PRIST Deemed to be University
Vallam, Thanjavur.

DEPARTMENT OF
MECHANICAL ENGINEERING

PROGRAM HANDBOOK

B.TECH
MECHANICAL ENGINEERING
PART TIME
[REGULATION 2019]

SEMESTER – I

Sl. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	19148S11P	Transforms & Partial Differential Equations	3	1	0	4
2	19154C12P	Electrical drives and controls	3	0	0	3
3	19154C13P	Engineering Thermodynamics	3	1	0	4
4	19154C14P	Fluid Mechanics and Machinery	3	1	0	4
5	19154C15P	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	19148S21P	Numerical Methods	3	1	0	4
2	19154C22P	Machine Tool Technology	3	0	0	3
3	19154C23P	Thermal Engineering	3	1	0	4
4	19154C24P	Strength of Materials	3	1	0	4
5	19154C25P	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	19148S31CP	Probability and Statistics	3	1	0	4
2	19154C32P	Kinematics of Machinery	3	1	0	4
3	19154C33P	Production Planning and Control	4	0	0	4
4	19154C34P	Engineering Metrology and Measurements	4	0	0	4
5	19154L35P	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	19154C41P	Power Plant Engineering	4	0	0	4
2	19154C42P	Dynamics of Machinery	3	1	0	4
3	19154C43P	Design of Machine Elements	3	1	0	4
4	19154E44-P	Elective -I	4	0	0	4
5	19154L45P	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	19154C51P	Heat and Mass Transfer	3	1	0	4
2	19154C52P	Design of Transmission Systems	3	1	0	4
3	19154C53P	Automobile Engineering	4	0	0	4
4	19154E54-P	Elective-II	4	0	0	4
5	19154L55P	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	19154C61P	Finite Elements Analysis	3	1	0	4
2	19154C62P	Mechatronics	4	0	0	4
3	19154C63P	Computer Integrated Manufacturing	4	0	0	4
4	19154E64-P	Elective-III	4	0	0	4
5	19154L65P	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	19160S71P	Total Quality Management	3	0	0	3
2	19154C72P	Process Planning and Cost Estimation	3	1	0	4
3	19154C73P	Applied Hydraulics and Pneumatics	4	0	0	4
4	19154E74-P	Elective-IV	3	0	0	3
5	19154P75P	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	19154E44AP	Gas Dynamics and Jet Propulsion	4	0	0	4
2	19154E44BP	Refrigeration and Air Conditioning	4	0	0	4
3	19154E44CP	Non Destructive Testing	4	0	0	4
4	19154E44DP	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	19154E54AP	Environmental Science and Engineering	4	0	0	4
2	19154E54BP	Composite Materials	4	0	0	4
3	19154E54CP	Robotics	4	0	0	4
4	19154E54DP	Design of Jigs, Fixtures and Press Tools	4	0	0	4

ELECTIVE III
SEMESTER – VI

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	19154E64AP	Principles of Management	4	0	0	4
2	19154E64BP	Nuclear Engineering	4	0	0	4
3	19154E64CP	Intellectual Property Rights	4	0	0	4
4	19148E64DP	Mathematics for Industrial Operations	4	0	0	4

ELECTIVE IV
SEMESTER – VII

S. No	Subject Code	Subject Name	Periods Per Week			C
			L	T	P	
1	19154E74AP	Quality Control and Reliability Engineering	3	0	0	3
2	19154E74BP	Vibration and Noise Control	3	0	0	3
3	19154E74CP	Unconventional Machining Process	3	0	0	3
4	19154E74DP	Industrial Engineering	3	0	0	3

19148C11P 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.

19153C12P ELECTRICAL DRIVES AND CONTROLS

UNIT-I   D.C. MACHINES   (9)

Principle of operation, Construction, Method of Excitation, Characteristics of d.c shunt, series ,compound generator, emf equation, application. Characteristics of d.c shunt, series, compound motor, torque equation, application, Types of d.c motor starters.

UNIT-II   A.C. MACHINES   (9)

Principle of operation, Construction of Induction and Synchronous machines- Characteristics and its applications. Starters for induction machines.

UNIT-III   (9)

Basic elements-types of drives-factors influencing the choice of electrical drives-heating and cooling curves-loading conditions and classes of duty-selection of power rating for drive motors with regard to thermal overloading and load variation factors.

