PRIST DEEMED to be University
Vallam, Thanjavur.

DEPARTMENT OF
MECHANICAL ENGINEERING

PROGRAM HANDBOOK

B.TECH
MECHANICAL ENGINEERING
PART TIME
[REGULATION 2017]

SEMESTER – I

Sl. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	17148H11P	Transforms & Partial Differential Equations	3	1	0	4
2	17153H12P	Electrical drives and controls	3	0	0	3
3	17154H13P	Engineering Thermodynamics	3	1	0	4
4	17154H14P	Fluid Mechanics and Machinery	3	1	0	4
5	17154H15P	Foundry And Welding Technology	4	0	0	4
Total No of Credits						19

SEMESTER – II

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	17148H21P	Numerical Methods	3	1	0	4
2	17153H22P	Electronics and Microprocessors	3	0	0	3
3	17154H23P	Thermal Engineering	3	1	0	4
4	17154H24P	Strength of Materials	3	1	0	4
5	17154H25P	Engineering Materials and Metallurgy	4	0	0	4
Total No of Credits						19

SEMESTER – III

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	17148H31CP	Probability and Statistics	3	1	0	4
2	17154H32P	Kinematics of Machinery	3	1	0	4
3	17154H33P	Machine Tool Technology	4	0	0	4
4	17154H34P	Engineering Metrology and Measurements	4	0	0	4
5	17154L35P	Computer Aided Simulation and Analysis Laboratory	0	0	3	2
Total No of Credits						18

SEMESTER –IV

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	17154H41P	Power Plant Engineering	4	0	0	4
2	17154H42P	Dynamics of Machinery	3	1	0	4
3	17154H43P	Design of Machine Elements	3	1	0	4
4	171--E44-P	Elective -I	4	0	0	4
5	17154L45P	Dynamics Laboratory	0	0	3	2
Total No of Credits						18

SEMESTER – V

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	17154H51P	Heat and Mass Transfer	3	1	0	4
2	17154H52P	Design of Transmission Systems	3	1	0	4
3	17154H53P	Automobile Engineering	4	0	0	4
4	171--E54-P	Elective-II	4	0	0	4
5	17154L55P	Heat Transfer Laboratory	0	0	3	2
Total No of Credits						18

SEMESTER –VI

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	17154H61P	Finite Elements Analysis	3	1	0	4
2	17154H62P	Mechatronics	4	0	0	4
3	17154H63P	Computer Integrated Manufacturing	4	0	0	4
4	171--E64-P	Elective-III	4	0	0	4
5	17154L65P	Mechatronics Laboratory	0	0	3	2
Total No of Credits						18

SEMESTER –VII

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	17160H71P	Total Quality Management	3	0	0	3
2	17154H72P	Process Planning and Cost Estimation	3	1	0	4
3	17154H73P	Applied Hydraulics and Pneumatics	4	0	0	4
4	171--E74-P	Elective-IV	3	0	0	3
5	17154P75P	Project Work	0	0	12	6
Total No of Credits						20

TOTAL NO OF CREDITS FROM SEMESTER I TO VII – 130

LIST OF ELECTIVES

ELECTIVE I

SEMESTER – IV

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	17154E44AP	Gas Dynamics and Jet Propulsion	3	1	0	4
2	17154E44BP	Refrigeration and Air Conditioning	3	1	0	4
3	17160E44CP	Marketing Management	4	0	0	4
4	17154E44DP	Renewable Sources of Energy	4	0	0	4

ELECTIVE II

SEMESTER – V

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	17158E54AP	Environmental Science and Engineering	4	0	0	4
2	17154E54BP	Composite Materials	4	0	0	4
3	17154E54CP	Robotics	4	0	0	4
4	17154E54DP	Design of Jigs, Fixtures and Press Tools	3	1	0	4

ELECTIVE III

SEMESTER – VI

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	17160E64AP	Principles of Management	4	0	0	4
2	17154E64BP	Nuclear Engineering	4	0	0	4
3	17154E64CP	Thermal Turbo Machines	3	1	0	4
4	17148E64DP	Mathematics for Industrial Operations	3	1	0	4

ELECTIVE IV

SEMESTER – VII

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	17160E74AP	Quality Control and Reliability Engineering	3	0	0	3
2	17154E74BP	Vibration and Noise Control	3	0	0	3
3	17154E74CP	Unconventional Machining Process	3	0	0	3
4	17154E74DP	Industrial Engineering	3	0	0	3

17148H11P TRANSFORMS & PARTIAL DIFFERENTIAL EQUATIONS

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9 + 3

Charpits method- Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

UNIT II FOURIER SERIES 9 + 3

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 identify – Harmonic Analysis.

UNIT III BOUNDARY VALUE PROBLEMS 9 + 3

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

UNIT IV FOURIER TRANSFORM 9 + 3

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

UNIT V Z -TRANSFORM AND DIFFERENCE EQUATIONS 9 + 3

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

TUTORIAL 15
TOTAL : 60

TEXT BOOKS

1. Grewal, B.S., "Higher Engineering Mathematics", Thirty Sixth Edition, Khanna Publishers, Delhi, 2001.
2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics Volume III", S. Chand & Company ltd., New Delhi, 1996.

REFERENCES

1. Narayanan, S., Manicavachagom Pillay, T.K. and Ramaniah, G., "Advanced Mathematics for Engineering Students", Volumes II and III, S. Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai, 2002.
2. Churchill, R.V. and Brown, J.W., "Fourier Series and Boundary Value Problems", Fourth Edition, McGraw-Hill Book Co., Singapore, 1987.

17154H13P ENGINEERING THERMODYNAMICS

UNIT- I: BASIC CONCEPTS 9

Basic concepts - 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.. First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipments.

UNIT – II: SECOND LAW, ENTROPY AND AVAILABILITY 9

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

UNIT – III: 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**.**

UNIT – IV : THERMODYNAMIC RELATIONS 9

Gas mixtures – Properties of ideal and real gases, equation of state, Vander Waal's equation of states, compressibility, compressibility chart. Exact differentials, Maxwell relations, Clausius Clapeyron equations, Joule Thomson Coefficient.

