UNIVERSITY DEPARTMENTS

ANNA UNIVERSITY CHENNAI :: CHENNAI 600 025

REGULATIONS – 2008

CURRICULUM FROM III & IV SEMESTERS FOR

B.E. MECHANICAL ENGINEERING

SEMESTER – III

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
MA9211	Mathematics – III	3	1	0	4
ME9201	Manufacturing Technology – I	3	0	0	3
ME9202	Engineering Thermodynamics	3	0	0	3
CE9211	Fluid Mechanics and Machinery	3	1	0	4
ME9203	Kinematics of Machines	3	1	0	4
EE9211	Electrical Drives and Control	3	0	0	3
PRACTICAL					
ME9204	Manufacturing Technology Laboratory- I	0	0	3	2
EE9212	Electrical Machines Laboratory	0	0	3	2
CE9212	Fluid Mechanics and Machinery Laboratory	0	0	3	2
	TOTAL				**27**

SEMESTER – IV

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
MA9262	Numerical Methods	3	1	0	4
CE9213	Strength of Materials	3	0	0	3
ME9251	Manufacturing Technology – II	3	0	0	3
ME9252	Engineering Materials and Metallurgy	3	0	0	3
ME9253	Dynamics of Machines	3	1	0	4
ME9254	Thermal Engineering – I	3	0	0	3
PRACTICAL					
ME9255	Computer Aided Machine Drawing	0	0	4	2
ME9256	Manufacturing Technology Laboratory – II	0	0	3	2
CE9214	Strength of Materials Laboratory	0	0	3	2
	TOTAL				**26**

SEMESTER – V

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
ME9301	Design of Jigs, Fixtures & Press Tools	3	0	0	3
ME9302	Thermal Engineering – II	3	0	0	3
ME9303	Hydraulics and Pneumatics	3	0	0	3
ME9304	Modern Machining Processes	3	0	0	3
ME9305	Design of Machine Elements	3	1	0	4
ME9306	Metrology & Measurements	3	0	0	3
PRACTICAL					
ME9307	Dynamics Laboratory	0	0	3	2
ME9308	Thermal Engineering Lab. – I	0	0	3	2
ME9309	Metrology & Measurements Laboratory	0	0	3	2
ME9310	Technical Seminar	0	0	2	0
	TOTAL				**25**

SEMESTER – VI

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
ME9351	Finite Element Analysis	3	0	0	3
ME9352	Microprocessor & Micro Controller	3	0	0	3
ME9353	Design of Transmission Systems	3	1	0	4
ME9354	Computer Aided Design & Manufacture	3	0	0	3
ME9355	Heat and Mass Transfer	3	0	0	3
	Elective – I	3	0	0	3
PRACTICAL					
ME9356	Thermal Engineering Lab. – II	0	0	3	2
ME9357	CAD / CAM Laboratory	0	0	3	2
ME9358	Microprocessor & Micro Controller Laboratory	0	0	4	2
GE9371	Communication skills and Soft Skills lab	0	0	2	1
	TOTAL				**26**

SEMESTER – VII

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
GE9022	Total Quality Management	3	0	0	3
ME9401	Power Plant Engineering	3	0	0	3
ME9402	Mechatronics	3	0	0	3
MG9362	Industrial Management	3	0	0	3
	Elective – II	3	0	0	3
	Elective – III	3	0	0	3
PRACTICAL					
ME9403	Computer Aided Simulation and Analysis Laboratory	0	0	3	2
ME9404	Mechatronics Laboratory	0	0	4	2
ME9405	Comprehension	0	0	2	1
ME9406	Design and Fabrication Project	0	0	4	2
	TOTAL				**25**

SEMESTER – VIII

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
	Elective – IV	3	0	0	3
	Elective – V	3	0	0	3
PRACTICAL					
ME9451	Project Work	0	0	12	6
	TOTAL				**12**

