

ANNA UNIVERSITY TIRUCHIRAPPALLI**Tiruchirappalli – 620 024****Regulations 2008****Curriculum****B.E. PRODUCTION ENGINEERING****SEMESTER III**

S.No.	Subject Code	Subject	L	T	P	C
Theory						
1	MA1201	Transforms and Partial Differential Equations	3	1	0	4
2	PR1201	Basic Machining Process	3	0	0	3
3	ME1203	Basics of Thermodynamics and Thermal Engineering	3	1	0	4
4	PR1202	Engineering Metallurgy	3	0	0	3
5	CE1208	Fluid Mechanics and Machinery	3	1	0	4
6	EE1205	Electrical Drives and Control	3	0	0	3
Practical						
7	PR1203	Basic Machining Process Laboratory	0	0	3	2
8	CE1211	Fluid Mechanics and Machinery Laboratory	0	0	3	2
9	EE1206	Electrical Engineering Laboratory	0	0	3	2
Total						27

SEMESTER IV

S.No.	Subject Code	Subject	L	T	P	C
Theory						
1	MA1254	Statistics and Numerical Methods	3	1	0	4
2	CE1259	Strength of Materials	3	1	0	4
3	PR1251	Advanced Machining Process	3	0	0	3
4	ME1257	Theory of Machines	3	0	0	3
5	PR1252	Fluid Power Drives and Control	3	1	0	4
6	EC1265	Electronics and Microprocessors	3	0	0	3
Practical						
7	ME1258	Metallurgy Laboratory	0	0	3	2
8	CE1260	Strength of Materials Laboratory	0	0	3	2
9	ME1255	Computer Aided Machine Drawings Laboratory	0	0	4	2
Total						27

SEMESTER V

S.No.	Subject Code	Subject	L	T	P	C
Theory						
1	HS1201	Environmental Science and Engineering	3	0	0	3
2	PR1301	Metrology and Computer Aided Inspection	3	1	0	4
3	PR1302	Metal Forming Technology	3	0	0	3
4	PR1303	Design of Jigs, Fixtures and Press Tools	3	0	0	3
5	PR1304	Machine Elements Design	3	1	0	4
6	PR1305	Welding Technology	3	0	0	3
Practical						
7	PR1306	CNC Machines Laboratory	0	0	3	2
8	PR1307	Metrology Laboratory	0	0	3	2
9	PR1308	Production Drawing	0	0	3	2
Total						26

SEMESTER VI

S.No.	Subject Code	Subject	L	T	P	C
Theory						
1	MG1351	Principles of Management	3	0	0	3
2	ME1402	Mechatronics	3	1	0	4
3	PR1351	Unconventional Machining Processes	3	0	0	3
4	PR1352	Foundry Technology	3	0	0	3
5	PR1353	Quality Control and Reliability Engineering	3	0	0	3
6	E1****	Elective I	3	0	0	3
Practical						
7	ME1405	Mechatronics Laboratory	0	0	3	2
8	PR1354	Fluid Power Laboratory	0	0	3	2
9	PR1355	Welding and Foundry Laboratory	0	0	3	2
Total						25

SEMESTER VII

S.No.	Subject Code	Subject	L	T	P	C
Theory						
1	MG1301	Total Quality Management	3	0	0	3
2	IC1404	Robotics	3	1	0	4
3	GE1452	Process Planning and Cost Estimation	3	1	0	4
4	ME1403	Computer Integrated Manufacturing	3	1	0	4
5	E2****	Elective II	3	0	0	3
6	E3****	Elective III	3	0	0	3
Practical						
7	ME1407	Computer Aided Design Laboratory	0	0	3	2
8	ME1356	Design and Fabrication Project	0	0	4	2
9	HS1301	Communication and Soft Skills Laboratory	0	0	3	2
Total						27

SEMESTER VIII

S.No.	Subject Code	Subject	L	T	P	C
Theory						
1	GE1451	Engineering Economics and Cost Analysis	3	0	0	3
2	E4****	Elective IV	3	0	0	3
3	E5****	Elective V	3	0	0	3
Practical						
4	PR1455	Project Work	0	0	6	6
Total						15

ELECTIVES FOR SEMESTER VI

S.No.	Subject Code	Subject	L	T	P	C
Theory						
1	PR1001	Measurement and Controls	3	0	0	3
2	ME1003	Renewable sources of Energy	3	0	0	3
3	PR1002	Tribology	3	0	0	3
4	MG1452	Marketing Management	3	0	0	3
5	MA1251	Numerical Methods	3	0	0	3
6	AT1360	Automobile Engineering	3	0	0	3

ELECTIVES FOR SEMESTER VII

S.No.	Subject Code	Subject	L	T	P	C
Theory						
1	ME1014	Logistics and Supply Chain Management	3	0	0	3
2	PR1003	Finite Element Techniques	3	0	0	3
3	ME1008	Composite Material	3	0	0	3
4	PR1004	Advanced Manufacturing Processes	3	0	0	3
5	PR1005	Industrial Safety Engineering	3	0	0	3
6	PR1006	Production Management	3	0	0	3

ELECTIVES FOR SEMESTER VIII

S.No.	Subject Code	Subject	L	T	P	C
Theory						
1	ME1011	Product Design and Costing	3	0	0	3
2	ME1012	Maintenance Engineering	3	0	0	3
3	PR1007	Management Information System	3	0	0	3
4	PR1008	Precision Engineering	3	0	0	3
5	PR1009	Manufacturing System and Simulation	3	0	0	3
6	PR1010	Knowledge Based System in Manufacturing	3	0	0	3
7	ME1013	Entrepreneurship Development	3	0	0	3
8	GE1301	Professional Ethics and Human Values	3	0	0	3

ANNA UNIVERSITY TIRUCHIRAPPALLI

Tiruchirappalli – 620 024

Regulations 2008

Syllabus

B.E. PRODUCTION 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 BOOK

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

PR1201 – BASIC MACHINING PROCESSES

L	T	P	C
3	0	0	3

UNIT I LATHE

9

Introduction to production processes – Types of production – Production processes – Casting – Forming – Machining and Welding – Machine – Machine tool – Lathe – Engine lathe – Block diagram – Sketch – Functions of each part – Work holding devices in lathe – Functions – Chuck, Centre – Dogs – Steady Rest and Follower Rest – mechanism of lathe – Apron – Feed – Tumbler Gear – various operations performed in Lathe – Facing – Turning – Chamfering and knurling – Relative positions of tool and job – Taper turning operations – Thread cutting – Thread – RH and LH – Single start and multi start with application – Method of thread cutting – Selection and arrangement of tool and work – Problems in metric and inch thread conversion – Specifications of Lathe – Burnishing

UNIT II SHAPER, PLANER & SLOTTER

9

Purpose of shaping – Block diagram – Functions of each part – Purpose of planer – Block diagram – Functions of each part – Purpose of slotting machine – Block diagram – Functions and working principle – Operations carried out – Horizontal plane – Vertical plane – V type with relative position – Comparison of planer with shaper – Work holding devices in shaper and planer – Quick return mechanism in shaper – Mechanical and hydraulic – Cross feed mechanism – Types of planer with application – Mechanism in planer – Comparison of shaping with slotting – Tool holding devices in shaper – Planer – Slotter – Simple problems to calculate the velocity – Speed – Feed – Depth of cut.

UNIT III DRILLING

9

Purpose of drilling – Block diagram and function – Types of drilling machines – Portable drilling – Bench type – Sensitive drilling – Radial arm drilling – Functions of parts – Purpose and operation – Gang milling – Multiple drill head – Upright drilling – Relative operations – Reaming – Boring, tapping – Counter boring – Courses sinking – Trepanning and spot facing – Work holding devices – specification torque calculation – Speed – Feed – Depth of cut.

UNIT IV MILLING

9

Milling machine purpose – Up and Down milling – Classification of milling machines – Slot – Keyway machining – Methods of milling – Single piece – String – Rotary – Index – Gang, progressive – Copy – Horizontal milling machine – Block diagram – Functions of each part – Applications – Vertical milling machine – Block diagram – Functions of each part applications – Gear cutting using milling machine – Procedure with neat sketch – Milling cutters – Peripheral – Face – End T slot – Attachments and special accessories for milling – Rotary – Slotting attachment – Indexing mechanism – Methods of indexing – Direct – Plain – Compound – Differential indexing – Problems – Specifications – Cutting conditions and parameters.