UNIT-IV CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C.
**   DRIVES   (9)**

Speed control of DC series and shunt motors – Armature and field control, Ward-Leonard control system - Using controlled rectifiers and DC choppers –applications.

UNIT-V CONVENTIONAL AND SOLID STATE SPEED CONTROL OF A.C.
**   DRIVES   (9)**

Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – applications.

Total Hours : 45

TEXT BOOKS

1.   VEDAM SUBRAHMANIAM, "Electric Drives (concepts and applications)", Tata McGraw-Hill, 2001
2.   NAGRATH.I.J. & KOTHARI.D.P, "Electrical Machines", Tata McGraw-Hill, 1998

REFERENCES

1.   PILLAI.S.K "A first course on Electric drives", Wiley Eastern Limited, 1998
2.   M.D.SINGH, K.B.KHANCHANDANI, "Power Electronics", Tata McGraw-Hill, 1998

19154C13P 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.

19154C14P 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
       (7th edition), 1995.
   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. 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, 2nd Edition, 2004.

19154C15P 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

19148C21P NUMERICAL METHODS

1.   SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS   9

Linear interpolation methods (method of false position) - Newton's method - Statement of Fixed Point Theorem - Fixed pointer iteration x=g(x) method - Solution of linear system of Gaussian elimination and Gauss-Jordan methods - Iterative methods: Gauss Jacobi and Gauss – Seidel methods- Inverse of a matrix by Gauss-Jordan method. Eigen value of a matrix by power methods.

2.   INTERPOLATION AND APPROXIMATION   9

Lagrangian Polynomials - Divided difference - Interpolation with a cubic spline - Newton forward and backward difference formulae.

3.   NUMERICAL DIFFERENTIATION AND INTEGRATION   9

Derivatives from difference table - Divided difference and finite difference - Numerical integration by Trapezoidal and Simpson's 1/3 and 3/8 rules - Romberg's method - Two and three point Gaussian quadrature formulas - Double integrals using trapezoidal and Simpson's rules.

4.   INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS
                                                9

Single step Methods : Taylor Series and methods - Euler and Modified Euler methods - Fourth order Runge-Kutta method for solving first and second order equations - Multistep methods – Milne's and Adam's predictor and corrector methods.

5.   BOUNDARY VALUE PROBLEMS   9

Finite difference solution for the second order ordinary differential equations. Finite difference solution for one dimensional heat equation by implict and explict methods - one dimensional wave equation and two dimensional Laplace and Poisson equations.

TUTORIAL: 15
TOTAL : 60

TEXT BOOKS

1.   Gerald, C.F, and Wheatley, P.O, "Applied Numerical Analysis", Sixth Edition, Pearson Education Asia, New Delhi.2002.
2.   Balagurusamy, E., "Numerical Methods", Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 1999.

REFERENCES

1.   Kandasamy, P.Thilakavthy, K and Gunavathy, K. "Numerical Methods", S.Chand and Co. New Delhi.1999
2.   Burden, R.L and Faries, T.D., "Numerical Analysis", Seventh Edition, Thomson Asia Pvt. Ltd., Singapore, 2002.
3.   Venkatraman M.K, "Numerical Methods" National Pub. Company, Chennai, 1991
4.   Sankara Rao K., "Numerical Methods for Scientists and Engineers", 2nd Ed. Prentice Hall India. 2004

19154C22P   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.**

19154C23P 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**.**

19154C24P 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.

19154C25P 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

19148C31CP PROBABILITY AND STATISTICS

1. PROBABILITY AND RANDOM VARIABLE   **9**

Axioms of probability - Conditional probability - Total probability - Bayes theorem - Random variable - Probability mass function - Probability density functions - Properties- Moments - Moment generating functions and their properties.

2.   TWO DIMENSIONAL RANDOM VARIABLES   **9**

Joint distributions - Marginal and conditional distributions – Covariance - Correlation and Regression - Transformation of random variables - Central limit theorem.

3. STANDARD DISTRIBUTIONS   **9**

Binomial, Poisson, Geometric, Negative Binomial, Uniform, Exponential, Gamma, Weibull and Normal distributions and their properties - Functions of a random variable.