UNIT – V: PSYCHROMETRY 9

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

TUTORIALS 15 TOTAL HOURS: 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, Tata Mc Graw Hill, New Delhi.

REFERENCES

1. Holman.J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, 1995.
2. Arora C.P, " Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
3. Sri Vastava R.C, Saha S. K, Jan A. K, " Thermodynamics" Prentice Hall of India, New Delhi, 2004.

17154H14P FLUID MECHANICS AND MACHINERY

1. BASIC CONCEPTS AND PROPERTIES 6

Fluid – definition - 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. KINEMATICS OF FLUID 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)- stream line, streak line and path line (definitions only)-stream function and velocity potential function (definitions only)- 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 (descriptive treatment only) - flow through pipes - Darcy -weisback's equation - pipe roughness -friction factor- Moody's diagram-minor losses - flow through pipes in series and in parallel - Boundary layer (definition only)

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, performance curves - cavitations in pumps - rotary pumps: working principles of gear and vane pumps

TUTORIALS 15 TOTAL : 60

TEXT BOOKS

Streeter, V.L., and Wylie, E.B., “Fluid Mechanics”, McGraw-Hill, 1983.

Kumar, K.L., “Engineering Fluid Mechanics”, Eurasia Publishing House (P) Ltd, New Delhi (7^{th} edition), 1995.

Vasandani, V.P., “Hydraulic Machines - Theory and Design”, Khanna Publishers.1992

REFERENCES

1. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", (5^{th} edition), Laxmi publications (P) Ltd, New Delhi, 1995
2. White, F.M., "Fluid Mechanics", Tata McGraw-Hill, 5^{th} Edition, New Delhi, 2003.
3. Ramamirtham, S., "Fluid Mechanics and Hydraulics and Fluid Machines", Dhanpat Rai and Sons, Delhi, 1998.
4. Som, S.K., and Biswas, G., "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw-Hill, 2^{nd} Edition, 2004.

7154H15P FOUNDRY & WELDING TECHNOLOGY

UNIT-I: INTRODUCTION **9**

Introduction to moulding and casting Processes – Steps involved – advantages, limitations and application of casting process. Patterns – Types _ 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,

UNIT – III: CASTING PROCESSES **9**

Sand casting processes –permanent mould casting processes-pressure die casting, centrifugal casting – precision/investment casting-shell moulding,– continuous casting — electro slag casting processes, Vacuum process, magnetic moulding process.

UNIT – IV: SPECIAL WELDING PROCESSES **9**

Gas tungsten arc (TIG) welding, Gas metal arc (MIG) welding, submerged arc welding, 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).

UNIT – V: MODERN WELDING PROCESSES **9**

Electron beam welding, laser beam welding, Plasma arc welding, friction welding, explosive welding, ultrasonic welding, stud welding, diffusion bonding, welding of dissimilar metals.

TUTORIALS: 15

TOTAL HOURS: 60

TEXT BOOK

1. Lal,Mand Khanna O.P "A Text Book of Foundry Technology" Dhanpat Rai and Sons, New Delhi 1986.
2. Workshop Technology Volume I &II,Hajra Choudry & Bhattacharya.

REFERENCES

1. Production Technology ,R.K.Jain & S.C.Gupta
2. Radhakrishnan.V.M. "Welding Technology and Design" New age International Pub. Ltd., New Delhi 2002

17154H23P THERMAL ENGINEERING

UNIT-I: GAS POWER CYCLES 9

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

UNIT – II: INTERNAL COMBUSTION ENGINES 9

Classification of IC engine, IC engine components and functions. Comparison of two stroke and four stroke engines. Fuel supply systems, Ignition Systems, Performance calculation. Comparison of petrol & diesel engine. Fuels, Knocking and Detonation. Lubrication system and cooling system. Exhaust gas analysis, pollution control nor

UNIT – III: STEAM NOZZLES AND TURBINES 9

Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow. Impulse and reaction principles, compounding, velocity diagrams for simple and multistage turbines,

UNIT – IV: AIR COMPRESSORS 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, various types of compressors (Thoeretical treatment only).

UNIT – V: REFRIGERATION AND AIR-CONDITIONING 9

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

TUTORIALS : 15
TOTAL HOURS : 60

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

TEXT BOOKS

1. Rajput, “Thermal Engineering”, S. Chand publishers, 2000.

REFERENCES

1. Kothandaraman.C.P., Domkundwar.S. and A.V.Domkundwar., “A course in Thermal Engineering”, Dhanpat Rai & Sons, Fifth edition, 2002
2. Holman. J.P., “Thermodynamics”, McGraw-Hill, 1985.

3. Rogers, Meyhew, "Engineering Thermodynamics", ELBS, 1992.
4. Arora.C.P., "Refrigeration and Air conditioning", TMH, 1994.
Sarkar B.K, " Thermal Engineering", Tata McGraw-Hill, 1998**.**

17154H24P STRENGTH OF MATERIALS

1. STRESS AND STRAIN 9

Bodies - Rigid and Deformable bodies- Stresses; Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy and unit strain energy

2. BEAMS - SFD & BMD 9

Beams -Types: Supports and Loads – Shear force and Bending Moment Diagrams in beams – Cantilever and Simply supported– 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.

3. TORSION IN SHAFTS 9

Analysis of torsion in shafts – Shear stress distribution – Solid, Stepped and Hollow shafts – Twist and torsion stiffness – Replacement of Shafts - Compound shafts – Fixed and simply supported shafts.

4. DEFLECTION IN SPRINGS 9

Springs- Introduction, Types- Close coiled helical springs – Maximum shear stress in spring section– Deflection of helical coil springs under axial loads – Design of helical coil springs – stresses in helical coil springs under torsion loads

5. ANALYSIS OF STRESSES IN TWO DIMENSIONS 9

Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point –Principal planes and stresses – Analytical Method- Graphical

Method: Mohr's circle – Only for two stresses applied mutually perpendicular to each other on a body– Maximum shear stress.