UNIT V GRINDING

9

Purpose – Classification – Surface finish – Applications – Grinding wheel – Types – Specifications – Selection – Surface grinding machine – Block diagram – Functions of each part – Cylindrical grinding – Centre-less grinding – Comparison – in feed – end feed and through feed – Balancing – Dressing – Loading and Truing of wheel – Special grinding machines – Specification of machine – Cutting condition.

Total: 45

TEXT BOOKS

1. HMT Bangalore, "Production Technology", Tata Mc-Graw Hill Publishing Company Limited, 2001.
2. Sharma, P.C., "A Text Book of Production Technology", S.Chand and Company, 2001.

REFERENCES

1. Jain, R.K., "Production Technology", Khanna Publishers, 2001.
2. Hajra Choudhary etal, "Elements of Production Technology –Vol. II", Asia Publishing House, 2000.
3. Kumar, B., "Manufacturing Technology", Khanna Publishers, 2000.

ME1203 – BASICS OF THERMODYNAMICS AND THERMAL ENGINEERING

L T P C
3 1 0 4

UNIT I BASIC THERMODYNAMICS 10

Systems – Zeroth law – First law – Steady flow energy equation – Heat and work transfer in flow and non-flow processes – Second law – Kelvin-Planck statement – Clausius statement – Concept of Entropy – Clausius inequality – Entropy change in non-flow processes – Properties of gases and vapours.

UNIT II AIR STANDARD CYCLE AND COMPRESSORS 9

Otto – Diesel – Dual combustion and Brayton cycles – Air standard efficiency – Mean effective pressure – Reciprocating compressors.

UNIT III STEAM AND JET PROPULSION 9

Properties of steam – Rankine cycle – Steam Nozzles – Simple jet propulsion system – Thrust rocket motor – Specific impulse.

UNIT IV REFRIGERATION AND AIR-CONDITIONING 8

Principles of psychrometry and refrigeration – Vapour compression – Vapour absorption types – Co-efficient of performance – Properties of refrigerants – Basic Principle and types of Air conditioning.

UNIT V HEAT TRANSFER 9

Conduction in parallel – Radial and composite wall – Basics of Convective heat transfer – Fundamentals of Radiative heat transfer – Flow through heat exchangers.

L: 45 T: 15 Total: 60

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

TEXT BOOKS

1. Nag.P.K., “Engineering Thermodynamics”, Tata McGraw-Hill, 2007.
2. Radhakrishnan E., “Fundamentals of Engineering Thermodynamics”, Prentice-Hall India, 2005.

REFERENCES

1. Ramalingam K.K. “Thermodynamics”, Sci-Tech Publications, 2006.
2. Holman.J.P., “Thermodynamics”, 3rd Edition, McGraw-Hill, 2007.
3. Arora C.P, “Thermodynamics”, Tata McGraw-Hill, 2003.

CE1208 – FLUID MECHANICS AND MACHINERY
(Common to Mechanical, Aeronautical, Automobile and Production)

L T P C
3 1 0 4

UNIT I INTRODUCTION 9

Units and 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 and 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 through pipes in series and in parallel.

UNIT III DIMENSIONAL ANALYSIS 9

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

UNIT IV ROTO DYNAMIC MACHINES 9

Homologous 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 and Utilisation of Electrical Energy”, Dhanpat Rai and Sons, 1994.

PR1203 – BASIC MACHINING PROCESS LABORATORY

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS

1. Lathe: Facing, Plain turning and Step Turning
2. Lathe: Taper Turning, Threading and Knurling
3. Lathe: Multi start Threading, Burnishing
4. Shaper: Cube
5. Shaper: Cube, V-Block
6. Drilling: Counter sinking, Counter Boring and Tapping
7. Milling Vertical: Surfacing, Pocket Milling
8. Milling Horizontal: Polygonal shape milling
9. Grinding: Surface & Cylindrical grinding
10. Slotting: Machining an internal spline

Total: 45

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: 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 and 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 and S.C Test on a single phase transformer
6. Regulation of an alternator by EMF and 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 and 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: 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 polynomial – 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, 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.
4. Gerald, C.F. and Wheatley, P.O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, 2006.

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.

PR1251 – ADVANCED MACHINING PROCESS

L	T	P	C
3	0	0	3

UNIT I **MECHANICS OF METAL CUTTING** **10**

Cutting tool angles – Tool signature – Orthogonal and oblique cutting – Cutting forces – Merchant circle diagram – Force and velocity relation.

UNIT II **TOOL MATERIAL, TOOL WEAR AND TOOL LIFE** **9**

Requirement of tool materials – Types of tool materials – Tool wear – Mechanism – Tool life – Machinability – Types of chips – Cutting fluids.

UNIT III **GEAR MANUFACTURE** **8**

Different methods of gear manufacture – Gear hobbling and gear shaping machines specifications – Gear generation – Different methods – Gear finishing and shaving – Grinding and lapping of hobs and Shaping cutters – Gear honing – Gear broaching.

UNIT IV **CNC MACHINES** **9**

NC, CNC and DNC – Types of CNC – Constructional features – Drives and control systems – Feed back devices – Interchangeable tooling system – Preset and qualified tools – ISO specification – Machining center – Turning center – CNC wire cut EDM.

UNIT V **CNC PROGRAMMING** **9**

Manual part programming – Steps involved – Sample program in lathe and milling – Computer aided part programming – APT program – CAM package – Canned cycles – Programming.

Total: 45

TEXT BOOKS

1. Hazlehurst, M., “Manufacturing Technology”, ELBS, 1978.
2. Jonathan Lin, S.C., “Computer Numerical Control from Programming to Networking”, Delmar Publishers, 1994.

REFERENCES

1. Groover, M.P., “Automatic Production Systems and Computer Integrated Manufacturing”, Prentice Hall, 1990.
2. Thyer, G.E., “Computer Numerical Control of Machine Tools”, BH.Newners, 1991.
3. Hajra Choudhury, C.J., “Elements of Workshop Technology, Vol. I and II”, Asia Publishing House, 1992.
4. Nagpal, G.R., “Machine Tool Engineering”, Khanna Publishers, 2002.

ME1257 – THEORY OF MACHINES

L	T	P	C
3	0	0	3

UNIT I MECHANISMS

11

Definition – Machine and structure – Kinematic link, pair and chain – Classification of kinematic pairs – Constraint and motion – Degrees of freedom – Slider crank – Single and double – Crank rocker mechanisms – Inversions – Applications – Introduction to kinematic analysis and synthesis of simple mechanisms – Determination of velocity and acceleration of simple mechanisms.

UNIT II FRICTION

9

Types of friction – Friction in screw and nut – Screw jack – Pivot, collar and thrust bearings – Plate and cone clutch – Belt (flat and vee) and rope drives – Creep in belts – Open and crossed belt drives – Ratio of tensions – Effect of centrifugal and initial tensions – Condition for maximum power transmission.

UNIT III GEARING AND CAMS

9

Gear – Types and profile – Nomenclature of spur and helical gears – Laws of gearing – Interference – Requirement of minimum number of teeth in gears – Gear trains – Simple, compound and reverted gear trains – Determination of speed and torque in epicyclic gear trains – Cams different types of followers – Cam – Types of cams and followers – Cam design for different follower motions.

UNIT IV BALANCING

8

Static and dynamic balancing – Single and several masses in different planes – Primary and secondary balancing of reciprocating masses – Balancing of single and multi cylinder engines – Governors and Gyroscopic effects.

UNIT V VIBRATION

8

Free, forced and damped vibrations of single degree of freedom systems – Force transmitted to supports – Vibration isolation – Vibration absorption – Torsional vibration of shafts – Single and multi-rotor systems – Geared shafts – Critical speed of shafts.

