieter, G.E., “Engineering Design – Materials and Process Approach”, Tata McGraw-Hill, 1991.
4. Carter, D.E., “Concurrent Engineering”, Addison Wesley, 1992.

OPERATIONS RESEARCH

(Common to Mechanical and Automobile)

L	T	P	C
3	0	0	3

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 multi-server models – Poisson input – Exponential service – Constant rate service – Infinite population.

Total: 45

TEXT BOOKS

1. Taha, H.A., “Operation Research”, 6th Edition, Pearson Education, 2003.
2. Wagner, “Operations Research”, Prentice Hall of India, 2000.

REFERENCES

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

MAINTENANCE ENGINEERING

(Common to Mechanical and Production)

L	T	P	C
3	0	0	3

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 and 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, slide-ways, 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. Garg, M.R., “Industrial Maintenance”, S. Chand and Co., 1986.
2. Higgins, L.R., “Maintenance Engineering Handbook”, 5th Edition, McGraw Hill, 1988.
3. Davies, “Handbook of Condition Monitoring”, Chapman and Hall, 1996.

ENTREPRENEURSHIP DEVELOPMENT

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

L	T	P	C
3	0	0	3

UNIT I ENTREPRENEURSHIP 9

Entrepreneur – Types of entrepreneurs – Difference between entrepreneur and intrapreneur – Entrepreneurship in economic growth – Factors affecting entrepreneurical growth.

UNIT II MOTIVATION 9

Major motives influencing an entrepreneur – Achievement motivation training – Self rating – Business game – Thematic Apperception Test – Stress management – Entrepreneurship development programs – Need – Objectives.

UNIT III BUSINESS 9

Small enterprises – Definition – Classification – Characteristics – Ownership structures – Project formulation – Steps involved in setting up a business – Identifying – Selecting a good business opportunity – Market survey and research – Techno economic feasibility assessment – Preparation of preliminary project reports – Project appraisal – Sources of information – Classification of needs and agencies.

UNIT IV FINANCING AND ACCOUNTING 9

Need – Sources of finance – Term loans – Capital structure – Financial institution – Management of working capital – Costing – Break even analysis – Network analysis techniques of PERT/CPM – Taxation – Income tax – Excise duty – Sales tax.

UNIT V SUPPORT TO ENTREPRENEURS 9

Sickness in small business – Concept, magnitude, causes and consequences – Corrective measures – Government policy for small scale enterprises – Growth strategies in small industry – Expansion, diversification, joint venture, merger and sub contracting.

Total: 45

TEXT BOOKS

1. Khanka, S.S., "Entrepreneurial Development", S.Chand and Co. Ltd., 1999.
2. Hisrich, R.D. and Peters M.P., "Entrepreneurship", 5th Edition Tata McGraw-Hill, 2002.

REFERENCES

1. Kanungo, R.N., "Entrepreneurship and Innovation", Sage Publications, 1998.
2. EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development", Institute of India, 1986.

PROFESSIONAL ETHICS AND HUMAN VALUES

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

L	T	P	C
3	0	0	3

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.