THIRD SEMESTER

Course Title	L	P	M
THEORY			
Advanced Engineering Mathematics *	4	0	100
Engineering Thermodynamics	4	0	100
Manufacturing Technology – I	4	0	100
Fluid Mechanics and Machinery *	4	0	100
Electrical Machines and Drives *	4	0	100
Machine Drawing	4	0	100
PRACTICAL			
Fluid Mechanics and Machinery Lab	0	3	100
Computer Aided Drafting Lab	0	3	100

ENGINEERING THERMODYNAMICS

1. BASIC CONCEPT AND FIRST LAW

9

Basic concepts - concept of continuum and 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, ENTROPY AND AVAILABILITY

9

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

3. PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE

9

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

4. IDEAL & REAL GASES AND THERMO DYNAMIC RELATIONS

9

Gas mixtures – Properties of ideal and real gases, equation of state, Avogadro's law, Van der Waals equation of state, compressibility, compressibility chart. Dalton's law of partial pressure, Exact differentials, T-D, relations, Maxwell relations, Clausius Clapeyron equations, Joule Thomson Coefficient.

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. Cengel, “Thermodynamics” An Engineering Approach, Third Edition – 2003, TMH,New Delhi.

REFERENCES

1. Holman.J.P., “Thermodynamics”, 8th Ed. McGraw-Hill, 2002
2. Arora C.P, “ Thermodynamics”, Tata McGraw-Hill, New Delhi, 2003.
3. Merala C, Pother, Craig W, Somerton, “ Thermodynamics for Engineers”, Schaum Outline Series, TMH.

FLUID MECHANICS AND MACHINERY

(Common to Mechanical and Mechatronics)

1. BASIC CONCEPTS AND PROPERTIES

6

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

2. FLIUD KINEMATICS AND FLUID DYNAMICS

12

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

3. INCOMPRESSIBLE FLUID FLOW

12

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

4. HYDRAULIC TURBINES

8

Fluid machines: definition and classification - exchange of energy - Euler's equation for turbo machines - Construction of velocity vector diagrams - head and specific work - components of energy transfer - degree of reaction.

Hydro turbines: definition and classifications - Pelton turbine - Francis turbine - propeller turbine - Kaplan turbine - working principles - velocity triangles - work done - specific speed - efficiencies -performance curve for turbines.

5. HYDRAULIC PUMPS

7

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

TUTORIALS

15

TOTAL:60

TEXT BOOKS

1. Streeter, V.L., and Wylie, E.B., “Fluid Mechanics”, McGraw-Hill, 1983.
2. Kumar, K.L., “Engineering Fluid Mechanics”, Eurasia Publishing House (P) Ltd, New Delhi (7th edition), 1995.
3. Vasandani, V.P., “Hydraulic Machines - Theory and Design”, Khanna Publishers.1992

REFERENCES

1. *Bansal, R.K., “Fluid Mechanics and Hydraulics Machines”, (5th edition), Laxmi publications (P) Ltd, New Delhi, 1995*
2. White, F.M., “Fluid Mechanics”, Tata McGraw-Hill, 5th Edition, New Delhi, 2003.
3. Ramamurtham. S, "Fluid Mechanics and Hydraulics and Fluid Machines", Dhanpat Rai and Sons, Delhi, 2003.

MANUFACTURING TECHNOLOGY – I

1. METAL CASTING PROCESSES 12

Sand casting – Sand moulds - Type of patterns – Pattern materials – Pattern allowances – Types of Moulding sand – Properties – Core making – Methods of Sand testing – Moulding machines – Types of moulding machines - Melting furnaces – Working principle of Special casting processes – Shell, investment casting – Ceramic mould – Lost Wax process – Pressure die casting – Centrifugal casting – CO_2 process – Sand Casting defects – Inspection methods

2. FABRICATION PROCESS 12

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

3. BULK DEFORMATION PROCESSES 12

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

4. SHEET METAL FORMING PROCESSES 12

Sheet metal characteristics - Typical shearing operations, bending and drawing operations – Stretch forming operations — Formability of sheet metal – Test methods – Working principle and application of special forming processes - Hydro forming – Rubber pad forming – Metal spinning – Explosive forming – Magnetic pulse forming – Peen forming – Super plastic forming – Process characteristics

5. FORMING AND SHAPING OF PLASTICS 12

Types of plastics - Characteristics of the forming and shaping processes – Moulding of Thermoplastics – Working principles and typical applications of - Injection moulding – Plunger and screw machines – Blow moulding – Rotational moulding – Film blowing – Extrusion - Typical industrial applications – Thermoforming – Processing of Thermosets – Working principles and typical applications - Compression moulding – Transfer moulding – Bonding of Thermoplastics – Fusion and solvent methods – Induction and Ultrasonic methods

TOTAL : 60

TEXT BOOKS:

1. Hajra Choudhury, Elements of Workshop Technology, Vol. I and II, Media Promoters Pvt Ltd., Mumbai, 2001
2. Serope Kalpajian, Steven R.Schmid, Manufacturing Engineering and Technology, Pearson Education, Inc. 2002(Second Indian Reprint).