TOTAL CREDIT: 193

LIST OF ELECTIVES FOR B.E. MECHANICAL ENGINEERING

ELECTIVES – I

CODE NO.	COURSE TITLE	L	T	P	C
ME9021	Energy Conservation & Management	3	0	0	3
ME9022	New and Renewable Sources of Energy	3	0	0	3
ME9023	Advanced Welding and Casting Processes	3	0	0	3
ME9024	Mechanical Vibrations & Noise	3	0	0	3
ME9025	Design for Manufacturing	3	0	0	3
ME9026	Gas Dynamics and Jet Propulsion	3	0	0	3
ME9027	Management Sciences	3	0	0	3
ME9028	Composite Materials & Mechanics	3	0	0	3
ME9029	Automobile Engineering	3	0	0	3
ME9030	Industrial Tribology	3	0	0	3
ME9031	Turbo Machinery	3	0	0	3
ME9032	Computational Fluid Dynamics	3	0	0	3
ME9033	Micro Electro Mechanical Systems	3	0	0	3
MF9032	Artificial Intelligence	3	0	0	3
ME9034	Design of Pressure Vessels and Piping	3	0	0	3
MF9351	Flexible Manufacturing Systems	3	0	0	3
ME9035	Measurements and Controls	3	0	0	3
GE9021	Professional Ethics in Engineering	3	0	0	3
GE9023	Fundamentals of Nanoscience	3	0	0	3
MA9261	Probability & Statistics	3	0	0	3
ME9036	Advanced IC Engineering	3	0	0	3
ME9037	Refrigeration and Air-conditioning	3	0	0	3
MF9023	Rapid Prototyping	3	0	0	3
MG9072	Entrepreneurship Development	3	0	0	3
MG9073	Marketing Management	3	0	0	3
MF9302	Theory of Metal Forming	3	0	0	3
ME9039	Design of Heat Exchangers	3	0	0	3
ML9402	Non Destructive Testing	3	0	0	3
ME9040	Nuclear Engineering	3	0	0	3
IE9023	Product Design and Development	3	0	0	3

(For University Departments under R-2008)

MA 9211 MATHEMATICS III

(Common to all branches of BE / B.Tech)

L	T	P	C
3	1	0	4

UNIT I FOURIER SERIES 9+3

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

UNIT II PARTIAL DIFFERENTIAL EQUATIONS 9+3

Formation – Solutions of first order equations – Sandard types and Equations reducible to standard types – Singular solutions - Lagrange's Linear equation – Integral surface passing through a given curve – Solution of linear equations of higher order with constant coefficients.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9+3

Method of separation of Variables – Solutions of one dimensional wave equation, - One-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates.

UNIT IV FOURIER TRANSFORM 9+3

Fourier integral theorem – Fourier transform pair-Sine and Consine transforms – Properties – Transform of simple function – Convolution theorem - Parseval's identity.

UNIT V Z – TRANSFORM AND DIFFERENCE EQUATION 9+3

Z-transform-Elementary properties-Inverse z transform – Convolution theorem-Formation of difference equation-Solution of difference equation using z transform.

Total: 45+15=60

TEXT BOOK

1. B.S.Grewal, "Higher Engineering Mathematics", Khanna Publications (2007)

REFERENCES

1. Glyn James, "Advanced Modern Engineering Mathematics, Pearson Education (2007)
2. B.V.Ramana, "Higher Engineering Mathematics" Tata McGraw Hill 2007.
3. N.P.Bali, and Manish Goyal, "A Text Book of Engineering 7th Edition (2007) Lakshmi Publications (P) Limited, New Delhi.

ME9201 MANUFACTURING TECHNOLOGY – I

L	T	P	C
3	0	0	3

OBJECTIVE

This course aims to impart the knowledge about various manufacturing processes. It deals with metal casting, metal forming and metal joining processes. After this course, a student will have a good exposure about the manufacturing processes and various operations and machinery. This also gives the recent trends in these processes also.

UNIT I FOUNDRY TECHNOLOGY 11

processes – shell, investment, die casting, centrifugal castings principles of gating system design - fettling and finishing of castings – defects in casting.

UNIT II HOT AND COLD WORKING 7

Hot and cold working process, rolling – introduction – rolling mills – rolling operations – production of seamless tube.

UNIT III FORGING 9

Introduction – forging operations – drop forging – warm forging – extrusion and drawing: extrusion practice – hot, cold, impact and hydrostatic extrusion. drawing process: defects and residual stresses, drawing equipment, stretch forming, deep forming, spinning processes and sheet metal forming.

1. ADVANCES IN FORMING PROCESS 9

High energy rate forming process; explosive forming, electro- hydraulic, electro magnetic forming, dynapack machine, advances in super forging. plastic materials and processes: types of plastics – types of moulding – compression moulding - transfer moulding – injection moulding.

2. PRINCIPLES AND APPLICATIONS OF JOININGPROCESSES 9

Gas welding, basic arc welding processes: thermit welding, electron beam welding, laser beam welding, and solid state welding: cold welding, ultrasonic welding, friction welding, resistance welding and explosive welding and welding defects. principles and applications of brazing and soldering – recent development in joining processes.