4.   TESTING OF HYPOTHESIS   **9**

Sampling distributions – Testing of hypothesis for mean, variance, proportions and differences using Normal, t, Chi-square and F distributions - Tests for independence of attributes and Goodness of fit.

5.   DESIGN OF EXPERIMENTS   **9**

Analysis of variance – One way classification – CRD - Two – way classification – RBD - Latin square.

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

TUTORIALS 15

TOTAL : 60

TEXT BOOKS

1. Ross. S., "A first Course in Probability", Fifth Edition, Pearson Education, Delhi 2002. (Chapters 2 to 8)

2. Johnson. R. A., "Miller & Freund's Probability and Statistics for Engineers", Sixth Edition, Pearson Education, Delhi, 2000. (Chapters 7, 8, 9, 12)

REFERENCES

1. Walpole, R. E., Myers, R. H. Myers R. S. L. and Ye. K, "Probability and Statistics for Engineers and Scientists", Seventh Edition, Pearsons Education, Delhi, 2002.

2. Lipschutz. S and Schiller. J, "Schaum's outlines - Introduction to Probability and Statistics", McGraw-Hill, New Delhi, 1998.

3. Gupta, S.C, and Kapur, J.N., "Fundamentals of Mathematical Statistics",   Sultan Chand, Ninth Edition , New Delhi ,1996.

19154C32P KINEMATICS OF MACHINERY

UNIT – I: BASICS OF MECHANISMS   7

Terminology and Definitions-Degree of Freedom Mobility-Kutzbach criterion-Grashoff's law-Kinematic Inversions of 4-bar chain and slider crank chains-Mechanical Advantage-Transmission angle-Description of reciprocating Mechanisms-Single slider crank, double slider crank mechanisms, Quick return mechanisms, Offset slider crank mechanism.

UNIT – II: KINEMATICS   12

Displacement, velocity and acceleration - analysis in simple mechanisms - Graphical Method velocity and acceleration polygons -Vector Approach, - Coriolis Acceleration.

UNIT – III: CAM PROFILE   8

Introduction-Classification cam and followers- cam nomenclature- Displacement diagrams-uniform velocity motion, uniform acceleration and retardation motion -Simple harmonic and Cycloidal motions – construction of displacement, velocity and acceleration diagrams-construction of cam profile with knife edge follower, roller follower, oscillating follower, flat faced mushroom follower

UNIT – IV: GEARS   10

Spur gear Terminology and definitions-Fundamental Law of toothed gearing-Inter changeable gears-gear tooth action – Terminology - Interference and undercutting-Non standard gear teeth-Helical, Bevel, Worm, Rack and Pinion gears (Basics only)-Gear trains-Parallel axis gear trains-Epicyclic gear trains

UNIT – V: FRICTION   8

Friction-Concepts, Types - Friction drives: Clutches - Introduction, Single & Multiplate Clutches – Friction in screw threads - Belt and rope drives.

Brakes: Types – Block Brake, Band: Simple Band & Differential, Band and Block Brakes.

TUTORIALS   15

TOTAL HOURS : 60

TEXT BOOKS

1. Rattan S.S, "Theory of Machines", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1998.
2. Ghosh A and A.K.Mallick, "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., New Delhi, 1988.

REFERENCES:

1. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984.
2. Rao J.S and Dukkipati R.V, "Mechanism and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.
3. John Hannah and Stephens R.C, "Mechanics of Machines", Viva Low-Prices Student Edition, 1999

STANDARDS:
1.   IS 2458 : 2001, Vocabulary of Gear Terms – Definitions Related to Geometry
2.   IS 3756 : 2002, Method of Gear correction – Addendum modification for External Cylindrical Gears with Parallel Axes.
3.   IS 5267 : 2002 Vocabulary of Gear Terms – Definitions Related to Worm   Gear Geometry.

4.   IS 12328 : Part 1: 1988 Bevel Gear Systems Part – 1 Straight Bevel Gears.
5.   IS 12328 : Part 2: 1988 Bevel Gear Systems Part – 2 Spiral Bevel Gears.