Total: 45

TEXT BOOKS

1. Bansal, R.K., “Theory of Machines”, Laxmi Publications (P) Ltd., 2001.
2. Rattan, S.S., “Theory of Machines”, Tata McGraw Hill publishing Co., 2002.

REFERENCES

1. Rao, J.S. and Duggipati, R.V., “Mechanism and Machine Theory”, 2nd Edition, Wiley Eastern Limited, 1992.
2. Malhotra, D.R. and Gupta, H.C., “The Theory of Machines”, Satya Prakasam, Tech. India Publications, 1989.
3. Shigley, J.E. and Uicker, J.J., “Theory of Machines and Mechanisms”, McGraw Hill, 1986.

PR1252 – FLUID POWER DRIVES AND CONTROL

L	T	P	C
3	1	0	4

UNIT I INTRODUCTION TO FLUID POWER and HYDRAULICS PRINCIPLE 8

Introduction to fluid power controls – Hydraulics and pneumatics – Selection criteria – Application of fluid power – Application of Pascal’s law, equation, transmission and multiplication of force – Pressure losses – Fluids, selection and properties – ISO symbols.

UNIT II FLUID POWER DRIVES 10

Fluid power drives – Pumps – Working principle and construction details of gear, vane and piston pumps, Hydraulic motors, hydrostatic transmission drives and characteristics – Hydraulic supply components, pneumatic power supply – Compressors – Air distribution – Air motors.

UNIT III FLUID POWER ELEMENTS 10

Control valves – Pressure, flow, direction – Working principle and construction – Special type – Valves – Cartridge, modular, proportional, and servo – Selection and actuation methods – Actuators – Selection and specification, cylinders, mounting, cushioning and pipe fittings – Fluid conditioning elements – Accumulators.

UNIT IV HYDRAULIC AND PNEUMATIC CIRCUITS DESIGN 10

Design of hydraulic and pneumatic circuits for automation – Selection and specification of circuit components, sequencing circuits, cascade, and karnaugh – Veitch map method – Regenerative, speed control and synchronizing circuits.

UNIT V ELECTRO PNEUMATICS AND PLC CIRCUITS 7

Use of electrical timers, switches, solenoid, relays, proximity sensors etc. – Electro pneumatic sequencing ladder diagram – PLC – Elements, functions and selection – PLC programming – Ladder and different programming methods – Sequencing circuits.

L: 45 T: 15 Total: 60

TEXT BOOKS

1. Anthony Esposito, “Fluid Power with Applications”, 5th Edition, Pearson education 2003.
2. Majumdar, “Oil Hydraulics: Principles and Maintenance”, Tata McGraw Hill, 2004.
3. Majumdar, “Pneumatic system: Principles and Maintenance”, Tata McGraw Hill, 2004.

REFERENCES

1. Reaves, W.W., “Technology of Fluid Power”, Delmer Publishers, 1997.
2. Petor Rohner, “Fluid Power Logic circuit, Design”, Macmillon Press Ltd., 1990.
3. Andrew Parr “Hydraulics and Pneumatics”, Jaico Publishing House, 2004.

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 – Zener effect – Zener 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. Hall, D.V., “Microprocessor and Interfacing, Programming and Hardware”, Tata McGraw-Hill, 1999.

ME1258 – METALLURGY LABORATORY

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS:

1. Specimen preparation for macro – examination.
2. Specimen preparation for micro examination and study of Micro structure of –
 - a) Carbon steel s(High, Medium, and Low)
 - b) Cast Iron (Gray, White, Nodular, Malleable)
 - c) Brass (70/30), Bronze (tin bronze), Al-Si alloy, cupro-nickel, Ti alloy.
3. Quantitative metallography – Estimation of volume fraction, particle size, size distribution, and shape.
4. Cooling curves
 - a) Pure Metal (Pb or Sn)
 - b) Alloy (Pb-Sn or Pb-Sb)
5. Heat treatments (carry out the following heat treatment and study the micro structure before and after heat treatments)
 - a) Annealing
 - b) Normalising
 - c) Quench Hardening
 - d) Tempering
6. Jominy End Quench Test
7. Foundry Sand testing
 - a) Sieve analysis
 - b) Strength of moulding sand
 - c) Permeability of moulding sand
 - d) Clay content of moulding sand
 - e) Moisture content of moulding sand
8. Electro-chemical Test
 - a) Electro deposition
 - b) Electro-chemical etching test

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
 - (i) Hardened samples and
 - (ii) Hardened and tempered samples.

LIST OF EQUIPMENTS

(for a batch of 30 students)

- | | |
|---|--------|
| 1. Universal Tensile Testing machine with double shear attachment – 40 Ton Capacity | 1 No. |
| 2. Torsion Testing Machine (60 NM Capacity) | 1 No. |
| 3. Impact Testing Machine (300 J Capacity) | 1 No. |
| 4. Brinell Hardness Testing Machine | 1 No. |
| 5. Rockwell Hardness Testing Machine | 1 No. |
| 6. Spring Testing Machine for tensile and compressive loads (2500 N) | 1 No. |
| 7. Metallurgical Microscopes | 3 Nos. |
| 8. Muffle Furnace (800 °C) | 1 No. |

Total: 45

ME1255 – COMPUTER AIDED MACHINE LABORATORY
(Common to Automobile and Production)

L T P C
0 0 4 2

1. Drawing of automobile components such as piston, connecting rod, valves, manifold and crank shaft.
2. Assembly drawing of screw jack, piston – connecting rod assembly, valve assembly, clutch assembly and gear box assembly.

Total: 45

LIST OF EQUIPMENTS

(for a batch of 30 students)

- | | | |
|-----|----------------|---------------|
| 1. | Computer nodes | - 30 Nos. |
| 2. | Software | |
| i) | Auto CAD | - 15 licenses |
| ii) | Pro-E | - 5 Nos. |

SEMESTER V

HS1201 – 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.

PR1301 – METROLOGY AND COMPUTER AIDED INSPECTION

L	T	P	C
3	1	0	4

UNIT I GENERAL CONCEPTS OF MEASUREMENT 8

Definition – Standards of measurement – Errors in measurement – Limits, fits and tolerances – Interchangeability and selective assembly – Accuracy and precision – Calibration of instruments – Principles of light interference – Interferometer – Measurement and calibration.

UNIT II LINEAR AND ANGULAR MEASUREMENTS 10

Slip gauges, micrometers, verniers, dial gauges and surface plats – Comparators: Mechanical, electrical, pneumatic and optical comparator angular measuring instruments – Sine bar, angle gauges, spirit level, autocollimators, angle dekkor and clinometers

UNIT III MEASUREMENT OF SURFACE FINISH AND MEASURING MACHINES 10

Surface finish: Definitions – Types of surface texture: Surface roughness measurement methods – Comparison, profilometers, pneumatic and replica – Measurement of run out and concentricity – Length bar measuring machine – Optical projection comparator – Tool makers microscope.

UNIT IV METROLOGY OF SCREW THREADS AND GEARS 9

Internal / External screw thread: Terminology, measurement of various elements of threads – Thread micrometer method, two wire and three wire methods – Gear terminology – Measurement of various elements: Constant chord method, base tangent method and plug method – Gear tester – Gear tooth measurement – Rolling gear tester.

UNIT V COMPUTER AIDED AND LASER METROLOGY 8

Co-ordinate measuring machine – Applications – LASER micrometer – LASER interferometer – LASER scanning gauge – Non contact and in- process inspection – Vision system.

L: 45 T: 15 Total: 60

TEXT BOOK

1. Gupta. I.C., “A Text Book of Engineering metrology”, Dhanpat Rai and sons, 1996.

REFERENCES

1. Jain. R.K., “Engineering Metrology”, Khanna publishers, 2002.
2. Galyer, G.N. and Shotbolt C.R., “Metrology for Engineers”, ELBS, 1990.
3. “ASTE Handbook of Industries Metrology”, Prentice Hall of India Ltd., 1992.
4. Rajput. R.K., “Engineering Metrology and Instrumentation”, Kataria and Sons Publishers, 2001.