Total : 45

TEXT BOOK

1. Kalpakjian, S., “Manufacturing Engineering and Technology”, Pearson Education India Edition, 2006

REFERENCES

1. Roy. A. Lindberg, Processes and Materials of Manufacture, PHI / Pearson Education, 2006
2. Hajra Choudhury S.K and Hajra Choudhury. A.K., Elements of Workshop Technology, Volume I and II, Media Promoters and Publishers Private Limited, Mumbai, 1997.
3. Paul Degarma E, Black J.T. and Ronald A. Kosher, Elighth Edition, Materials and Processes, in Manufacturing Prentice – Hall of India, 1997.
4. Sharma, P.C., A Text book of Production Technology, S. Chand and Co. Ltd., 2004.
5. P.N. Rao, Manufacturing Technology Foundry, Forming and Welding, TMH-2003; 2nd Edition
6. S. Gowri, P. Hariharan, A. Suresh Babu, Manufacturing Technology I, Pearson Education, 2008.

		L T P C
ME9202	**ENGINEERING THERMODYNAMICS**	**3 0 0 3**

AIM

To teach and train the students about the heat energy dynamics and utilization.

OBJECTIVE

The student must acquire the knowledge capability of analyzing and solving any concept or problem associated with heat energy dynamics and utilization.

PREREQUISITE

1. BASIC CONCEPT AND FIRST LAW 9

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

2. SECOND LAW AND ENTROPY 9

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

3. THERMODYNAMIC AVAILABILITY 9

Basics – Energy in non-flow processes : Expressions for the Exergy of a closed system-Equivalence between mechanical energy forms and Exergy – Flow of energy associated with heat flow – Exergy consumption and entropy generation. Exergy in steady flow processes : Expressions for Exergy in steady flow processes – Exergy dissipation and entropy generation.

4. PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE 9

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

5. PSYCHROMETRY 9

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

TUTORIALS 15

TOTAL : 60

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

TEXT BOOKS :

1. Nag.P.K., “Engineering Thermodynamics”, Tata McGraw-Hill, New Delhi, 1998.
2. Lynn D Russell, George A, Adebiyi “Engineering Thermodynamics” Indian Edition, Oxford 3. University Press, New Delhi, 2007.

REFERENCES :

1. Yunus A angel and Michael Boleo, Thermodynamics An Engineering Approach
2. E.Ratha Krishnan, Fundamentals of Engineering Thermodynamics, 2nd Edition, Prentice – Hall of India Pvt. Ltd, 2006
3. Arora C.P, “Thermodynamics”, Tata McGraw-Hill, New Delhi, 2003.
4. Merala C, Pother, Craig W, Somerton, “Thermodynamics for Engineers”, Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.
5. Venwylen and Sontag, “Classical Thermodynamics”, Wiley Eastern, 1987
6. Holman.J.P., “Thermodynamics”, 3rd Ed. McGraw-Hill, 1995.

CE9211 FLUID MECHANICS AND MACHINERY

L T P C
3 1 0 4

OBJECTIVES:

a. The student is introduced to the mechanics of fluids through a thorough understanding of the properties of the fluids. The dynamics of fluids is introduced through the control volume approach which gives an integrated under standing of the transport of mass, momentum and energy.
b. The applications of the conservation laws to flow though pipes and hydraulics machines are studied

I. INTRODUCTION **12**

Units & Dimensions. Properties of fluids – Specific gravity, specific weight, viscosity, compressibility, vapour pressure and gas laws – capillarity and surface tension. Flow characteristics: concepts of system and control volume. Application of control volume to continuity equiation, energy equation, momentum equation and moment of momentum equation.

II. FLOW THROUG CIRCULAR CONDUITS **12**

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

III. DIMENSIONAL ANALYSIS **9**

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

IV. ROTO DYNAMIC MACHINES **16**

Homologus 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.

V. POSITIVE DISPLACEMENT MACHINES **11**

Recriprocating pumps, Indicator diagrams, Work saved by air vessels. Rotory pumps. Classification. Working and performance curves.

TOTAL : 60

TEXT BOOKS:

1. Streeter. V. L., and Wylie, E.B., Fluid Mechanics, McGraw Hill, 1983.
2. Rathakrishnan. E, Fluid Mechanics, Prentice Hall of India (II Ed.), 2007.

REFERENCES:

1. Ramamritham. S, Fluid Mechanics, Hydraulics and Fluid Machines, Dhanpat Rai & Sons, Delhi, 1988.
2. Kumar. K.L., Engineering Fluid Mechanics (VII Ed.) Eurasia Publishing House (P) Ltd., New Delhi, 1995.
3. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., New Delhi.