19154C33P PRODUCTION PLANNING AND CONTROL

UNIT I   INTRODUCTION   9

Objectives and benefits of planning and control-Functions of production control-Types of production- job- batch and continuous-Product development and design-Marketing aspect - Functional aspects- Operational aspect-Durability and dependability aspect aesthetic aspect. Profit consideration- Standardization, Simplification & specialization- Break even analysis- Economics of a new design.

UNIT II   WORK STUDY   9

Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.

UNIT III   PRODUCT PLANNING AND PROCESS PLANNING   9

Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning- Steps in process planning-Quantity determination in batch production-Machine capacity, balancing- Analysis of process capabilities in a multi product system.

UNIT IV   PRODUCTION SCHEDULING   9

Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems - Line of balance – Flow production scheduling- Batch production scheduling-Product sequencing – Production Control systems-Periodic batch control-Material requirement planning kanban – Dispatching-Progress reporting and expediting- Manufacturing lead time-Techniques for aligning completion times and due dates.

UNIT V   INVENTORY CONTROL AND RECENT TRENDS IN PPC   9

Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system - Ordering cycle system-Determination of Economic order quantity and economic lot size- ABC analysis - Recorder procedure-Introduction to computer integrated

production planning systems- elements of JUST IN TIME SYSTEMS-Fundamentals of MRP II and ERP.

TOTAL: 45 PERIODS

TEXT BOOKS:
1. James. B. Dilworth, "Operations management – Design, Planning and Control for manufacturing and services" Mcgraw Hill International edition 1992.
2. Martand Telsang, "Industrial Engineering and Production Management", First edition, S. Chand and Company, 2000.

REFERENCES:
1. Chary. S.N., "Theory and Problems in Production & Operations Management", Tata McGraw Hill, 1995.
2. Elwood S.Buffa, and Rakesh K.Sarin, "Modern Production / Operations Management", 8th Edition John Wiley and Sons, 2000.
3. Jain. K.C. & Aggarwal. L.N., "Production Planning Control and Industrial Management", Khanna Publishers, 1990.
4. Kanishka Bedi, "Production and Operations management", 2nd Edition, Oxford university press, 2007.
5. Melynk, Denzler, " Operations management – A value driven approach" Irwin Mcgraw hill.
6. Norman Gaither, G. Frazier, "Operations Management" 9th Edition, Thomson learning IE, 2007
7. Samson Eilon, "Elements of Production Planning and Control", Universal Book Corpn.1984
8. Upendra Kachru, " Production and Operations Management – Text and cases" 1st Edition, Excel books 2007

19154C34P   ENGINEERING METROLOGY AND MEASUREMENTS

UNIT – I: INTRODUCTION   9

Measurement -Introduction – Generalised measurement system-Units and standards-measuring instruments- range of accuracy, precision- repeatability-systematic and random errors-correction, calibration, interchangeability.

UNIT – II: LINEAR AND ANGULAR MEASURING DEVICES   9

Definition of Metrology-Linear measuring instruments: Vernier, micrometer, interval measurement, Slip gauges and classification, limit gauges- Comparators: Mechanical, pneumatic and electrical types, applications.

Angular measurements: -Sine bar, optical bevel protractor, angle Decker – Taper measurements.

UNIT – III: SCREW THREAD & GEAR FORM MEASUREMENT   9

Measurement of screw threads-Thread gauges, floating carriage micrometer-measurement of gears-tooth thickness-constant chord and base tangent method-.

UNIT – IV: LASER METROLOGY   AND CMM   9

Precision instruments based on laser-Principles- laser interferometer-application in linear, angular measurements

Coordinate measuring machine (CMM)- Constructional features – types, applications –computer aided inspection.

UNIT – V: POWER, FLOW AND TEMPERATURE MEASUREMENT 9

Force, torque, power:-mechanical and pneumatic type-Flow measurement: Venturi, orifice, rotameter,–Temperature: bimetallic strip, pressure thermometers, thermocouples,

TEXT BOOKS:
1. Jain R.K., "Engineering Metrology", Khanna Publishers, 1994
2. Alan S. Morris, "The Essence of Measurement", Prentice Hall of India, 1997

REFERENCES:
1. Gupta S.C, "Engineering Metrology", Dhanpat rai Publications, 1984
2. Jayal A.K, "Instrumentation and Mechanical Measurements", Galgotia Publications 2000
3. Alan S. Morris, "The Essence of Measurement", Prentice Hall of India, 1997

4. Donald D Eckman, "Industrial Instrumentation", Wiley Eastern, 1985.

19154L35P 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

19154C41P 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

19154C42P 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

19154C43P   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.