TUTORIALS 15
TOTAL: 60

TEXT BOOKS

1. Popov E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 1997.
2. Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co, New Delhi, 1981

REFERENCE BOOKS

1. Nash W.A, "Theory and problems in Strength of Materials", Schaum Outline Series, McGraw-Hill Book Co, New York, 1995
2. Ryder G.H, "Strength of Materials", Macmillan India Ltd., Third Edition, 2002
3. Singh D.K "Mechanics of Solids" Pearson Education 2002.

17154H25P ENGINEERING MATERIALS AND METALLURGY

1. CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 10

Solid solutions, substitutional and interstitial – phase diagrams, invariant reactions, Iron – Iron carbide equilibrium diagram

2. HEAT TREATMENT 11

Definition – Full annealing, stress relief, recrystallisation and spheroidizing –normalising, hardening and Tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram CCR - Hardenability, Jominy end quench test

3. FERROUS AND NON FERROUS METALS 9

Effect of alloying additions on steel (Mn, Si, Cr, Mo, V Ti & W) - stainless and tool steels – HSLA - maraging steels –types of CI
Copper and Copper alloys – Brass, Bronze and Cupronickel – Aluminum and Al-Cu – precipitation strengthening treatment.

4. NON-METALLIC MATERIALS 9

Polymers – types of polymer– Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE Polymers — Engineering Ceramics – Properties and applications of Al_2O_3, SiC, SiC, Si_3, N_4, PSZ and Sialon – Fibre and particulate reinforced composites.

5. MECHANICAL PROPERTIES AND TESTING 6

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

Total Hours : 45

TEXT BOOK:

1. Kenneth G.Budinski and Michael K.Budinski "Engineering Materials" Prentice-Hall of India Private Limited, 4th Indian Reprint 2002.

REFERENCES:

1. William D Callsber "Material Science and Engineering", John Wiley and Sons 1997**.**
2. Raghavan.V "Materials Science and Engineering", Prentice Hall of India Pvt., Ltd., 1999.
Sydney H.Avner "Introduction to Physical Metallurgy" McGraw Hill Book Company, 1994

17154H33P MACHINE TOOL TECHNOLOGY

UNIT – I: METAL CUTTING THEORY 8

Introduction: material removal processes, types of machine tools – theory of metal cutting: chip formation, Types of metal cutting, cutting tool materials, Types of tool wear, Simple problems on Tool life.

UNIT –II: CENTRE LATHE AND SPECIAL PURPOSE LATHES 10

Centre lathe, constructional features, cutting tools, various operations, taper turning methods, thread cutting methods, special attachments, machining time and power estimation.
Capstan and turret lathes – automatic lathes : semi automatic, automats – single spindle : cutting off, multi spindle; cutting off machines.

UNIT – III: SHAPING, PLANING, SLOTTING & MILLING MACHINES 10

Reciprocating machine tools: shaper, planer, slotter ; milling : types, milling cutters, operations.

UNIT – IV: GRINDING, BROACHING AND GEAR CUTTING 10

Grinding: Introduction- Grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding – honing, lapping, super finishing, polishing and buffing.
Broaching Machines: broach Specification – push, pull, surface and continuous broaching machines, Gear cutting: forming, generation, shaping, Hobbing.

UNIT – V: CNC MACHINES AND APT PROGRAMMING 7

Numerical Control (NC) machine tools – CNC – Introduction, Types, constructional details, special features, Advantages and applications.
Part programming fundamentals – manual programming – computer assisted part programming – APT language.

TOTAL : 45

TEXT BOOKS :

1. Hajra Choudry, "Elements of Work Shop Technology – Vol. II", Media Promoters. 2002
2. P.C. Sharma, "A Text Book of Production Engineering", S. Chand and Co. Ltd, IV edition, 1993.

REFERENCES:

1. Rao, P.N. "Manufacturing Technology", Metal Cutting and Machine Tools, Tata McGraw–Hill, New Delhi, 2003.
2. Richerd R. Kibbe, John E. Neely, Roland O. Merges and Warren J. White, "Machine Tool Practices", Prentice Hall of India, 2003.
3. HMT – "Production Technology", Tata McGraw-Hill, 1998.

17154L35P COMPUTER AIDED SIMULATION AND ANALYSIS LABORATORY

LIST OF EXPERIMENTS

A. Simulation ***15***

1. Simulation of cam and follower mechanism using C / MAT Lab.

2. Analysis (Simple Treatment only) 30
3. Stress analysis of a plate with a circular hole.
4. Stress analysis of rectangular L bracket
5. Stress analysis of an axi-symmetric component
6. Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
7. Mode frequency analysis of a 2 D component
8. Mode frequency analysis of beams (Cantilever, Simply supported, Fixed ends)
9. Harmonic analysis of a 2D component
10. Thermal stress analysis of a 2D component
11. Conductive heat transfer analysis of a 2D component
12. Convective heat transfer analysis of a 2D component

TOTAL : 45

17154H41P POWER PLANT ENGINEERING

UNIT – I: INTRODUCTION : 9

Layout of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants - Steam Boilers and Cycles – High Pressure and Super Critical Boilers – Fluidised Bed Boilers

UNIT – II: STEAM POWER PLANT 9

Fuel Handling and Ash Handling, Combustion Equipment for burning coal, MechanicalStokers, Pulveriser, Electrostatic Precipitator, Draught, Cooling Towers

UNIT – III: NUCLEAR AND HYDEL POWER PLANTS 9

Nuclear Energy – Fission, Fusion Reaction, Types of Reactors, pressurized water reactor, Boiling Water Reactor,.

Hydel Power Plant – Essential Elements, Selection of Turbines, Governing of Turbines- Micro Hydel developments.

UNIT – IV: DIESEL AND GAS TURBINE POWER PLANT 9

Types of Diesel Plants, Components, Selection of Engine Type, Applications Gas Turbine Power Plant – Fuels – Open and Closed Cycles – Reheating – Regeneration and Intercooling

UNIT – V: POWER PLANTS ECONOMICS 9

Geo thermal –OTEC – Tidel - Pumped storage - Solar thermal central receiver system.