		L T P C
ME9203	**KINEMATICS OF MACHINES**	**3 1 0 4**

OBJECTIVES

ii) To understand the basic components and layout of linkages in the assembly of a system/machine.

iii) To understand the principles involved in assembly the displacement, velocity, and acceleration at any point in a link of a mechanism.

iv) To understand the motion resulting from a specified set of linkages.

v) To understand and to design few linkage mechanisms and cam mechanisms for specified output motions.

vi) To understand the basic concepts of toothed gearing and kinematics of gear trains.

vii) To understand the effects of friction in motion transmission and in machine components.

1. BASICS OF MECHANISMS: 12

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility – Kutzbach criterion, Gruebler's criterion – Grashof's Law – Kinematic inversions of four-bar chain and slider crank chains – Limit positions – Mechanical advantage – Transmission Angle – Description of some common mechanisms – Quick return mechanisms, Straight line generators, Dwell mechanisms, Ratchets and Escapements, Universal Joint – Basic structures of Robot Manipulators (serial & parallel) – Design of quick return crank-rocker mechanisms.

2. KINEMATICS OF LINKAGE MECHANISMS: 15

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method – Velocity and acceleration polygons – Velocity analysis using instantaneous centres – Kinematic analysis by complex algebra methods – Vector approach – Computer applications in the kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration.

3. KINEMATICS OF CAM MECHANISMS: 12

Classification of cams and followers – Terminology and definitions – Displacement diagrams – Uniform velocity, parabolic, simple harmonic, cycloidal and polynomial motions – Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – sizing of cams.

4. GEARS AND GEAR TRAINS: 12

Law of toothed gearing – Involutes and cycloidal tooth profiles –Spur Gear terminology and definitions –Gear tooth action – contact ratio – Interference and undercutting – Non-standard gear teeth – Helical, Bevel, Worm, Rack and Pinion gears [Basics only] – Gear trains – Speed ratio, train value – Parallel axis gear trains – Epicyclic Gear Trains – Differentials – Automobile gear box.

5. FRICTION: 9

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Bearings and lubrication – Friction clutches – Belt and rope drives – Friction aspects in brakes – Friction in vehicle propulsion and braking.

Total : 60

TEXT BOOK

1. Ambekar A.G, “Mechanism and Machine Theory” Prentice Hall of India, New Delhi, 2007.
2. Shigley J.E. ,Pennock G.R.and Uicker.J.J., ‘Theory of Machines and Mechanisms’, Oxford University Press,2003.

REFERENCE

1. Thomas Bevan, ‘Theory of Machines’, CBS Publishers and Distributors, 1984.
2. Ghosh.A, and A.K.Mallick, ‘Theory of Mechanisms and Machines’, Affiliated East-West Pvt. Ltd., New Delhi, 1988.
3. Rao.J.S. and Dukkipati.R.V. ‘Mechanisms and Machine Theory’, Wiley-Eastern Ltd., New Delhi, 1992.
4. John Hannah and Stephens R.C., ‘Mechanics of Machines’, Viva Low-Prices Student Edition, 1999.
5. V.Ramamurthi, Mechanics of Machines, Narosa Publishing House, 2002.
6. Robert L.Norton, Design of Machinery, McGraw-Hill, 2004.

STANDARDS

IS 2458 : 2001, Vocabulary of Gear Terms – Definitions related to Geometry.

IS 3756 : 2002, Method of Gear Correction – Addendum modification for External cylindrical gears with parallel axes.

IS 5267 : 2002 Vocabulary of Gear Terms – Definitions Related to Worm Gear Geometry.

IS 12328 : Part 1: 1988 Bevel Gear Systems Part – 1 Straight Bevel Gears.

IS 12328 : 1988 Bevel Systems Part – 2 Spiral Bevel Gears.

		L	T	P	C
EE 9211	**ELECTRICAL DRIVES AND CONTROL**	**3**	**0**	**0**	**3**

AIM

To provide knowledge in the area of electrical dives and their control techniques

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PREREQUISTE

Basic Electrical Engineering

OBJECTIVE

To impart knowledge on

I. Basics of electric drives
II. Different speed control methods
III. Various motor starters and controllers
IV. Applications

1. INTROUDCTION 9

Fundamentals of electric drives – advances of electric drive-characteristics of loads – different types of mechanical loads – choice of an electric drive – control circuit components: Fuses, switches, circuit breakers, contactors. Relay – control transformers.

2. SPEED CONTROL OF DC MACHINES 9

DC shunt motors – Speed Torque characteristics - Ward Leonard method, DC series motor – series parallel control – solid state DC drives – Thyristor bridge rectifier circuits- chopper circuits.

3. SPEED CONTROL OF AC MACHINES 9

Induction motor – Speed torque Characteristics – pole changing, stator frequency variation - slip-ring induction motor – stator voltage variation - Rotor resistance variation, slip power recovery – basic inverter circuits- variable voltage frequency control.