19154L45P DYNAMICS LABORATORY

LIST OF EXPERIMENTS

1. Governors - Determination of sensitivity, effort, etc. for Watt, Porter

2. Cam - Study of jump phenomenon and drawing profile of the cam.
3. Motorised Gyroscope-Verification of laws -Determination of gyroscopic couple.
4. Whirling of shaft-Determination of critical speed of shaft with concentrated loads.
5. Balancing of rotating masses.
6. Determination of moment of inertia by oscillation method for connecting rod and flywheel.
7. Vibrating system - Spring mass system-Determination of damping co-efficient of single degree of freedom system.
8. Determination of torsional frequencies for compound pendulum and flywheel system with lumped Moment of inertia.

9. Transverse vibration –free- Beam. Determination of natural frequency and deflection of beam.

Total Hours: 45

19154C51P 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.

19154C52P 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.

19154C53P 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.

19154L55P THERMAL ENGINEERING LABORATORY II

LIST OF EXPERIMENTS

HEAT TRANSFER   **30**
1. Thermal conductivity measurement by guarded plate method
2. Thermal conductivity of pipe insulation using lagged pipe apparatus
3. Natural convection heat transfer from a vertical cylinder
4. Forced convection Inside tube
5. Heat transfer from Pin-fin (natural & forced convection modes)
6. Determination of Stefan-Boltzmann constant
7. Determination of Emissivity of a grey surface
8. Effectiveness of Parallel/counter flow heat exchanger

REFRIGERATION AND AIR CONDITIONING   **15**
1. Determination of COP of a refrigeration system
2. Experiments on air-conditioning system
3. Performance test on single/two stage reciprocating air compressor.

                                                           Total Hours : 45

19154C61P 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.

19154C62P 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).

19154C63P   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.

19154L65P MECHATRONICS LABORATORY

LIST OF EXPERIMENTS

1. Fluid power circuits to control
   (i) single and double acting cylinder
2. Design of circuits with logic sequence using Electro pneumatic trainer kits.
3. Circuits with multiple cylinder sequences in Electro pneumatic using PLC.
4. Servo controller interfacing for open loop
5. Servo controller interfacing for closed loop
6. Stepper motor interfacing with 8051 Micro controller
   (i) full step resolution (ii) half step resolution
7. Computerized data logging system with control for process variables like pressure flow and temperature.

TOTAL : 45

19160C71P 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

19154C72P 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.

19154C73P 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
19154E44AP 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

19154E44BP REFRIGERATION AND AIR CONDITIONING

UNIT – I: REFRIGERATION CYCLES   9

Review of thermodynamic principles of refrigeration. Vapour compression refrigeration cycle - use of P-H charts - multistage systems - cascade system - COP comparison. Vapor absorption refrigeration system. Ammonia water and Lithium Bromide water systems.

UNIT – II: REFRIGERANTS AND SYSTEM COMPONENTS   9

Compressors - reciprocating & rotary (Fundamentals only) - condensers - evaporators - cooling towers. Refrigerants - properties - selection of refrigerants, Alternate Refrigerants, Refrigeration plant controls - testing and charging of refrigeration units. Applications to refrigeration systems - ice plant - food storage plants.

UNIT – III: PSYCHROMETRY   9

Psychrometric processes- use of psychrometric charts - - Grand and Room Sensible Heat Factors - bypass factor - requirements of comfort air conditioning - comfort charts - factors governing optimum effective temperature,

UNIT – IV: COOLING LOAD CALCULATIONS   9

Types of load - design of space cooling load - heat transmission through building. Solar radiation - infiltration - internal heat sources (sensible and latent) - outside air and fresh air load - estimation of total load - Domestic, commercial and industrial systems - central air conditioning systems.

UNIT – V: AIRCONDITIONING SYSTEM   9

Air conditioning equipments – air cleaning and air filters - humidifiers - dehumidifiers - air washers - condenser – cooling tower and spray ponds - elementary treatment of duct design - air distribution system. Thermal insulation of air conditioning systems. - applications: car, industry, stores, and public buildings

Total Hours : 45

TEXT BOOKS:

1.   Manohar Prasad, "Refrigeration and Air Conditioning", Wiley Eastern Ltd., 1983.
2.   Arora. C.P., "Refrigeration and Air Conditioning", Tata McGraw-Hill New Delhi, 1988.