PR1302 – METAL FORMING TECHNOLOGY

L	T	P	C
3	0	0	3

UNIT I **STRESS TENSOR AND YIELD CRITERIA** **10**

State of stress – Components of stress – Symmetry of stress tensor – Principal stresses – Stress deviator – Von Mises – Tresca yield criteria – Comparison of yield criteria – Octahedral shear stress and shear strain – Forming load calculations.

UNIT II **FUNDAMENTALS OF METAL FORMING** **10**

Classification of forming processes – Mechanics of metal working – Flow stress determination – Effect of temperature – Strain rate and metallurgical structure on metal working – Friction and lubrication – Deformation zone geometry – Workability – Residual stresses.

UNIT III **FORGING AND ROLLING** **9**

Forging – Types of presses and hammers – Classification – Open die forging and closed die forging – Die design – Forging in plane strain – Calculation of forging loads – Forging defects – Causes and remedies – Residual stresses in forging – Rolling: Classification of rolling processes – Types of rolling mills – Hot and cold rolling – Rolling of bars and shapes – Forces and geometrical relationship in rolling – Analysis of rolling load – Torque and power – Rolling mill control – Rolling defects – Causes and remedies.

UNIT IV **EXTRUSION AND DRAWING** **7**

Direct and indirect extrusion – Variables affecting extrusion – Deformation pattern – Equipments – Port-hole extrusion die – Hydrostatic extrusion – Defects and remedies – Simple analysis of extrusion – Tube extrusion and production of seamless pipe and tube – Drawing of rods, wires and tubes.

UNIT V **SHEET METAL FORMING AND OTHER PROCESSES** **9**

Forming methods: Shearing, blanking, bending, stretch forming and deep drawing – Types of dies used in press working – Defects in formed part – Sheet metal formability – Formability limit diagram – High velocity forming: Comparison with conventional forming – Explosive forming – Electro hydraulic – Electro magnetic forming – Dynapak and petro-forge forming.

Total: 45

TEXT BOOKS

1. Dieter.G.E., “Mechanical Metallurgy”, SI Edition, McGraw-Hill Co., 1995.
2. Nagpal. G.R., “Metal Forming Processes”, Khanna Publications, 2000.

REFERENCES

1. Kurt Lange “Handbook of Metal Forming”. Society of Manufacturing Engineers, Michigan, 1988.
2. Avitzur, “Metal Forming - Processes and Analysis”, Tata McGraw-Hill Co., 1977.
3. ASM Metals Handbook, Vol.14, “Forming and Forging”, Metals Park, Ohio, 1990.
4. Taylor Altan, Soo I.K. Oh, Gegel, H.L., “Metal Forming: Fundamentals and Applications”, ASM. Metals Park. Ohio, 1983.

PR1303 – 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 9

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. Grant, H. E., “Jigs and Fixture” Tata McGraw-Hill, 2003.
3. “Fundamentals of Tool Design”, CEEE Edition, ASTME, 1983.
4. “Design Data Handbook”, PSG College of Technology, Coimbatore.

PR1304 – MACHINE ELEMENTS DESIGN

L	T	P	C
3	1	0	4

UNIT I FUNDAMENTALS OF DESIGN 7

Design process – Computer aided design – Optimum design – Mechanical properties of materials – Types of loads – Stresses: Static, varying, thermal, impact and residue – Factor of safety – Stress concentration factors – Preferred numbers.

UNIT II DESIGN OF GEARS 10

Design of gears: Spur helical, bevel and worm gears – Design of multistage speed reducers.

UNIT III DESIGN OF BASIC MACHINE ELEMENTS AND JOINTS 12

Design of shafts, keys, couplings and journal bearings – Selection of rolling element bearings – Design of pin, riveted and welded joints – Screw fasteners – Power screws.

UNIT IV DESIGN OF ENGINE PARTS 8

Design of piston – Connecting rod – Crankshafts – Flywheels.

UNIT V DESIGN OF SPRINGS 8

Design of helical springs – Compression and tension – Leaf springs.

L: 45 T: 15 Total: 60

TEXT BOOKS

1. Bhandari V.B., “Design of Machine Elements”, Tata McGraw-Hill Publishing Company Ltd, 1998.
2. Khurmi R.S. and Gupta J.K., “A Text book of Machine Design”, S.Chand and Company, 2004.

REFERENCES

1. Harmrock, B. J., B O Jacobson, “Fundamentals of Machine Elements”, McGraw-Hill, 1999.
2. Sharma C.S. and Kamlesh Purohit, “Design of Machine Elements”, PHI 2003.
3. Prabhu, T.J., “Design of Transmission Elements”, Mani Offset Printers, 2004.

UNIT I INTRODUCTION 10

Welding as a production process – Its advantages and limitations – Gas welding process – Types of fuels – Acetylene, indane, butane etc. – Gas welding equipments – Gas welding technique – Electric arc welding – Manual metal arc welding – Power supplies, cables and other accessories for arc welding – Welding technique – Atomic, hydrogen welding, thermit welding, soldering, brazing and braze welding.

UNIT II SPECIAL WELDING PROCESSES 9

Gas tungsten arc (TIG) welding – Gas metal arc (MIG) welding – Submerged arc welding – electro slag welding processes – Power sources and other characteristics for these individual processes – Equipments and accessories – Application and limitation of each process – Resistance welding processes – Their principle – Types (spot, seam, projection, percussion, flash) – Equipments required for each application.

UNIT III MODERN WELDING PROCESSES 8

Electron beam welding – Laser beam welding – Plasma arc welding – Friction welding – Explosive welding – Ultrasonic welding – Stud welding – Under water welding – Diffusion bonding – Cold welding – Welding of dissimilar metals – Welding of plastics.

UNIT IV WELDMENT TESTING 9

Defects in welding in various processes – Causes and remedies – Destructive testing of weldments – Strength, hardness, ductility, fatigue, creep properties etc. – Non destructive testing of weldments – Ultrasonic dye penetrant – Magnetic particle inspection – X ray testing procedures and identification defects – Case studies – Weld thermal cycle – Residual stresses – Distortion in welding stress relieving techniques.

UNIT V WELDABILITY, AUTOMATION AND DESIGN IN WELDING 9

Weldability definition –Temperature distribution in welding – Heat affected zone weldability of steel, cast iron, aluminium – Pre heating and post heating of weldment – Estimation of transition temperature – Automation in welding – Seam tracking vision and arc sensing –Welding robots – Design of weldments – Welding symbols positions of welding joint and groove design – Weld stress – Calculations – Design of weld size – Defects in welding – Their causes and remedies.

Total: 45**TEXT BOOKS**

1. Little R.L., “Welding Technology”, Tata McGraw-Hill, 2000.
2. Partner, R.S., “Welding Process and Technology”, Khanna Publishers, 1994.

REFERENCES

1. Lancaster J.F., “Metallurgy of Welding”, George Allen and Unwin, 1991.
2. “Metals Hand Book”, Volume 6, Sixth Edition, ASM, 1971.
3. “AWS Welding Hand Book”, Volume 1 to 4, AWS.
4. Radhakrishnan.V.M., “Welding Technology and Design”, New Age International Pub. Ltd., 2002.

PR1306 – CNC MACHINES LABORATORY

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS

1. Manual part programming for CNC machines using standard G codes and M codes - Simulation of Tool path – Machining practical on Trainer type of CNC machines.
2. CNC Lathe programming exercise for a simple component involving linear and circular interpolation.
3. CNC Lathe programming exercise for a simple component involving thread cutting and profile cutting.
4. CNC Lathe programming making use of subroutine and Do loop.
5. CNC Milling program exercise involving mirror image, tool setting, job setting and editing tools.
6. CNC Milling program exercise involving linear and circular interpolation and canned cycles.
7. CNC Milling program making use of canned cycles
8. CNC code generation using any CAM software.
9. Simulation of machining operations using any CAM software.

Total: 45

LIST OF EQUIPMENTS

(for a batch of 30 students)

CNC trainer lathe	–	2 Nos.
CNC trainer milling Machine	–	2 Nos.
Any Standard CAM software	–	5 Licenses

(Examples: Master CAM, SMART CAM, ESPIRIT, CADEM etc.,)

Computers – (Pentium 4, 128 RAM, 20 GB HDD, 17 inch Color Monitor) 5 Sets.