4. MOTOR STARTERS AND CONTROLLERS 9

DC motor starters : using voltage sensing relays, current sensing relays and time delay relays - wound rotor induction motor starters – starters using frequency sensing relays - DOI -starter and auto transformers starter.

5. HEATING AND POWER RATING OF DRIVE MOTORS 9

Load diagram, over load capacity, insulating materials, heating and cooling of motors, service condition of electric drive – continuous, intermittent and short time – industrial application.

Total = 45

TEXT BOOKS

1. N.K De and P.K Sen ‘Electric Drives’ Prentice Hall of India Private Ltd,2002.
2. Vedam Subramaniam ‘Electric Drives’ Tata McGraw Hill ,New Delhi,2007
3. V.K Mehta and Rohit Mehta ‘ Principle of Electrical Engineering’ S Chand & Company,2008

REFERENCES

1. S.K Bhattacharya Brinjinder Singh ‘Control of Electrical Machines’ New Age International Publishers,2002.
2. John Bird ‘Electrical Circuit theory and technology’ Elsevier, First Indian Edition, 2006.

ME 9204 MANUFACTURING TECHNOLOGY LAB- I

L	T	P	C
0	0	3	2

OBJECTIVE

Student should have knowledge on common basic machining operations

LIST OF EXPERIMENTS

Measurement of the Machined Components and Machining time estimation of:

1. Taper Turning
2. External thread cutting
3. Internal thread cutting
4. Eccentric Turning
5. Knurling
6. Square Head Shaping
7. Hexagonal Head Shaping
8. Drilling and Tapping
9. Determination of Cutting forces in Turning and Milling Operations.

REFERENCES

1. Hajra Choudhury, S.K and Hajra Choudhury. A.K., " Elements of Workshop Technology', Volume I and II, Media Promoters and Publishers Private Limited, Mumbai, 1997.

2. Sharma, P.C.A Text book of Production Technology, S. Chand and Co. Ltd., 2004.

3. Roy. A. Lindberg, "Process and Materials of Manufacture", Pearson Education Fourth Edition 2006

EE 9212 ELECTRICAL MACHINES LABORATORY

L T P C
0 0 3 2

1. Speed Control of DC Shunt Motor
2. Load Test on DC Shunt Motor
3. Study of DC Motors
4. Swinbuirne's Test
5. Load Test on DC Series Motor
6. Load Test on DC Compound Motor
7. Load Test on 3 Phase Induction Motor
8. Study of AC Motor Starters
9. No load and Blocked Rotor Test on 3 Phase Induction Motor

Total : 45

CE 9212 FLUIDS MECHANICS AND MACHINERY LABORATORY

L T P C
0 0 3 2

1. FLOW MEASUREMENT

Calibration of Flow Measuring instruments – venturimeter, orificemeter, rotometer, Calibration of flows in open channels – weirs and notches. Estimation of friction factor in flow through pipes.

2. PUMPS

Determination of performance characteristics of pumps – centrifugal pumps, submersible pumps, turbine pumps and positive displacement pumps – reciprocating and gear pumps.

3. TURBINES

Determination of performance characteristics of turbines – reaction turbines and impulse turbines.

Total : 45

REFERENCE

1. CWR, Hydraulics Laboratory Manual,2004

MA 9262 NUMERICAL METHODS

L T P C
3 1 0 4

1. SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS (10 +3)

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton-Raphson method- Solution of linear system of equations - Gauss Elimination method – Pivoting - Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method - Eigenvalues of a matrix by Power method and by Jacobi's method.

2. INTERPOLATION AND APPROXIMATION (8 + 3)

Interpolation with unequal intervals - Lagrange interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

3. NUMERICAL DIFFERENTATION AND INTEGRATION (9 + 3)

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's rules.

4. INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS (9 + 3)

Single step-methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations - Multi-step methods - Milne's and Adams-Bashforth predictor-corrector methods for solving first order equations.

5. BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS (9 + 3)

Finite difference methods for solving two-point linear boundary value problems. Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat-flow equation by explicit and implicit (Crank Nicholson) methods - One dimensional wave equation by explicit method.

L = 45 T = 15 Total = 60

TEXT BOOKS

1. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, 2004.
2. Sankara Rao, K. "Numerical methods for Scientists and Engineers', 3rd Edition Prentice Hall of India Private Ltd., New Delhi, 2007.

REFERENCE BOOKS

1. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, New Delhi, 2007.
2. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, New Delhi, 2006.
3. Brian Bradie, "A friendly introduction to Numerical analysis", Pearson Education Asia, New Delhi, 2007.