Cost of Electric Energy – Fixed and operating Costs – Energy Rates –Economics of load sharing, comparison of economics of various power plants**.**

Total Hours: 45

TEXT BOOKS:

1. G.D.Rai, "Introduction to Power Plant Technology", Khanna Publishers, 1995.
2. Nag P.K, "Power plant Engineering", Tata McGraw-Hill, 1998.

REFERENCES:

1. K.K.Ramalingam, "Power Plant Engineering", Scitech Publications, 2002.
2. Frank D.Graham "Power Plant Engineers Guide", D.B. Taraporevala Sons & Co, New Delhi, 1993.
3. T.Morse Frederick, "Power Plant Engineering", Prentice Hall of India, 1998

17154H42P DYNAMICS OF MACHINERY

UNIT – I: FORCE ANALYSIS IN MOVING PARTS 10

Rigid Body dynamics in general plane motion – Equations of motion - Dynamic force analysis - Inertia force and Inertia torque – D'Alemberts principle - - Dynamic Analysis in Reciprocating Engines – Gas Forces - Equivalent masses - Bearing loads - Crank shaft Torque - Turning moment diagrams - Fly wheels

UNIT – II: BALANCING OF MOVING PARTS 9

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

UNIT – III: FREE VIBRATIONS 10

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

UNIT – IV: FORCED VIBRATIONS 6

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

UNIT – V: MECHANISMS FOR CONTROL 10

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

TUTORIAL 15 TOTAL HOURS : 60

TEXT BOOKS:

1. Rattan S.S., "Theory of Machines", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1994.
2. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984.

REFERENCES:

1 Ghosh A. and Mallick A.K., "Theory of Mechanisms and Machines", Affiliated East-West Press Pvt. Ltd., New Delhi, 1988.
2 Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms", McGraw-Hill, Inc., 1995.
3. Rao J.S. and Dukkipati R.V., "Mechanism and Machine Theory ", Wiley-Eastern Limited, New Delhi, 1992.
4 John Hannah and Stephens R.C., "Mechanics of Machines", Viva low-Priced Student Edition, 1999.
5 Sadhu Singh "Theory of Machines" Pearson Education, 2002

17154H43P DESIGN OF MACHINE ELEMENTS

UNIT – I : STRESSES IN MACHINE MEMBERS 9

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

UNIT – II: DESIGN OF SHAFTS AND COUPLINGS 9

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

UNIT – III: DESIGN OF FASTNERS AND WELDED JOINTS 9

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

UNIT – IV: DESIGN OF SPRINGS AND LEVERS 9

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

UNIT – V: DESIGN OF BEARINGS AND FLYWHEELS 9

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

TUTORIAL 15
TOTAL HOURS : 60

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

TEXT BOOKS:

1. Juvinall R.C, and Marshek K.M, "Fundamentals of Machine Component Design", John Wiley & Sons, Third Edition, 2002.

2. Bhandari V.B, "Design of Machine Elements", Tata McGraw-Hill Book Co, 2003.

REFERENCES:

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

STANDARDS:

IS 10260 : Part 1 : 1982 Terms, definitions and classification of Plain bearings Part 1 : Construction.

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

IS 10260 : Part 1 : 1982 Terms, definitions and classification of Plain bearings Part 3 : Lubrication.

17154H51P HEAT AND MASS TRANSFER

UNIT – I: CONDUCTION **11**

Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation – General Differential equation of Heat Conduction – Fourier Law of Conduction – Cartesian and Cylindrical Coordinates – One Dimensional Steady State Heat Conduction – Conduction through Plane Wall, Composite walls– Conduction with Internal Heat Generation –

UNIT – II: CONVECTION **10**

Basic Concepts – Convective Heat Transfer Coefficients – Boundary Layer Concept – Types of Convection – Forced Convection – Dimensional Analysis – External Flow – Flow over Plates,– Internal Flow – Laminar and Turbulent Flow – – Free Convection –Flow over Vertical Plate, Horizontal Plate, Inclined Plate

UNIT – III: HEAT EXCHANGERS **9**

Nusselts theory of condensation-pool boiling, flow boiling, correlations in boiling and condensation. Types of Heat Exchangers – LMTD Method of heat Exchanger Analysis – Effectiveness – NTU method of Heat Exchanger Analysis – Overall Heat Transfer Coefficient – Fouling Factors**.**

UNIT – IV: RADIATION **8**

Basic Concepts, Laws of Radiation – Stefan Boltzman Law, Kirchoff Law –Black Body Radiation –Grey body radiation Shape Factor Algebra – Radiation Shields .

UNIT – V: MASS TRANSFER **7**

Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy

TUTORIAL:15 ***TOTAL HOURS 60***

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

TEXT BOOKS:

1. Sachdeva R C, "Fundamentals of Engineering Heat and Mass Transfer" New Age International, 1995.
2. Kothandaraman C.P "Fundamentals of Heat and Mass Transfer" New Age International, New Delhi, 1998

REFERENCES:

3. Ozisik M.N, "Heat Transfer", McGraw-Hill Book Co., 1994.
4. Holman J.P "Heat and Mass Transfer" Tata McGraw-Hill, 2000.
5. Frank P. Incropera and David P. DeWitt, "Fundamentals of Heat and Mass Transfer", John Wiley and Sons, 1998.

17154H52P DESIGN OF TRANSMISSION SYSTEMS

UNIT – I: DESIGN OF TRANSMISSION SYSTEMS 9

Selection of V belts and pulleys – selection of Flat belts and pulleys -– Selection of Transmission chains and Sprockets. Design of pulleys and sprockets.

UNIT – II: SPUR GEARS AND PARALLEL AXIS HELICAL GEARS 9

Gear Terminology-Speed ratios and number of teeth-Force analysis - Dynamic effects - Fatigue strength - Factor of safety - Gear materials – Module and Face width-power rating calculations based on strength and wear considerations -– Pressure angle in the normal and transverse plane-Equivalent number of teeth-forces and stresses.

UNIT – III: BEVEL AND CROSS HELICAL GEARS 9

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears.
Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.