LIST OF EXPERIMENTS

1. Calibration of Dial gauge, Micrometer, Vernier and Height gauge
2. Use of Sine bar for measuring angles
3. Study and use of Profile Projector
4. Measurement of thread parameters using Floating Carriage Micrometer
5. Surface roughness measurement
6. Use of Mechanical and Pneumatic comparator
7. Measurement of gear tooth thickness
8. Measurement of Internal, External angles and Bores using standard Balls, and Height gauge.
9. Measurement of Straightness and Flatness using precision level.
10. Study and use of Toolmaker's microscope
11. Study of Digital measuring instruments

Total: 45**LIST OF EQUIPMENTS**

(for a batch of 30 students)

- | | | |
|-----|---|----------|
| 1. | Vernier Calipers | - 5 Nos. |
| 2. | Micrometer | - 2 Nos. |
| 3. | Dial gauges | - 2 Nos. |
| 4. | Height gauge | - 1 No. |
| 5. | Slip gauge set | - 2 sets |
| 6. | Sine Bar | - 1 No. |
| 7. | Profile Projector | - 1 No. |
| 8. | Gear tooth Vernier | - 1 No. |
| 9. | Gear Tooth micrometer | - 1 No. |
| 10. | Floating Carriage Micrometer | - 1 No. |
| 11. | Thread Plug Gauge | - 1 No. |
| 12. | 2 Wire or 3 wire set box | - 1 No. |
| 13. | Surface Roughness Measuring instruments (portable type) | - 1 No. |
| 14. | Precision Spheres | - 1 set |
| 15. | Mechanical Comparator | - 1 No. |
| 16. | Precision level | - 1 No. |
| 17. | Toolmakers microscope | - 1 No. |
| 18. | Digital micrometer | - 1 No. |
| 19. | Digital Vernier | - 1 No. |
| 20. | Digital height gauge | - 1 No. |

OBJECTIVES

To enable the student to understand and interpret all the technology, physical features, symbols etc and be able to draw assembly drawings of several engineering components.

1. Review of the concepts of engineering fits and tolerances – Review of the basic terminology and symbols used in component and assembly drawings
2. Detailed part drawings and assembly drawings (with suitable tolerancing, machining symbols, standard specification of fit)
 - a) Lathe Tailstock
 - b) Machine Vice
 - c) Four Jaw Chuck of Lathe
 - d) Square Turret tool holder for Lathe
 - e) Swivel Bearing
 - f) Hydraulic / Pneumatic power cylinder assembly
 - g) Mechanical fly press
 - h) Petrol engine connecting rod assembly
 - i) Injection moulding Die assembly for plastic products
 - j) Blue print reading (at least 5 industrial drawings)
3. Computer aided drawing of simple members consisting of at least three components – practices of component and assembly drawings

Total: 45

TEXT BOOK

1. Narayanan.K.L. Kannaiah. P and Venkata Reddy.K., “Production Drawing”, New Age International Ltd., 1996.

REFERENCES

1. Nagpal G.R. “Machine Drawing”, Khanna Publishers, New Delhi, 1994.
2. Bhat.N.D., “Machine Drawing”, Charotar Publishing House, Anand 2000.
3. Sadu Singh and Shah, P.L., “Fundamentals of Machine Drawing”, PHI 2003.

LIST OF EQUIPMENTS
(for the batch of 30 students)

- | | |
|--|--------------|
| 1. Drawing board | 30 Nos. |
| 2. Computer System
(Pentium 4, 128 RAM, 20 GB HDD, 17 inch Color Monitor) | 15 Sets. |
| 3. Auto Cad 2004 | 15 Licenses. |

SEMESTER VI

MG1351 – 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 Koortz and Heinz Weihrich, “Essentials of Management”, Tata McGraw-Hill, 1998.
2. Massie, J. L., “Essentials of Management”, 4th Edition, Prentice Hall of India, 2003.

REFERENCES

1. Tripathy P.C and Reddy P.N., “Principles of Management”, Tata McGraw-Hill, 1999.
2. Decenzo David and Robbin Stephen A, “Personnel and Human Resources Management”, Prentice Hall of India, 1996.
3. JAF Stomer, Freeman R. E and Gilbert, D.R., “Management”, 6th Edition, Pearson Education, 2004.
4. Fraidoon Mazda, “Engineering Management”, Addison Wesley, 2000.

ME1402 – 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 BOOK

1. Bolton W., “Mechatronics”, 2nd Edition, Pearson Education, 1999.

REFERENCES

1. Michael B. Histan 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.
4. Kamm, L. J., “Understanding Electro – Mechanical Engineering”, An Introduction to Mechatronics, Prentice – Hall of India Pvt., Ltd., 2000.
5. Nitaigour Premchand Mahadik, “Mechatronics”, Tata McGraw-Hill publishing Company Ltd, 2003.

PR1351 – 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 BOOK

1. Jain, V.K., “Advanced Machining Processes”, Allied Publishers Pvt. Ltd., 2002.

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.
4. Paul De Garmo, J.T.Black, and Ronald.A.Kohser, “Material and Processes in Manufacturing”, 8th Edition, Prentice Hall of India Pvt. Ltd., 2001.

PR1352 – FOUNDRY TECHNOLOGY

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION 7

Introduction to moulding and casting processes – Steps involved – Advantages, limitations and application of casting process – Patterns – Types and their applications – Pattern allowances – Pattern materials – Colour coding as per BIS – Pattern making cores – Core prints – Core boxes – Core making.

UNIT II MOULDING PROCESSES 9

Manual moulding processes – Equipments and tools – Moulding sand ingredients – Moulding sand properties – Influence of ingredients on properties – Sand preparation and control – Sand testing – Machine moulding – Types of machines and its applications – Core blowers – Core shooters.

UNIT III CASTING PROCESSES 12

Sand casting processes – Permanent mould casting processes – Pressure die casting – Centrifugal casting – Precision/investment casting – Shell moulding – CO₂ moulding – Continuous casting – Squeeze casting – Electro slag casting processes – Vacuum process – Full mould process – Magnetic moulding process.

UNIT IV MELTING, POURING AND TESTING 10

Foundry remelting furnaces – Selection of furnace – Crucible – Oil fired furnace – Electric furnaces – Resistance, arc and induction furnaces – Cupola steel melting – Non-ferrous melting practices – Pouring equipments – Inspection of castings, destructive and non destructive – Casting defects – Occurrence, causes and remedies.

UNIT V POURING, FEEDING AND AUTOMATION 7

Gating system – Functions – Types of gating systems – Gating ratio – Riser – function – Types of risers – Riser design – Foundry layout and automation.

Total: 45

TEXT BOOK

1. Jain P.L., “Principles of Foundry Technology”, Tata McGraw-Hill, 1995.

REFERENCES

1. Heine, Lpoer et al, “Principles of Metal Casting”, McGraw-Hill Publication, 1999.
2. Taylor H.F. Fleming M.C. and Wulff.J, “Foundry engineering”; Wiley Eastern Ltd.,1993.
3. Gupta R.B, “Foundry Engineering”; Satyaprakashan, 1989.
4. Lal,Mand Khanna O.P., “A Text Book of Foundry Technology”, Dhanpat Rai and Sons, 1986.
5. Lindberg R.A, “Processes and Materials of Manufacture”, Prentice Hall, 2000.
6. Banga T.R. and Agarwal R.L. “Foundry Engineering”, Khanna Publishers, 1992.

PR1353 – 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 RELIABILITY 9

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

Total: 45

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

TEXT BOOKS

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

REFERENCES

1. Monohar Mahajan, "Statistical Quality Control", Dhanpat Rai and Sons, 2001.
2. Gupta, R.C., "Statistical Quality control", Khanna Publishers, 1997.
3. Besterfield D.H., "Quality Control", Prentice Hall, 1993.
4. Sharma S.C., "Inspection Quality Control and Reliability", Khanna Publishers, 1998.
5. Danny Samson, "Manufacturing and Operations Strategy", Prentice Hall, 1991.