CE9213 STRENGTH OF MATERIALS

L	T	P	C
3	0	0	3

1. STRESS, STRAIN AND DEFORMATION OF SOLIDS 8

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic Constants – Volumetric strains – Stresses on inclined planes – Principal stresses and principal planes – Mohr's circle of stress.

2. TRANSEVERSE LOADING ON BEAMS AND STRESSES IN BEAMS 13

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending - bending formula – bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

3. TORSION 6

Stresses and deformation in circular and hollows shafts – Stepped shafts – Shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs.

4. DEFLECTION OF BEAMS 10

Double Integration method – Macaulay's method – Area moment theorems for computation of slopes and deflections in beams – Conjugate beam and energy method – Maxwell's reciprocal theorems.

5. THIN CYLINDERS, SPHERES AND THICK CYLINDERS 9

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses – deformation in thin cylinders –spherical shells subjected to internal pressure –deformations in spherical shells - Lame's theory – application of theories of failure

TEXTBOOKS

1. Rajput.R.K. "Strength of Materials" S.Chand & co Ltd. New Delhi 1996

2. Jindal U.C. "Strength of Materials" Asian Books Pvt Ltd, New Delhi 2007

REFERENCES

1. Egor.P.Popov "Engineering Mechanics of Solids" Prentice Hall of India, New Delhi 1997

2. Subramanian R. "Strength of Materials" Oxford University Press, Oxford Higher Education series ,2007

3. Hibbeler , R.C, Mechanics of materials", Pearson Education, Low price Edition,2007

ME9251 MANUFACTURING TECHNOLOGY – II

L	T	P	C
3	0	0	3

OBJECTIVE

To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching. To understand the basic concepts of (CNC) Computer Numerical Control of Machine tools and CNC Programming.

1. THEORY OF METAL CUTTING 8

Mechanics of chip formation, single point cutting tool, forces in machining, thermal aspects of chip formation. orthogonal metal cutting, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

2. CENTRE LATHE AND SPECIAL PURPOSE LATHES 10

Centre lathe, constructional features, specification, cutting tools, nomenclature various operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation. capstan and turret lathes – tool layout, - automatic lathes: semi automatics – single spindle: swiss type, automatic screw type- multi spindle:

3. RECIPROCATING MACHINES, MILLING MACHINES AND GEAR CUTTING 12

Reciprocating machine tools: shaper, planer, slotter: milling: types, milling cutter attachments, change gear calculations, machining time calculation, operations. hole making: drilling, reaming, boring, tapping, machining time calculations. gear cutting: forming, generations, shaping, planning and hobbing-tool and cutter grinders.

4. ABRASIVE PROCESS, BROACHING 8

Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding , surface grinding, centreless grinding, internal grinding-honing, lapping, super finishing, polishing and buffing, abrasive jet grindling.broaching machines: broach construction – push, pull, surface and continuous broaching machines.

5. CNC MACHINE TOOLS AND PART PROGRAMMING 7

Numerical control (NC) machine tools – CNC types, constructional details, special features. machining centre, training centre.part programming fundamentals – manual programming.

Total : 45

TEXT BOOKS

1. Roy. A. Lindberg, “Process and Materials of Manufacture”, PHI / Pearson Education Fourth , Edition 2006.

2. Rao. P.N “ Manufacturing Technology”, Metal Cutting and Machine Tools, Tata Mc Graw–Hill, New Delhi, 2003.

REFERENCES

1. Richerd R Kibbe, John E. Neely, Roland O. Merges and Warren J. White. “Machine Tool Practices”, Prentice Hall of India, 1998
2. HMT – Production Technology, Tata Mc Graw Hill, 1998.
3. Hajra Choudhury. Elements of Workshop Technology – Vol.II. Media Promoters.
4. Geofrey Boothroyd, Fundamentals of Metal Machining and Machine Tools, Mc Graw Hill, 1984.

ME9252 ENGINEERING MATERIALS AND METALLURGY

L T P C
3 0 0 3

OBJECTIVE

To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

1. CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9

Constitution of alloys – Solid solutions, substitutional and interstitials – Phase diagrams and microstructure development: Isomorphous, eutectic, peritectic, eutectoid and peritectroid alloy systems. Iron-Iron carbide equilibrium diagram, Development of microstructures in Iron- carbon alloys.

2. HEAT TREATMENT 9

Full annealing-stress relief, Recrystalisation- Spheroidizing, Normalising, Hardening and tempering of steel. Isothermal transformation diagrams- TTT– CCT cooling curves - Hardenability, Jominy end quench test – Austempering, martempering – case hardening, carburizing, nitriding, cyaniding, carbonotriding –flame and induction hardening – vacuum and plasma hardening – current trends- thermo-mechanical treatments- elementary ideas on sintering.