UNIT – IV: GEAR BOXES DESIGN 9

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box -Constant mesh gear box. – Design of multi speed gear box.

UNIT – V: DESIGN OF CAM, CLUTCHES AND BRAKES 9

Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses.
Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches-

TUTORIALS 30

TOTAL HOURS: 75

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

TEXT BOOKS

1. Prabhu. T.J., "Design of Transmission Elements", Mani Offset, Chennai, 2000,
2. Bhandari, V.B., "Design of Machine Elements", Tata McGraw-Hill Publishing Company Ltd., 1994.

REFERENCES

1. Maitra G.M., Prasad L.V., "Hand book of Mechanical Design", II Edition, Tata McGraw-Hill, 1985.
2. Shigley J.E and Mischke C. R., "Mechanical Engineering Design", McGraw-Hill International Editions, 1989.

17154H53P AUTOMOBILE ENGINEERING

UNIT – I: STRUCTURE OF VEHICLESAND 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 –.

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 convertors– Propeller shaft – Slip Joint – Universal Joints – Differential and Rear Axle**.**

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.

UNIT – V: ALTERNATIVE ENERGY SOURCES 5

Use of Natural Gas, LPG, Biodiesel, Gasohol and Hydrogen in Automobiles - Electric and Hybrid Vehicles, Fuel Cells.

Note: Practical training in dismantling and assembling of Engine parts Transmission System should be given to the students

Total Hours : 45

TEXT BOOKS:

1. Sethi H.M, "Automobile Technology", Tata McGraw-Hill-2003
2. Kirpal Singh "Automobile Engineering Vol. 1& 2", Standard Publishers, New Delhi.

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, 2003, Tata McGraw-Hill.

17154H61P FINITE ELEMENT ANALYSIS

UNIT – I: INTRODUCTION TO FEA: 9

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

UNIT – II: ONE DIMENSIONAL PROBLEMS 9

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

UNIT – III: TWO DIMENSIONAL PROBLEMS 9

Introduction – Finite element modelling – Scalar valued problem – Poisson equation –Laplace equation – Triangular elements – Element stiffness matrix – Force vector – Galarkin approach - Stress calculation.

UNIT – IV: AXISYMMETRIC PROBLEMS 9

Axisymmetric formulation – Element stiffness matrix and force vector – Galarkin approach – Body forces– Stress calculations – Boundary conditions.

UNIT – V: ISOPARAMETRIC ELEMENTS 9

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

TUTORIAL 15
TOTAL HOURS :60

TEXT BOOKS*:*

1. Chandrupatla T.R., and Belegundu A.D., "Introduction to Finite Elements in Engineering", Pearson Education 2002, 3rd Edition.
2. Reddy J.N., "An Introduction to Finite Element Method", McGraw-Hill International Student Edition, 1985

REFERENCES:

1. Rao S.S., "The Finite Element Method in Engineering", Pergammon Press, 1989
2. Logan D.L., "A First course in the Finite Element Method", Third Edition, Thomson Learning, 2002.
3. Robert D.Cook., David.S, Malkucs Michael E Plesha, "Concepts and Applications of Finite Element Analysis" 4 Ed. Wiley, 2003.

17154H62P MECHATRONICS

UNIT – I: INTRODUCTION 9

Introduction to Mechatronics – 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: POWER DRIVE SYSTEM 9

Pneumatic and Hydraulic Systems – Directional Control Valves – Rotary Actuators.

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 Systems, Electromechanical Systems – Hydraulic – Mechanical Systems.

Continuous and discrete process Controllers – Control Mode – Two – Step mode – Proportional Mode – Derivative Mode – Integral Mode – PID Controllers.

UNIT – IV: PROGRAMMING LOGIC CONTROLLERS(PLC) 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 .

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

Total Hours : 45

TEXT BOOKS:

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

REFERENCES

1. Michael B. Histand and David G. Alciatore, “ 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 (Indian Reprint).

17154H63P COMPUTER INTEGRATED MANUFACTURING

UNIT – I: INTRODUCTION 8

CIM-Introduction. - 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.

UNIT – II: GROUP TECHNOLOGY AND CAPP 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.

approaches to computer aided process planning -variant approach and generative approaches - CAPP and CMPP process planning systems.

UNIT – III: SHOP FLOOR CONTROL AND BASICS OF FMS 9

Shop floor control -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

UNIT – IV: CIM IMPLEMENTATION AND LAN 10

CIM and company strategy - system modeling tools -IDEF models - activity cycle diagram - CIM open system architecture (CIMOSA)- manufacturing enterprise wheel-CIM architecture.

Communication fundamentals- local area networks -topology - LAN implementations - network management and installations**.**

UNIT – V: OPEN SYSTEM AND DATABASE FOR CIM 8

Open systems-open system inter connection - manufacturing automations protocol and technical office protocol (MAP /TOP)

Development of databases -database terminology- architecture of database systems-data modeling and data associations -relational data bases - database operators - advantages of data base and relational database.

Total Hours : 45

TEXT BOOKS*:*

1. Mikell.P.Groover "Automation, Production Systems and computer integrated manufacturing", Pearson Education 2001.
2. Radhakrishnan P, Subramanyan S.and Raju V., "CAD/CAM/CIM", 2nd Edition New Age International (P) Ltd, New Delhi. 2000.

REFERENCES:

1. Roger Hanman "Computer Intergrated Manufacturing", Addison –Wesley, 1997.
2. Mikell.P.Groover and Emory Zimmers Jr., "CAD/CAM", Prentice hall of India Pvt. Ltd., New Delhi-1.1998.

17160H71P TOTAL QUALITY MANAGEMENT

UNIT – I: BASICS OF TQM **9**

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT – II: PRINCIPLES OF TQM **9**

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT – III: QUALITY CONCEPTS **9**

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Concept of six sigma,

UNIT – IV: TQM TOOLS **9**

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, FMEA – Stages of FMEA.

UNIT – V: ISO STANDARDS **9**

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, ISO 14000 – Concept, Requirements and Benefits.