MR14105 – 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
 - (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 & PNEUMOSIM Software / Automation studio | - 10 sets. |
| 4. | 8051 - Microcontroller kit with stepper motor and drive circuit | |
| | LABVIEW software | - 2 Nos. |
| 5. | LAB VIEW software with Sensors to measure Pressure, Flow rate, direction, speed, velocity and force. | - 2 Nos |

PR1354 – FLUID POWER LABORATORY

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS

1. Study of Elements of Hydraulic systems
2. Study of Elements of pneumatic systems
3. Actuation of single acting cylinder using a trainer
4. Actuation of double acting cylinder using a trainer
5. Speed control of a hydraulic cylinder using flow control valve
6. Simulation of Hydraulic circuits using various control valves
7. Sequencing of Hydraulic / Pneumatic circuits
8. Electro-pneumatic circuits in a trainer
9. PLC based pneumatic circuits.
10. Simulation of Logic circuits.
11. Simulation of Hydraulic circuits using software
12. Simulation of Pneumatic circuits using software

Total: 45

LIST OF EQUIPMENTS

(or a batch of 30 students)

- | | | |
|----|--|--------------|
| 1. | Hydraulic cut section models | - 1 Kit |
| 2. | Pneumatic cut section models | - 1 kit |
| 3. | Hydraulic trainer with single acting and double acting cylinders | - 1 No. |
| 4. | Pneumatic trainer | - 1 No. |
| 5. | Electro pneumatic trainer kit | - 1 No. |
| 6. | PLC trainer Kit | - 1 No. |
| 7. | Hydraulic simulation software | - 5 Licenses |
| 8. | Pneumatic simulation software | - 5 Licenses |

LIST OF EXPERIMENTS

WELDING

- a) Study of different welding equipments and accessories: Gas, Electric Welding
- b) Oxy-acetylene gas welding of Lap joint, Butt Joint and T Joint.
- c) Electric arc welding of Lap Joint, Butt Joint, and T Joint.
- d) Welding of pipes in different positions.
- e) Brazing practice – furnace brazing.
- f) Brazing welding of cast iron.
- g) Thermit welding of thick material like rod plates etc.

FOUNDRY

Preparation of green moulding sand using a 5 kg muller and testing for

- h) Compression, shear, tensile, transverse strengths, hardness
 - i. in green condition:
 - ii. in dry condition after drying in oven at 150 ° C for one and half hour.
- i) Permeability testing.
- j) Determining the clay content.
- k) Sieve analysis of dry silica sand.
- l) Determining the moisture content by various methods.
- m) Melting any non-ferrous metal and making simple castings - Demonstration.

Total: 45

LIST OF EQUIPMENTS

(for a batch of 30 students)

- 1. 5 Kg Muller - 1No.
- 2. Sand rammer - 1 No
- 3. Weighing balance - 1 No.
- 4. Universal sand strength testing with all accessories - 1 Set.
- 5. Permeability tester - 1 No.
- 6. Quick moisture tester - 1 No.
- 7. Infra-red drier - 1 No.
- 8. Sieve shaker with Sieves - 1 Set.
- 9. Crucible furnace - 1 No.
- 10. Oxy acetylene gas welding equipment - 1 Set.
- 11. Electric Welding Transformer, welding booth - 5 No.

SEMESTER VII

MG1301 – 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 BOOK

1. Besterfield, D. H. et al., “Total Quality Management”, Pearson Education, Inc. 2003.

REFERENCES

1. Evans, J. R., and Lidsay, W.M., “The Management and Control of Quality”, 5th Edition, South-Western (Thomson Learning), 2002.
2. Feigenbaum.A.V., “Total Quality Management”, McGraw Hill, 1991.
3. Oakland.J.S. “Total Quality Management”, Butterworth – Heinemann Ltd., Oxford, 1989.
4. Narayana V. and Sreenivasan, N.S., “Quality Management – Concepts and Tasks”, New Age International, 1996.
5. Zeiri. “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

IC1404 – ROBOTICS

(Common to Mechanical, Automobile and Production)

L	T	P	C
3	1	0	4

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 effector 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.

L:45 T: 15 Total: 60

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.

GE1452 – PROCESS PLANNING AND COST ESTIMATION

(Common to Mechanical and Production)

L	T	P	C
3	1	0	4

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.

L:45 T: 15 Total: 60

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.

ME1403 – 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.

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.
4. Radhakrishnan P, Subramanyan S. and Raju V., “CAD/CAM/CIM”, 2nd Edition, New Age International (P) Ltd, 2000.

ME1407 – COMPUTER AIDED DESIGN LABORATORY

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS

1. Two dimensional geometry creation and modification using standard drafting package.
2. Detailing and documentation of a typical production drawing.
3. Attributes and Data extraction from a drawing.
4. Creation of Simple Solid Models using CSG and B-Rep Approach.
5. Surface Modeling types.
6. Interfacing database package with typical drafting package.
7. Object Modeling and Mesh generation using simple elements.
8. Analysis of typical machine elements.
9. Kinematics Analysis of simple mechanisms.
10. Software project consisting of development of algorithms and programs in the field of manufacturing applications.
11. Comparative Study of the features of at least three high-end Cad Software packages.

Total: 45

LIST OF EQUIPMENTS (for the batch of 30 students)

- | | | |
|----|---|----------|
| 1. | Computer System
(Pentium 4, 256 RAM, 40 GB HDD, 17 inch Color Monitor) | 30 Sets. |
| 2. | Auto CAD 2004 or Pro-E or CATIA or Unigraphics Licenses | 15 |

ME1356 – DESIGN AND FABRICATION PROJECT

(Common to Mechanical and Production)

L	T	P	C
0	0	4	2

The objective of this project 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 in the college and demonstrate its working apart from submitting the project report. The report should contain assembly drawing, parts drawings, process charts relating to fabrication.

HS1301 – 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

GE1451 – 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 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 BOOK

1. Panneer Selvam, R., “Engineering Economics”, Prentice Hall of India Ltd, 2001.

REFERENCES

1. Park, C.S., “Contemporary Engineering Economics”, Prentice Hall of India, 2002.
2. Newman, D.G., Lavelle, J.P., “Engineering Economics and analysis” Engg. 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.
5. Smith, G.W., “Engineering Economy”, Iowa State Press, 1973.

PR1455 – 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 in periodical seminars on the progress made in the project.

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

ME1003 – 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 – CO₂ emissions and Global warming – Renewable energy resources and their importance – Potential impacts of harnessing the different renewable energy resources.

UNIT II SOLAR ENERGY 9

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

UNIT III WIND, TIDAL AND GEO THERMAL ENERGY 9

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

UNIT IV BIO ENERGY 9

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

UNIT V OTHER RENEWABLE ENERGY SOURCES 9

Direct energy conversion (Description, principle of working and basic design aspects only) – Magneto hydrodynamic systems (MHD) – Thermoelectric generators – Thermionic generators – Fuel cells – Solar cells – Types, emf generated, power output, losses and efficiency and applications – Hydrogen conversion and storage systems.

Total: 45

TEXT BOOK

1. Rai G.D., “Non conventional Energy sources”, Khanna Publishers, 1999.

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.
5. Desai, A.V., “Non-conventional Energy”, Wiley Eastern Ltd, 1990.

PR1002 – TRIBOLOGY

L	T	P	C
3	0	0	3

UNIT I SURFACES, FRICTION AND WEAR 9

Topography of the surfaces – Surface features – Surface interaction – Theory of friction – Sliding and rolling friction – Friction properties of metallic and non-metallic materials – Friction in extreme conditions – Wear, types of wear – Mechanism of wear – Wear resistance materials – Surface fatigue wear – Brittle fracture wear – Wear of ceramics and polymers.

UNIT II LUBRICANTS AND LUBRICATION TYPES 9

Lubricants and their physical properties – Lubricants standards – Lubrication regimes – Hydrodynamic lubrication – Thermal, inertia and turbulent effects – Elasto hydrodynamic and plasto hydrodynamic and magneto hydrodynamic lubrication – Hydro static lubrication.