3. FERROUS AND NON FERROUS METALS 9

Effect of alloying additions on steel (Mn, Si, Cr, Mo, V, Ti & W)- classification of steels (tool steel, stainless)– cast irons – alloy cast irons- Copper and Copper alloys –Aluminum and its alloys- Magnesium and its alloys– Titanium and its alloys- Nickel and Cobalt alloys, properties and applications of these materials.

4. NON-METALLIC MATERIALS 9

Types, properties and applications: Polymers, Ceramics and Composites– Super conductors- nanomaterials and their properties.

5. MECHANICAL PROPERTIES AND TESTING 9

Crystal imperfections- Dislocations- Strengthening mechanisms- Elastic, anelastic and viscoelastic behaviour – modulus of elasticity- plastic deformation- Mechancial tests- tension, compression, impact, hardness- effect of temperature, grain size , solutes and precipitates on dislocation dynamics – Mechancism of Fracture - mechanism of creep-creep resistant materials- creep tests- fracture toughness- ductile-brittle transition –deformation mechanism maps- fatigue fracture-fatigue test.

Total : 45

TEXT BOOKS

1. Raghavan. V. Materials Science and Engineering", Prentice Hall of India Pvt. Ltd, 5th edition, 2007.
2. Williams D Callister, "Material Science and Engineering" Wiley India Pvt Ltd, Revised Indian edition 2007.

REFERENCES

1. George E. Dieter, Mechanical Metallurgy, McGraw Hill, 2007.
2. Syndney H Avner, "Introduction to Physical Metallurgy", 2/E Tata McGraw Hill Book Company, 2007.
3. Kenneth G. Budinski and Michael K. Budinski "Engineering Materials", PHI / Pearson Educations, 8th Edition, 2007.
4. G.S. Upadhay and Anish Upadhay, "Materials Science and Engineering", Viva Books Pvt. Ltd, 2006.
5. James F. Shackelford and Madanpalli K. Muralidhara, Introduction to Materials Science for Engineers, Pearson Education, 6th edition, 2007.
6. Donald R. Askeland and Pradeep P. Phulé, The Science and Engineering of Materials, Thomson 5th edition, 2007.

ME9253 DYNAMICS OF MACHINES

L T P C
3 1 0 4

OBJECTIVE

(i) To understand the force-motion relationship in components subjected to external forces.
(ii) To understand the force-motion analysis of standard mechanisms.
(iii) To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.
(iv) To understand the effect of Dynamics of undesirable vibrations.
(v) To understand the principles in mechanisms used for governing of machines.

1. FORCEANALYSIS 15

Applied and constraint forces – Free body diagrams – Static equilibrium conditions – Two, three & four members – Static force analysis of simple mechanisms – Dynamic force analysis – Inertia force and Inertia torque – D Alembert's principle – The principle of superposition – Dynamic Analysis in reciprocating engines – Gas forces – Equivalent masses – Bearing loads – Crank shaft torque – Turning moment diagrams – Fluctuation of energy – Fly Wheels – Engine shaking forces – Cam dynamics – Unbalance, Spring Surge and Windup.

2. BALANCING 12

Static and dynamic balancing – Balancing of rotating masses – Balancing a single cylinder engine – Balancing Multi-cylinder engines – Partial balancing in locomotive engines – Balancing of linkages – Balancing machines.

3. FREE VIBRATION 12

Basic features of vibratory systems – Idealized models of basic elements and lumping of parameters – Degrees of freedom – single degree of freedom – Free vibration – Equations of motion – Natural frequency – Types of Damping – Damped vibration – Extending to multi degree freedom systems – Critical speeds of shafts – Torsional vibration – Torsionally equivalent shaft – Two and three rotor systems.

4. FORCED VIBRATION 6

Response to periodic forcing – Harmonic disturbances – Disturbance caused by unbalance – Support motion – force transmissibility and amplitude transmissibility – Vibration isolation.

5. MECHANISM FOR CONTROL 15

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

Total : 60

TEXT BOOK

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

REFERENCES

1. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984.
2. Ghosh A. and Mallick A.K., "Theory of Mechanisms and Machines", affiliated East-West Press Pvt. Ltd., New Delhi, 1988.
3. Rao J.S. and Dukkipati R.V., "Mechanism and Machine Theory", Wiley-Eastern Limited, New Delhi, 1992.

ME9254 THERMAL ENGINEERING-I

L T P C
3 0 0 3

AIM :

To understand the applications of concepts of thermodynamics for various power cycles, steam turbines, IC engines and gas turbines.