TOTAL : 45

TEXT BOOKS:

1. Dale H. Besterfiled, et al., “Total Quality Management”, Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.
2. Basker, “ TOTAL QUALITY MANAGEMENT”, Anuradha Agencies.

REFERENCES:

1. Feigenbaum.A.V. “Total Quality Management”, McGraw Hill, 1991.
2. Oakland.J.S. “Total Quality Management”, Butterworth – Hcinemann Ltd., Oxford. 1989.
3. Narayana V. and Sreenivasan, N.S. “Quality Management – Concepts and Tasks”, New Age International 1996

17154H72P PROCESS PLANNING AND COST ESTIMATION

UNIT-I: WORK STUDY AND TIME STUDY 10

Method study – Definition – Objectives-Motion economy- Principles – Tools and Techniques-Applications – Work measurements- purpose – use – procedure – tools and techniques- Standard time –Time study– principles – applications.

UNIT-II: PROCESS PLANNING 10

Definition – Objective –approaches to process planning- Process planning activities – Finished part requirements- manufacturing sequences- machine selection – material selection parameters-Set of documents for process planning-process chart - 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.

UNIT-IV: COST ESTIMATION 8

Types of estimates – methods of estimates – data requirements and sources- collection of cost

UNIT-V: PRODUCTION COST ESTIMATION 10

Estimation of material cost, labour cost and over heads, allocation of overheads – Estimation for different types of jobs. Total Hours : 45

TEXT BOOKS:

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

2 Russell.R.S and Tailor, B.W, "Operations Management", PHI, 4th Edition, 2003.

REFERENCES:

1. Phillip.F Ostwalal and Jairo Munez, "Manufacturing Processes and systems", John Wiley, 9th Edition, 1998.
2. Chitale.A.V. and Gupta.R.C., "Product Design and Manufacturing", PHI, 2nd Edition, 2002.

17154H73P APPLIED HYDRAULICS AND PNEUMATICS

UNIT – I: FUNDAMENTALS OF FLUID POWER SYSTEM 9

Fluid power, Advantages Application .Types of fluid power systems, Properties of hydraulic fluids – General types of fluids – Fluid power symbols.

Basics of Hydraulics- Pascals Law- Laminar and Turbulent flow – Reynold's number

UNIT – II: HYDRAULIC SYSTEM & COMPONENTS 9

Sources of Hydraulic Power: Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps – pump characteristics – Variable displacement pumps.

Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like tanden, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder, Rotary actuators – Fluid motors, Gear, Vane and Piston motors.

UNIT – III: DESIGN OF HYDRAULIC CIRCUITS 9

Construction of Control Components : Director control valve – 3/2 way valve – 4/2 way valve – Shuttle valve – check valve – pressure control valve –Flow control valve – Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram.

Accumulators and Intensifiers : Types of accumulators – Accumulators circuits, sizing of accumulators, intensifier – Applications of Intensifier – Intensifier circuit.

UNIT – IV: PNEUMATIC SYSTEMS AND COMPONENTS 9

Pneumatic Components: Properties of air – Compressors – Filter, Regulator, Lubricator Unit – Air control valves, Quick exhaust valves, pneumatic actuators.

Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, , Sequential circuit design for simple applications using cascade method.

UNIT – V: DESIGN OF PNEUMATIC CIRCUITS 9

Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves.

Fluidics – Introduction to fluidic devices, simple circuits,. Fluid power circuits; failure and troubleshooting.

Total Hours : 45

TEXT BOOKS :

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education 2000.
2. Dudelyt, A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall, 1987.

REFERENCES:

1. Anthony Lal, "Oil hydraulics in the service of industry", Allied publishers, 1982.
2. Michael J, Prinches and Ashby J. G, "Power Hydraulics", Prentice Hall, 1989.
3. Majumdar S.R., "Oil Hydraulics", Tata McGraw-Hill, 2000.

LIST OF ELECTIVES

17154E44AP GAS DYNAMICS AND JET PROPULSION

UNIT – I: FUNDAMENTALS OF COMPRESSIBLE FLOW 8

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

UNIT – II: FLOW THROUGH VARIABLE AREA DUCTS 9

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

UNIT – III : Flow through Constant Area Ducts 10

Flow in constant area ducts with friction (Fanno flow) – Fanno curves and Fanno flow equation, variation of flow propertiesFlow in constant area ducts with heat transfer (Rayleigh flow), Rayleigh line and Rayleigh flow equation, variation of flow properties,

UNIT – IV: NORMAL SHOCK 8

Governing equations, variation of flow parameters like static pressure, static temperature, density, stagnation pressure and entropy across the normal shock, Prandtl - Meyer equation, flow in convergent and divergent nozzle with shock, normal shock in Fanno and Rayleigh flows,

UNIT – V: PROPULSION 10

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

TUTORIAL 15
TOTAL HOURS : 60

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

TEXT BOOKS

1. Yahya. S.M., “Fundamental of compressible flow”, New Age International (p) Ltd., New Delhi, 1996.
2. Patrich.H. Oosthvizen, William E.Carscallen, “Compressible fluid flow”, McGraw-Hill, 1997

REFERENCES:

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

17160E44CP MARKETING MANAGEMENT

1. MARKETING PROCESS 9

Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. selling versus marketing, industrial versus consumer marketing,

2.BUYING BEHAVIOUR AND MARKET SEGMENTATION 9

Cultural, demographic factors, motives, types, buying decisions, segmentation factors - demographic -Psycho graphic and geographic segmentation, process, patterns.

3.PRODUCT PRICING AND MARKETING RESEARCH 9

Objectives, pricing, decisions and pricing methods, process of marketing research.

4.MARKETING PLANNING AND STRATEGY FORMULATION 9

Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

5.ADVERTISING, SALES PROMOTION AND DISTRIBUTION 9

Characteristics, impact, goals, types, and sales promotions- point of purchase- unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing.

TOTAL : 45

TEXT BOOKS

1. Ramasamy and Nama kumari, "Marketing Environment: Planning, implementation and control the Indian context", 1990.
2. Govindarajan. M, "Industrial marketing management", Vikas Publishing Pvt. Ltd, 2003.