UNIT III LUBRICATION THEORY 9

Fluid film in simple shear – Viscous flow between very close parallel plates – Shear stress variation – Reynolds Equation for film lubrication – High speed unloaded journal bearings – Loaded journal bearings.

UNIT IV ROLLING ELEMENT BEARINGS 9

Geometry and kinematics – Contact stresses – Hertzian stress equation – Load divisions – Stresses and deflection – Axial loads and rotational effects – Bearing life capacity and variable loads – ISO standards – Oil films and their effects – Rolling bearing failures.

UNIT V SURFACE ENGINEERING AND MATERIAL FOR BEARINGS 9

Surface modifications – Transformation hardening, surface fusion – Thermo chemical processes – Surface coatings – Plating and anodizing – Fusion processes – Vapour phase processes – Materials for rolling element bearings – Materials for fluid film bearings – Materials for marginally lubricated and dry bearings.

Total: 45

TEXT BOOK

1. Hutchings I.M., “Tribology, Friction and wear of Engineering Materials”, Edward Arnold, 1990.

REFERENCES

1. Cameron, A., “Basic Lubrication Theory”, Ellis Herward Ltd., 1981.
2. Hulling, J., “Principles of Tribology”, Macmillan, 1984.
3. Williams J.A., “Engineering Tribology”, Oxford Univ. Press, 1994.
4. Neale M.J., “Tribology Hand Book”, Butterworth Heinemann, 1995.

MA1251 – 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 – Jordan methods – Iterative methods – Gauss – Seidel methods – Inverse of a matrix by Gauss Jordan 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.

AT1360 – 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.

ELECTIVES FOR SEMESTER VII

ME1014 – LOGISTICS AND SUPPLY CHAIN MANAGEMENT

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION 9

Logistics – Concepts, definition and approaches – Factors affecting logistics – Supply chain: Basic tasks and new corporate model.

UNIT II SUPPLY CHAIN MANAGEMENT 9

The new paradigm – The modular company – Network relation – Supply process – Procurement process – Distribution management

UNIT III EVOLUTION OF SUPPLY CHAIN MODELS 9

Strategy and structure – Factors of supply chain – Manufacturing strategy stages – Supply chain progress – Model for competing through supply chain management – PLC grid – Supply chain redesign – Linking SC with customer.

UNIT IV SUPPLY CHAIN ACTIVITY SYSTEMS 9

Structuring the SC – SC and new products – Functional roles in SC – SC design framework – Collaborative product commerce.

UNIT V SCM – ORGANIZATION AND INFORMATION SYSTEM 9

Management task – Logistics organization – Logistics information systems – Topology of SC application – MRP, ERP – Warehouse management system – Product data management – Cases.

Total: 45

TEXT BOOK

1. Schraj, P.B. and Lasen, T.S, “Managing Global Supply Chain”, Viva Books, 2000.

REFERENCES

1. Ayers, J.B., “Hand Book of Supply Chain Management”, St. Lencie Press, 2000.
2. Nicolas, J.N., “Competitive Manufacturing Management”, McGraw-Hill, 1998.

PR1003 – FINITE ELEMENT TECHNIQUES

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION

8

General field problems in engineering – Discrete and continuous models – Characteristics – the relevance and place of finite element method – Variational calculus – Variational formulation of boundary value problems – The method of weighted residuals – Rayleigh-Ritz and Galerkin methods – Solution of large system of equations – Choleski Decomposition – Gaussian elimination procedures.

UNIT II GENERAL PROCEDURE OF FET

5

Discretization of domain – Selection of interpolation polynomials – Convergence requirements – Formulation of element characteristics matrices and load vectors – Assembly of element characteristics matrices – Solution of finite element equations – Post processing of results.

UNIT III FINITE ELEMENT ANALYSIS OF ONE DIMENSIONAL AND TWO DIMENSIONAL PROBLEMS

12

One dimensional finite element analysis – Linear bar element – Quadratic bar element – Beam element – Frame element – One dimensional heat transfer – Two dimensional finite element analysis – Approximation of geometry and field variables – Three noded triangular element – Four noded rectangular element – Six noded triangular element – Natural coordinates and coordinate transformation – Numerical integration – Incorporation of boundary conditions – Solution of state equilibrium equations – 2D fluid problems.

UNIT IV ISO-PARAMETRIC ELEMENTS

10

Iso-parametric elements – Dynamic analysis – Equations of motion using Lagrange's approach – Consistent and lumped mass matrices – Formulation of FE equations for vibration problems – Solution of Eigen value problems – Transient vibration analysis – Thermal transients.

UNIT V APPLICATION OF FINITE ELEMENT ANALYSIS

10

Finite element analysis of crank shaft torsional vibrations – Axi-symmetric FEA of a pressure vessel – Application of FEM in various metal forming processes – Metal cutting machines – Solidification of castings – Weldment design.

Total: 45

TEXT BOOKS

1. Chandraputla T.R., and Belegundu A.D., "Introduction of Finite Element in Engineering", PHI, 1997.
2. Seshu. P., "Text Book of Finite Element Analysis", PHI, 2003

REFERENCES

1. Rao, S.S., "The Finite Element Method in Engineering", Pergamon Press, 1993
2. Segerland L.J., "Applied Finite Element Analysis", John Wiley and Sons, Inc, 1989.
3. Reddy J.L., "An Introduction to Finite Element Method", McGraw-Hill International Student Edition, 1990.
4. Rajasekaran S., "Numerical Methods for Initial and boundary Value Problems", Wheeler and Co., Pvt. Ltd., 1987.

ME1008 – 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.

PR1005 – INDUSTRIAL SAFETY ENGINEERING

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION TO THE DEVELOPMENT OF INDUSTRIAL SAFETY AND MANAGEMENT 8

History and development of industrial safety – Implementation of factories Act – Formation of various councils – Safety and productivity – Safety organizations – Safety committees – Safety committee structure – Roll of management and roll of Govt. in industrial safety – Safety analysis.

UNIT II OPERATIONAL SAFETY (HOT METAL OPERATION) 8

Hot metal operation – Safety in cutting – Safety in welding – Safety in Boilers – Pressure vessels – Furnace (all types) – Heat treatment processes shops – Electroplating – Grinding – Forming processes – Rolling – Forging – Surface hardening – Casting – Moulding – Coiling.

UNIT III OPERATIONAL SAFETY (COLD METAL OPERATION) 9

Safety in handling of portable power tools – Hand grinder – Machining shop – Drilling – Polishing machine – Safety in assembly shop – Material handling – Dock safety – Safety in generation and distribution of power – Distribution and handling of industrial gases – Safety in inspection – Safety in chemical laboratories – Ammonia printing – Safety in power press – Safety in sewage – Disposal and cleaning – Safety in Industrial pollution and control – Working at height.

UNIT IV ACCIDENT PREVENTION AND PROTECTIVE EQUIPMENTS 10

Personal protective equipment – Survey the plant for locations and hazards – Part of body to be protected – Education and training in safety – Prevention causes and cost of accident – House keeping – First aid – Fire fighting equipment – Accident reporting – Investigations – Industrial psychology in accident prevention – Safety trials.

UNIT V THE ACTS WHICH DEAL THE SAFETY AND INDUSTRIAL HYGIENE 10

Features of factory act – Explosive act – Boiler act – ESI act – Workman's compensation act – Industrial hygiene – Occupational safety – Diseases prevention – Ergonomics – Occupational diseases, stress and fatigue – Health, safety and the physical environment – Engineering methods of controlling chemical hazards, safety and the physical environment – Control of industrial noise and protection against it – Code and regulations for worker safety and health.

Total: 45

TEXT BOOKS

1. Ray Asfahl C., "Industrial Safety and Health Management", 5th Edition, Prentice Hall, 2003.
2. Willie Hammer, "Occupational Safety Management and Engineering", 5th Edition, Prentice Hall, 2000.

REFERENCES

1. Krishnan N.V., "Safety in Industry", Jaico Publishers House, 1996.
2. John Ridley, "Industrial safety and the law", P.M.C. Nair Publishers, 1998.
3. John Channing, "Safety Law for Occupational Health and Safety", Butterworth-Heinemann, Oxford University Press, 2002.