REFERENCES:

1.   Jordon and Prister, "Refrigeration and Air Conditioning", Prentice Hall of India PVT Ltd., New Delhi, 1985.
 2.   Stoecker N.F and Jones,"Refrigeration and Air Conditioning"TMH, New Delhi,

19154E44CP NON DESTRUCTIVE TESTING

UNIT I: OVERVIEW OF NDT **9**

NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterisation. Relative merits and limitations, Various physical characteristics of materials and their applications in NDT., Visual inspection – Unaided and aided.

UNIT II: SURFACE NDE METHODS **9**

Liquid Penetrant Testing - Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods, Testing Procedure, Interpretation of results. Magnetic Particle Testing- Theory of magnetism, inspection materials Magnetisation methods, Interpretation and evaluation of test indications, Principles and methods of demagnetization, Residual magnetism.

UNIT III:THERMOGRAPHY AND EDDY CURRENT TESTING (ET) **9**

Thermography- Principles, Contact and non contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation - infrared radiation and infrared detectors, Instrumentations and methods, applications. Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation.

UNIT IV: ULTRASONIC TESTING (UT) AND ACOUSTIC EMISSION (AE) **9**

Ultrasonic Testing-Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A/Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight Diffraction. Acoustic Emission Technique – Principle, AE parameters, Applications.

UNIT V: RADIOGRAPHY (RT) **9**

Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square, law, characteristics of films - graininess, density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero-Radiography, Computed Radiography, Computed Tomography

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Baldev Raj, T.Jayakumar, M.Thavasimuthu "Practical Non-Destructive Testing", Narosa Publishing House, 2014.
2. Ravi Prakash, "Non-Destructive Testing Techniques", 1st revised edition, New Age International Publishers, 2010

REFERENCES:

1. ASM Metals Handbook, "Non-Destructive Evaluation and Quality Control", American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17.
2. ASNT, American Society for Non Destructive Testing, Columbus, Ohio, NDT Handbook,Vol. 1, Leak Testing, Vol. 2, Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4, Radiographic Testing, Vol. 5, Electromagnetic Testing, Vol. 6, Acoustic Emission Testing, Vol. 7, Ultrasonic Testing
3. Charles, J. Hellier," Handbook of Nondestructive evaluation", McGraw Hill, New York 2001.
    1. 4. Paul E Mix, "Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition New Jersey, 2005

19154E44DP 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.

19158E54AP ENVIRONMENTAL SCIENCE AND ENGINEERING

UNIT I INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES   10
Definition, scope and importance – need for public awareness – forest resources: use and over-exploitation, deforestation,. Timber extraction, mining, dams-benefits and problems – mineral resources: use and effects on forests and tribal people – water resources: use and over-utilization of surface and exploitation, environmental effects of extracting and using mineral resources, case studies – food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – energy resources: growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies – land resources: land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources.

UNIT II   ECOSYSTEMS AND BIODIVERSITY   14
Concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem.   Introduction to biodiversity – definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity –endangered and endemic species of India – conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

UNIT III   ENVIRONMENTAL POLLUTION   8
Definition – causes, effects and control measures of: (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards — role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

UNIT IV   SOCIAL ISSUES AND THE ENVIRONMENT   7
From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management
environmental ethics: issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents. environment production act – air (prevention and control of pollution) act – water (prevention and control of pollution) act – wildlife protection act – forest conservation act – issues involved in enforcement of environmental legislation – public awareness

UNIT V   HUMAN POPULATION AND THE ENVIRONMENT   6
Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – hiv / aids – women and child welfare – role of information technology in environment and human health – case studies.

TOTAL : 45

TEXT BOOKS
1.   Gilbert M .Masters, "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
2.   Miller T.G. Jr., "Environmental Science", Wadsworth Publishing Co.