REFERENCES

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

17154E44DP RENEWABLE SOURCES OF ENERGY

UNIT– I: FACTORS AFFECTING ENERGY SOURCES: 9

Primary energy sources - world energy resources- energy cycle of the earth –environmental aspects of energy utilisation, CO_2 emissions and Global warming–renewable energy resources and their importance. Potential impacts of harnessing the different renewable energy resources.

UNIT – II: SOLAR ENERGY : 9

Principles of Solar energy collection -Solar radiation - measurements - instruments - data and estimation- types of collectors - characteristics and design principles of different type of collectors - performance of collectors - testing of collectors. Solar thermal applications - water heaters and air heaters - performance and applications - simple calculations - solar cooling - solar drying - solar ponds - solar tower concept - solar furnace.

UNIT – III: WIND, TIDAL AND GEO THERMAL ENERGY 9

Energy from the wind - general theory of windmills - types of windmills - design aspects of horizontal axis windmills - applications. Energy from tides and waves – working principles of tidal plants and ocean thermal energy conversion plants - power from geothermal energy - principle of working of geothermal power plants.

UNIT – IV: BIO ENERGY 9

Energy from bio mass & 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: RECENT ADVANCEMENTS 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,

Total Hours : 45

TEXT BOOKS

1. Rai G.D, "Non conventional Energy sources" (1999) Khanna Publishers, New Delhi
2. Ashok V Desai, "Non-conventional Energy", Wiley Eastern Ltd, New Delhi, 1990

REFERENCES

1. Sukhatme, S.P., Solar Energy, 2nd edition, TMH, 2003
2. Sulton, "Direct Energy Conversion", McGraw-Hill, 1966.
3. Duffie and Beckmann, "Solar Energy Thermal Processes, John Wiley, 1974.

17154E54BP COMPOSITE MATERIALS

1. 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.

2. 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).

3. 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.

4. 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).

5. 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", Chapman and Hall, London, England, 1st edition, 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. Sharma S.C., "Composite materials", Narosa Publications, 2000.
3. "Short Term Course on Advances in Composite Materials, Composite Technology Centre, Department of Metallurgy", IIT- Madras, December 2001.

17154E54CP ROBOTICS

UNIT-I: INTRODUCTION OF ROBOT BASICS 7

Robot – Definition – Robot Anatomy – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and Their Functions – Need for Robots – Different Applications

UNIT-II: ROBOT ACTUATORS AND END EFFECTORS 10

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of all these Drives End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered Internal Grippers and External Grippers;

UNIT-III: SENSORS AND MACHINE VISION SYSTEM 10

Requirements of a sensor, Principles and Applications of the following types of sensors – Position of sensors - Piezo Electric Sensor, LVDT, Optical Encoders, Range Sensors, Proximity Sensors - nductive, Hall Effect, Capacitive, Ultrasonic Touch Sensors, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis – Data Reduction, Segmentation, Feature Extraction, Object Recognition.

UNIT-IV: ROBOT KINEMATICS AND ROBOT PROGRAMMING 10

Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional),
Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple programs

UNIT – V: IMPLEMENTATION AND ROBOT ECONOMICS 8

RGV, AGV; Implementation of Robots in Industries – Various Steps; Safety Considerations for Robot Operations; Economic Analysis of Robots – Pay back Method, Rate of Return Method.

Total Hours : 45

TEXT BOOKS:

1. M.P.Groover, "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

17154E64AP UNCONVENTIONAL MACHINING PROCESSES

UNIT – I: INTRODUCTION: 5

Non traditional machining Process – Introductions-Need–types- Brief overview of all techniques.

UNIT – II: AJM, WJM & USM 10

Abrasive Jet Machining – Water Jet Machining – Ultrasonic Machining. (AJM, WJM and USM). Working Principles – equipment used – Process parameters – MRR-Variation in techniques used – Applications.

UNIT – III: EDM 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: ECM & ECG 12

Chemical Machining and Electro-Chemical machining (CHM and 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: LBM, PAM & EBM 10

Laser Beam machining (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles-Equipment-Types-Beam control techniques – Applications**.**

Total Hours : 45

TEXT BOOKS:

1. Vijay.K. Jain "Advanced Machining Processes" Allied Publishers Pvt. Ltd., New Delhi (2002) ISBN 81-7764-294-4.
2. Benedict. G.F. "Nontraditional Manufacturing Processes" Marcel Dekker Inc., New York (1987).

REFERENCES:

1. Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw-Hill, New Delhi (1980).
2. Mc Geough, "Advanced Methods of Machining" Chapman and Hall, London (1998).

17154E64BP NUCLEAR ENGINEERING

UNIT-I: NUCLEAR PHYSICS 9

Nuclear model of an atom-Equivalence of mass and energy-binding- radio activity-half life-neutron interactions-cross sections.

UNIT-II: NUCLEAR REACTIONS AND REACTION MATERIALS 9

Mechanism of nuclear fission and fusion- radio activity- chain reactions-critical mass and composition-nuclear fuel cycles and its characteristics-uranium production and purification-Zirconium, thorium, beryllium.

UNIT-III: REPROCESSING 9

Reprocessing: nuclear fuel cycles-spent fuel characteristics-role of solvent extraction in reprocessing-solvent extraction equipment.

UNIT-IV: NUCLEAR REACTOR 9

Nuclear reactors: types of fast breeding reactors-design and construction of fast breeding reactors-heat transfer techniques in nuclear reactors- reactor shielding. Fusion reactors.

UNIT-V: SAFETY AND DISPOSAL 9

Safety and disposal: Nuclear plant safety-safety systems-changes and consequences of accident-criteria for safety-nuclear waste-types of waste and its disposal-radiation hazards and their prevention-weapons proliferation.

Total Hours : 45

TEXT BOOKS :

1. Thomas J.Cannoly, "Fundamentals of nuclear Engineering" John Wiley 1978.

REFERENCES:

1. Collier J.G., and Hewitt G.F, "Introduction to Nuclear power", Hemisphere publishing, New York. 1987
2. Wakil M.M.El., "Power Plant Technology" – McGraw-Hill International, 1984.
3.