REFERENCES:

1. Elements of Manufacturing Processes, B.S. Magendran Parashar & R.K. Mittal, Prentice Hall of India, 2003.
2. Manufacturing Technology, P.N. Rao, Tata McGraw-Hill Publishing Limited, II Edition, 2002.
3. A text book of production technology, P.C. Sharma, S. Chand and Company, IV Edition, 2003.

MACHINE DRAWING

1. DRAWING STANDARDS
6

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

2. FITS AND TOLERANCES
6

Fits and tolerance - allocation of fits for various mating parts - tolerance data sheet - tolerance table preparation -Geometric tolerance.

3. ASSEMBLY DRAWING
12

Preparation of assembled views given parts details - couplings: flange, universal - Bearing: footstep, Plummer block - Lathe tailstock - Stop valves - etc.

4. DETAILED DRAWING
12

Preparation of parts details given assembled views - screw jack - connecting rod ends - cross heads - etc.

5. ACTUAL MEASUREMENT OF DIMENSIONS AND DRAWING PRACTICE 24

The students must be made to disassemble machines and take actual dimensions and prepare parts drawings,assembly drawings, exploded views and isometric views as record work.

Some Machines of Interest are:

1. Lathe Chuck
2. Gear Reducer
3. Gear Pump
4. Steam Stop Valve
5. Pneumatic Cylinder assembly
6. Pneumatic Valves
7. Centrifugal pump assembly
8. I.C.Engine Cylinder - Piston, Connection rod and Crankshaft assembly
9. Automobile Gear Box
10. Clutch Assembly

Note: The Examination must include:

1) Total assembly Test
2) Identifying the missing element of the assembly
3) A Drawing test

Total No of periods: 60

TEXT BOOKS

1. Bhatt, N.D., " Machine Drawing ", Published by R.C.Patel, Chartstar Book Stall, Anand, India, 2003.
2. P.S.G. Design Data Book.

REFERENCES

1. Sidheswar, N., Kanniah, P. and Sastry, V.V.S., " Machine Drawing ",Tata McGraw Hill, 1997.

ELECTRICAL MACHINES AND DRIVES

1. CIRCUITS AND TRANSFORMERS

6

D.C. Voltage, current, power-Ohms law-series, parallel circuits – Kirchoff's laws – mesh analysis – A.C. voltage – sinusoidal waves, hasor representation – power factor – complex power - basic idea of transformers – simple problems.

2. ELECTRICAL MOTORS

12

Constructional details, principle of operation and performance characteristics of D.C. motors, single phase induction motor, three phase induction motor, synchronous motors, universal motors, stepper motors and reluctance motor.

3. SPEED CONTROL AND STARTING

9

Speed control of D.C. motors – three phase induction motors – starting methods of D.C. motor and three phase induction motor – electrical braking – simple problems.

4. ELECTRICAL DRIVES

9

Type of Electrical Drives – Selection & factors influencing the selection – heating and cooling curves – loading condition and classes of duty – determination of power rating – simple problems.

5. SOLID STATE DRIVES (QUALITATIVE TREATMENT ONLY)

9

Advantages of solid state drives – D.C. motor control using rectifiers and choppers – control of induction motor by V, V/f and slip power recovery scheme using inverters and A.C. power regulators.

TOTAL : 45

TEXT BOOK

1. N.K.De.,P.K.Sen "Electric Drives", Prentice Hall, First edition 1999.

REFERENCES

1. I.J. Nagrath, T.P. Kothari., "Basic Electrical Engineering", McGraw-Hill Publishing company Ltd., Second edition, 2002.
2. S.K. Bhattacharya " Electrical Machines" second edition 1999, Tata McGraw-

Hill Pvt. Company Ltd., Second edition, 1999.
3. G.K. Dubey "Fundamental Electrical Drives" second edition 2002, Narosa Publications, Second edition, 2002.
4. Pillai, S.K., "A Seish course on Electrical Drives", Wilay Eastern Ltd., New Delhi, 1982.

FLUID MECHANICS AND MACHINERY LAB

LIST OF EXPERIMENTS

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

TOTAL: 45

COMPUTER AIDED DRAFTING LAB

1. INTRODUCTION TO DRAFTING SOFTWARE

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

2. PREPARATION OF 2-D DRAWINGS

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

3. ASSEMBLY DRAWING (Preparation of assembled view)

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