REFERENCES
1.   Bharucha Erach, "The Biodiversity of India", Mapin Publishing Pvt. Ltd., Ahmedabad India.
2.   Trivedi R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media.
3.   Cunningham, W.P.Cooper, T.H.Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
4.   Wager K.D. "Environmental Management", W.B. Saunders Co., Philadelphia, USA, 1998.
5.   Townsend C., Harper J and Michael Begon, "Essentials of Ecology, Blackwell Science.
6.   Trivedi R.K. and P.K. Goel, Introduction to Air Pollution, Techno-Science Publications.

19154E54BP 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.

19154E54CP   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

19154E54DP DESIGN OF JIGS, FIXTURES AND PRESS TOOLS

UNIT-I: TYPES AND FUNCTIONS OF JIGS AND FIXTURES   8

Tool design objectives - Production devices - Inspection devices - Materials used in Jigs and Fixtures – Types of Jigs - Types of Fixtures-Mechanical actuation-pneumatic and hydraulic actuation-Analysis of clamping force.

UNIT-II: JIGS   9

Drill bushes –different types of jigs-plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs-. Air operated Jigs components. Design and development of Jigs for given components.

UNIT-III: FIXTURES   9

General principles of boring, lathe, milling and broaching fixtures- Grinding, planning and shaping fixtures, assembly, Inspection and welding fixtures- Modular fixtures. Design and development of fixtures for given component.

UNIT-IV: PRESS WORKING   10

Press working terminology-Presses and press accessories-Computation of capacities and tonnage requirements. Elements of progressive combination and compound dies:. Bolster plate-punch plate-punch holder-guide pins and bushes.

UNIT-V: DESIGN AND DEVELOPMENT OF DIES   9

Design and development of progressive and compound dies for Blanking and piercing operations. Bending dies – development of bending dies-forming and drawing dies-Development of drawing dies.

Total Hours : 45

(Use of approved design data book is permitted)

TEXT BOOKS:
1. Edward G Hoffman, "Jigs & Fixture Design", Thomson – Delmar Learning, Singapore 2004
2. Donaldson. C, "Tool Design", Tata McGraw-Hill, 1986

REFERENCES:
1. Kempster, "Jigs & Fixtures Design", The English Language Book Society", 1978
2. Joshi, P.H., "Jigs & Fixtures", Second Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi 2004
3. "Fundamentals of Tool Design", CEEE Edition, ASTME, 1983
4. Design Data Handbook PSG College of Technology, Coimbatore

19154E64AP 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*).*

19154E64BP 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.

19154E64CP   INTELLECTUAL PROPERTY RIGHTS

UNIT I: INTRODUCTION 9

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II: REGISTRATION OF IPRs 10

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III: AGREEMENTS AND LEGISLATIONS 10

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV: DIGITAL PRODUCTS AND LAW 9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V: ENFORCEMENT OF IPRs 7

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

                                                        TOTAL :45 PERIODS

 TEXT BOOKS:

1. S.V. Satarkar, Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002.
2. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012

REFERENCES:

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.

2. Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy",
McGraw Hill Education, 2011.
  1. 3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual
     Property, Edward Elgar Publishing Ltd., 2013.

19148E64DP MATHEMATICS FOR INDUSTRIAL OPERATIONS

Unit I   Introduction to Linear Programming (LP)

Introduction to applications of operations research in functional areas of management. Linear Programming – formulation, solution by graphical and simplex methods (Primal – Penalty, Two Phase), Special cases, Sensitivity Analysis.

Unit II   Transportation and Assignment models

Transportation Models (Minimizing and Maximizing Cases) – Balanced and unbalanced cases – Initial Basic feasible solution by N-W Corner Rule, Least cost and Vogal's approximation methods. Check for optimality. Solution by MODI / Stepping Stone method. Cases of degeneracy. Transportation Models. Assignment Models (Minimizing and Maximizing Cases) – Balanced and Unbalanced Cases. Solution by Hungarian and Branch and Bound Algorithms. Travelling Salesman problem. Crew Assignment Models.

Unit III   Integer Linear Programming and Game Theory

Solution to pure and mixed integer programming problem by Branch and Bound and cutting plane algorithms. Game Theory – Two person zero sum games – Saddle point, Dominance Rule, Convex Linear Combination (Averages), methods of matrices, graphical and L.P. Solutions.