17154E64CP THERMAL TURBO MACHINES

1. INTRODUCTION TO TURBO MACHINES 9

Turbines, Pumps, Compressors– Stages of Turbo machines – Energy transfer between fluid and rotor – Stage velocity triangles of Thermal Turbo machines – Classification – General energy equation Modified to turbo machines – compression and expansion process – Velocity triangles – Work – T-S and H-S diagram, Total – to – Total and Total – to – Static efficiencies.

2. CENTRIFUGAL FANS AND BLOWERS 9

Definition, selection and classifications –Types of blading design-velocity triangles - Stage Parameters – Flow analysis in impeller blades –Design parameter- Volute and Diffusers – Efficiencies and Losses

Centrifugal Compressors: - Constructional details – Stage velocity triangles — Stage work – Stage pressure rise – Stage efficiency – Degree of reaction – Slip factor – H-S diagram – Efficiencies

3. AXIAL FANS AND PROPELLERS 9

Definition , classifications – Stage parameters – Types of fan stages

Cascade of blades – Cascade tunnel - Blade geometry-Cascade variables-Energy transfer and loss in terms of lift and drag - Axial Flow Compressors: definition and classifications – Constructional details – Stage velocity triangles, work and pressure rise – H-S diagram – Stage efficiencies and losses- Degree of reaction

4. AXIAL FLOW TURBINES 9

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

5. RADIAL FLOW TURBINES AND WIND TURBINES 9

Constructional details — Stage velocity triangles – H-S diagram – Stage efficiencies and losses.

Wind turbines: definition and classifications – Constructional details –Horizontal axis wind turbine- Power developed – Axial thrust – Efficiency.

TOTAL : 45

TEXT BOOKS

1. Yahya, S.H., “Turbines, Compressors and Fans”, Tata McGraw-Hill Publishing Company, 1996.

2. Dixon S.L “Fluid Mechanics, Thermodynamics of turbomachines”-2nd Edition, Pergamon press 1990.

3.

REFERENCES

1. Kadambi V and Manohar Prasad- "An Introduction to energy conversion - Vol. III", Turbomachines- Wiley Eastern India Ltd, 1977.

17160E74CP PRINCIPLES OF MANAGEMENT
(COMMON TO ALL BRANCHES)

UNIT I - Nature of Management **9**

Definitions, meaning, scope, administration and management - Science and art Mgmt as a profession, University of management Hierarchy (Top, middle and supervisory, Levels), Principles of Management

UNIT II - Development of Management Thought **9**

Taylor and Scientific Management, Principles of Scientific Management Contributions of fayol,Barnard and social system theory, Contributions of Herbert Simon, Contributions of Peter Drucker, Contributions of behavioral scientists ,Contribution of system scientists

UNIT III - Planning and organizing **9**

Definition and features of planning, Nature of planning, Importance of planning
Types of planning, Steps in planning. Management by objectives, Strategies and policies, Definition of organization, Importance of organization, Principles of organization, Span of management

UNIT IV - Direction and Coordination **9**

Meaning, definition, principles of direction, Techniques of direction - Meaning of supervision, Functions of supervisor, Meaning of coordination Element and features of coordination, Importance of coordination Cooperation and coordination systems approach Steps for effective coordination Meaning and causes of conflicts, Management of conflicts

UNIT V – Controlling **9**

Definition, Meaning .elements, steps in establishing control procedure Control Techniques, Requirements of good control systems Budget –meaning, definitions, types Zero based budgeting, responsibility accounting, budgetary control, Report –meaning types PERT and CPM Management by Exception

Total Hours: 45

Textbooks:

1. Prasad L.M ., Principles and practice of Management ,New Delhi Sultan Chand and sons ,1998

References:

1. saxena ,s.c principles and practice of management Agra : sahitya bhawan 1998
2. Koontz Harold and others ,Management New York :McGraw Hill 1980
3. stoner james and others ,Management ,New Delhi :PHI ,1997
4. Dale Yoder : Personnel Management and industrial Relations ,New Delhi PHI 1974

17154E74DP INDUSTRIAL ENGINEERING

Unit I Introduction to Industrial Engineering

Introduction to Industrial Engineering – Evolution of modern Concepts in Industrial Engineering – Functions of Industrial Engineering – Field of application of Industrial Engineering Product Development and research- Design function – Objectives of design- Manufacturing Vs purchase- Development of designs- Experimentation- prototype production and testing simplification and standardization – Selection of materials and processes- Human factors in design- value Engineering job plan.

Unit II Plant layout

Plant layout - Types of layouts- Product, process, fixed, Group technology, Flexible manufacturing system- elementary concepts and structure, flow charts, use of time study data, physical facilities- Constructional details- environmental control like lighting, temperature, humidity, Ventilation, noise and dust, Industrial waste disposal-

Unit III - Material handling

Principles of material handling- Types of material handling equipments- Selection and application maintenance and replacements- Preventive and brake- down maintenance and replacement- Preventive and brake- down maintenance- economic aspect, Replacement of equipment- Method of providing for depreciation- Determination of economic life, Criteria for selection of equipment- Simple problem.

Unit IV Organization,

Principles of organization, Development of Organizational charts like line, staff, line and staff & functional types. Resources, Human relationship. Factory acts, payment of wages, workmen compensation, E.S.I. Sales management & forecasting cost accounting, Budgetary control. , partnership, Joint stock & co-operative stores.

Unit V Labour welfare and Industrial Safety

Workers participation in management- Labour welfare and social security- Industrial safety- Important statutory provisions in labour legislation. Safety engineering, accident prevention program , safety design concepts, fire protection-industrial noise-Legislations on safety in industry . Recent Developments in maintenance methods-RCM- CBM –DMS – TPM etc.

References:

1. Industrial Engineering and Management - O. P. Khanna
2 Industrial Engineering & Production Management, M Mahajan - Dhanpat Rai (pub).
3. Industrial Engineering - Dr. B. Kumar – Khanna pub.