ELECTIVES FOR SEMESTER VIII

ME1011 – 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.

ME1012 – 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 Hand book”, 5th Edition, McGraw Hill, 1988.
3. Armstrong, “Condition Monitoring”, BSIRSA, 1988.
4. Davies, “Handbook of Condition Monitoring”, Chapman and Hall, 1996.
5. “Advances in Plant Engineering and Management”, Seminar Proceedings - IPE, 1996.

PR1007 – MANAGEMENT INFORMATION SYSTEM

L	T	P	C
3	0	0	3

UNIT I FUNDAMENTALS OF INFORMATION 9

Introduction – IS for operation, management and strategic advantage – Meaning and role of MIS – System approach – Knowledge on computer system – Selection – Developing IS.

UNIT II INFORMATION SYSTEM TECHNOLOGY 9

Computer hardware – Software – Telecommunications – Data base management – Modern communication – Video conferencing – Internet and super high way – System configuration and selection.

UNIT III INFORMATION SYSTEM IN MANAGEMENT 9

Transaction processing and reporting – Decision making and decision support system – Artificial intelligence and expert system – Office information system – MIS as technique for programmed decision.

UNIT IV PLANNING, DESIGNING AND IMLEMENTING THE MIS 9

Strategic and project planning conceptual design – Detailed design – Implementation – Evaluation and maintenance – Controlling of I S.

UNIT V MODERN TRENDS IN MIS 9

System concept – Control – Modeling – Case study in hostel, hospital, hotel, stores and production industries etc.,

Total: 45

TEXT BOOK

1. Murdict, R.G., “Information System for Modern Management”, Prentice-Hall of India, 1998.

REFERENCES

1. James A.O., Brien, “Management Information Systems”, Galgotia Publications, 1995.
2. Davis, G.B, “Management Information Systems; Conceptual foundations Structure and Development”, McGraw-Hill, 1984.
3. Sadagopan, “Management Information System”, Prentice Hall India Limited, 2000.

PR1008 – PRECISION ENGINEERING

L	T	P	C
3	0	0	3

UNIT I CONCEPT OF ACCURACY AND OF MACHINE TOOLS 10

Part accuracy – Errors – Accuracy of machine tools – Spindle accuracy – Displacement accuracy – Errors due to numerical interpolation – Definition of accuracy of NOC system – errors in the N.C machines – Feed stiffness – Zero stability.

UNIT II STATIC STIFFNESS AND ITS INFLUNCE AND INACCURACY DUE TO THERMAL EFFECTS IN THE MACHINE TOOLS 9

Overall stiffness of a lathe – Compliance of work piece – Errors caused by cutting forces deformation in turning, boring and milling – Heat sources – Thermal effects – Rate of thermal expansion.

UNIT III DIMENSIONING ACCURACY AND SURFACE FINISH 9

Definition of terms – Dimensional chains – Dimensional stepped shaft – Assigning Tolerances in the constituent dimensions – Dimensional chains – Concepts of precision machining – Finish turning – Boring – Grinding.

UNIT IV MICRO MANUFACTURING PROCESS 9

Micro machining – Photo resist process – Lithography – Optical – Processing of materials – Electron beam machining – Iron beam machining – Micro forming – Diamond turning – Micro positioning devices.

UNIT V SMART STRUCTURES, MATERIALS AND MICRO ACTUATORS 8

Smart structures – Smart sensors – Micro valves – MEMS – Micro motors – Micro pumps – Micro dynamometer – Micro machines – Structures – Cooling channels – Micro optics – Micro nozzles.

Total: 45

TEXT BOOKS

1. Murthy.R.L. “Precision Engineering in Manufacturing”, New Age International (P) Ltd.,
2. Norio Taniguchi, “Nano Technology”, Oxford University Press, 1996.

REFERENCES

1. Campbell, S.A., “The Science and Engineering of Micro electronic Fabrication”, Oxford University Press, 1996.
2. Randy Frank, “Understanding Smart Sensors”, Artech House, Boston, 1996.

PR1009 – MANUFACTURING SYSTEM AND SIMULATION

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION 9

Basic concept of system – Elements of manufacturing system – Concept of simulation – Simulation as a decision making tool – Types of simulation – System modeling – Types of modeling.

UNIT II RANDOM NUMBERS 10

Probability and Statistical concepts of simulation – Pseudo random numbers – Methods of generating random numbers – Discrete and continuous distribution – Testing of random numbers – Sampling: simple, random and simulated.

UNIT III DESIGN OF SIMULATION EXPERIMENTS 8

Problem formulation – Data collection and reduction – Time flow mechanical – Key variables – Logic flow chart starting condition – Run size – Experimental design consideration – Output analysis, interpretation and validation – Application of simulation in engineering industry.

UNIT IV SIMULATION LANGUAGE 8

Study of GPSS (Basic blocks only): Generate – Queue – Depart – Size – Release – Advance – Terminate – Transfer – Enter and Leave.

UNIT V CASE STUDIES 10

Development of simulation models using GPSS for queuing, production, inventory, maintenance and replacement systems.

Total: 45

TEXT BOOKS

1. Jerry Banks and Carson, J.S., “Discrete event system simulation”, Prentice Hall, 1991.

REFERENCES

1. Mize, J.H. and Grady Cox J., “Essential of Simulation”, Prentice Hall, 1989.
2. Written, J.L., Bentley, L.D. and Barice V.M., “System Analysis and Design Methods”, Galgotia Publication, 1995.
3. Shannon R.E., “System Simulation”, Prentice Hall, 1993.

PR1010 – KNOWLEDGE BASED SYSTEM IN MANUFACTURING

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION 10

Artificial intelligence – Introduction – Problems, problem spaces and search – Production systems – Problem characteristics – Knowledge representation issues – Representations and mappings – Approaches to knowledge representation – Representing simple facts in logic – Representing knowledge using rules – Procedural versus declarative knowledge – Logic programming – Forward versus backward reasoning – Inference engine – Knowledge acquisition – Protocol analysis – Optimization and knowledge based systems.

UNIT II AUTOMATED MANUFACTURING SYSTEMS 8

Introduction – Manufacturing systems – Performance measures of manufacturing systems – Computer – Controlled machines – Material handling systems – Flexible manufacturing systems – Architecture of FMS – Computer control systems – Intelligent manufacturing systems components – System architecture and data flow.

UNIT III TECHNOLOGY BASED SYSTEM 8

Design of mechanical parts – Refinement and model based approaches – Design of mechanisms – Feature based design – Knowledge based design for automated assembly – Process planning – Automatic feature recognition – Selection of process plans in automated manufacturing systems – Operation sequencing – Machining parameters optimization – Knowledge based systems for equipment selection.

UNIT IV INTELLIGENT MANUFACTURING SYSTEMS 9

Group technology – Models and algorithms – Cluster analysis – Knowledge based systems for GT – Models and algorithms – Models and algorithms for machine layout – Knowledge based systems for machine layout – Scheduling models and algorithms – Knowledge based systems for scheduling.

UNIT V RECENT ADVANCES 10

Applications of artificial neural network, fuzzy logic and genetic algorithms in manufacturing – ANN for tool wear monitoring – Application of neural networks to process modeling and control – Application of genetic algorithms to flow shop, scheduling, job shop scheduling and machine scheduling problem – Application of non traditional optimization techniques like ACO, PSO, Artificial immune systems in manufacturing.

Total: 45

TEXT BOOK

1. Andrew Kusiak, “Intelligent Manufacturing Systems”, Prentice Hall, 1990

REFERENCES

1. Mohamed Jamshidi, “Design and Implementation of Intelligent Manufacturing Systems”, Prentice Hall, 1995.
2. Mitsuo, Gen, Runwei Cheng, “Genetic Algorithms and Engineering Design”, John Willey, 1997.
3. Elaine Rich, “Artificial Intelligence”, Tata McGraw-Hill, 1995.
4. Vishwanandham, N, Narahari, Y., “Performance Modeling of Automated Manufacturing Systems”, Prentice Hall of India, 1998.

GE1301 – 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 issues – 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

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