OBJECTIVE

1. To integrate the concepts, laws and methodologies from the first course in thermodynamics into the analysis of cyclic process.
2. To apply the thermodynamic concepts into various thermal appliction like, IC engines Steam turbines, Gas Turbines

Pre-Requisite : Sufficient Knowledge in Engineering Thermodynamics

1. GAS POWER CYCLES **9**

Otto, Diesel, Dual, Brayton cycles - Calculation of mean effective pressure and air standard efficiency, Actual and theoretical PV diagram of Two stroke and Four stroke engines.

2. AIR COMPRESSOR **9**

Classification and working principle, work of compression with and without clearance. Volumetric efficiency, Isothermal efficiency and isentropic efficiency of reciprocating air compressors. Multistage air compressor and inter cooling – work of multistage air compressor., Problems in single and two stage air compressors. Various types of compressors.

3. INTERNAL COMBUSTION ENGINES AND ITS SYSTEMS **9**

Classification of IC engine - components and functions. Actual and theoretical Valve timing diagram, port timing diagram and p-V diagrams. Comparison of two stroke & four stroke engines and SI and CI engines.

4. INTERNAL COMBUSTION ENGINE FUELS, COMBUSTION AND PERFORMANCE **9**

Comparison of petrol and diesel engine Fuels. Air-fuel ratio calculation, Knoecking and Detonation, Lubrication system and cooling system Performance calculation. Exhaust gas analysis, pollution control norms.

5. GAS TURBINES **9**

Open and closed Gas turbine cycles –Methods of Cycle improvement - Regeneration – Intercooling - Reheating and their combinations –Performance-Materials.

Total: 45

TEXT BOOKS

1. Rajput, R.K., Thermal Engineering, 6th Edition, Laxmi Publications, 2007
2. Ballaney, P.L., “Thermal Engineering” , Khanna Publishers, 24th Edition, 2003.

REFERENCES

1. Holman, J.P.” Thermodynamics”, McGraw Hill, 1965.
2. Rudramoorthy, R., Thermal Engineering, 4th Edition, Tata McGraw Hill, New Delhi, 2006.
3. Domkundwar, Kothandaraman, and Domkundwar, A Course in Thermal Engineering, Dhanpat Raj & Sons, Fifth edition, 2002.

ME9255 COMPUTER AIDED MACHINE DRAWING

L	T	P	C
0	0	4	2

OBJECTIVE

i) To make the students understand and interpret drawings of machine components so as to prepare assembly drawings either manually and using standard CAD packages.

ii) To familiarize the students with Indian Standards on drawing practices and standard components.

1. DRAWING STANDARDS **4**

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

2. 2-D DRAWINGS **8**

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

3. ASSEMBLY DRAWING **16**

Preparation of assembled views given part details for components such as

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

4. INTRODUCTION TO DRAFTING PACKAGE **17**

Drawing, Editing, Dimensioning, Plotting Commands, Layering Concepts, Hatching, Detailing, basic principles of geometric dimensioning & tolerancing

TOTAL 45 PERIODS

ME9256 MANUFACTURING TECHNOLOGY LAB - II

L	T	P	C
0	0	3	2

OBJECTIVE

Student should acquire skills on common basic machining operations and press working.

LIST OF EXPERIMENTS

1. Contour Milling using vertical milling machine
2. Gear Cutting & Gear Hobbing
3. Hexagonal Machining using Horizontal Milling Machine
4. Gear Cutting – Gear Shaping
5. Spline Broaching
6. Exercise in Surface Grinding
7. Exercise in Cylindrical Grinding
8. Exercise in Tool and Cutter Grinder
9. Spur and helical gear cutting in Milling Machine
10. Determination of cutting forces in Milling Machine
11. Study of Turret and Capstan lathe
12. Forming of Simple Components in Press Working and simple Calculations of sheet metal work

REFERENCES

1. Sharma, P.C.A Text book of Prod, S. Chand and Co. Ltd., 2004.
2. Kalpakjian, S., " Manufacturing Engineering and Technology", Pearson Education India Edition, 2006.
3. Roy. A. Lindberg, "Process and Materials of Manufacture", Pearson Education Fourth Edition 2006

CE9214 STRENGTH OF MATERIALS LABORATORY

L	T	P	C
0	0	3	2

OBJECTIVE:

To study the properties of materials when subjected to different types of Loading.

1. Tension test on mild steel rod.
2. Double shear test on metals.
3. Torsion test on mild steel rod.
4. Impact test on metal specimen.
5. Hardness test on metals.
6. Compression test on helical spring.
7. Deflection test on carriage spring.