Unit IV   Dynamic Programming, Simulation and Decision Theory

Dynamic Programming (DP) – Deterministic Cases – Maximizing and Minimizing problems. DP techniques for L.P. problems, decision making under risk – decision trees – decision making under uncertainty. Application of simulation techniques for decision making.

Unit V   Queuing Theory and Replacement Models

Basic elements of the Queuing Model, of the Poisson and Exponential Distributions, Queuing with combined arrivals and departures, Queues with priorities for service, P.E.R.T. & C.P.M. and replacement model: drawing networks – identifying critical path – probability of completing the project within given time – project crashing – optimum cost and optimum duration.

Total no. of hrs: 60 hrs.

TEXT BOOK

1. K. Kannan, Operation Research, Anuradha publication
2. Hamdy, A. Taha, Operation Research: An Introduction, Prentice-Hall of India; New Delhi 2007.
3. Premkumar Gupta, Hira, Operations Research, S. Chand, 2008

REFERENCES BOOKS

1. J. K Sharma, Operations Research: Theory and Applications, Macmillan India, 2007.
2. Barry Render, Ralph M. Stair. Jr. Michael E. Hanna, Quantitative Analysis for Management, 9/e PHI Pvt. Ltd New Delhi 2007.
3. N.D. Vohra, Quantitative Techniques in Management, TMH, New Delhi, 2007
4. Winston, Operations Research, Cengage, 2008.

19160E74AP QUALITY CONTROL AND RELIABILITY ENGINEERING

UNIT - I :   INTRODUCTION   10

Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality cost-Variation in process- factors – process capability – process capability studies and simple problems –

UNIT - II : CONTROL CHARTS FOR VARIABLES AND ATTRIBUTES   8 Theory

of Control chart-variables-X- chart, R –chart, control chart for attributes –control chart for

proportion or fraction defectives – p chart and np chart

UNIT-III :   ACCEPTANCE SAMPLING   9

Lot by lot sampling – types – probability of acceptance in single, double, – O.C. curves – producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts- - uses of standard sampling plans.

UNIT –IV: LIFE TESTING - RELIABILITY   9

Life testing – Objective – failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability – simple problems**.**

UNIT-V :   QUALITY AND RELIABLITY   9

Reliability improvements – techniques- use of Pareto analysis – design for reliability – redundancy unit and standby redundancy – Optimization in reliability

Total Hours : 45

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

TEXT BOOKS:

1. R.C.Gupta, "Statistical Quality control", Khanna Publishers, 1997.
2. L.S.Srinath, "Reliability Engineering", Affiliated East west press, 1991.

REFERENCES:

1. Monohar Mahajan, "Statistical Quality Control", Dhanpat Rai & Sons, 2001

2. Besterfield D.H., "Quality Control", Prentice Hall, 1993.
3. Sharma S.C., "Inspection Quality Control and Reliability", Khanna Publishers, 1998.

19154E74BP VIBRATION AND NOISE CONTROL

1. **BASICS OF VIBRATION**   9

Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and non linear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems.

2. **BASICS OF NOISE**   9

Introduction, amplitude, frequency, wavelength and sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, measurement environment, equipment, frequency analysis,

3. **AUTOMOTIVE NOISE SOURCES**   9

Noise Characteristics of engines, engine overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, brake noise.

4. **CONTROL TECHNIQUES**   9

Vibration isolation, tuned absorbers, un tuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

5. **SOURCE OF NOISE AND CONTROL**   9

Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption.

TOTAL : 45

TEXT BOOKS

1. Singiresu S.Rao - "Mechanical Vibrations" - Pearson Education, ISBM –81-297-0179-0 - 2004.
2. Kewal Pujara "Vibrations and Noise for Engineers, Dhanpat Rai & Sons, 1992.

REFERENCES

1. Bernard Challen and Rodica Baranescu - "Diesel Engine Reference Book" - Second edition - SAE International - ISBN 0-7680-0403-9 – 1999.
2. Julian Happian-Smith - "An Introduction to Modern Vehicle Design"- Butterworth-Heinemann, ISBN 0750-5044-3 - 2004
3. John Fenton - "Handbook of Automotive body Construction and Design Analysis - Professional Engineering Publishing, ISBN 1-86058-073- 1998.

19160E74CP 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

19154E74DP 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.