St. PETER'S UNIVERSITY

Chennai – 600 054.

B.E. PRODUCTION ENGINEERING

3 & 4 SEMESTERS CURRICULUM AND SYLLABI

Regulations – 2008

SEMESTER III

(Applicable to the students admitted from the Academic year 2008–2009 onwards)

Code No.	Course Title	Credit	L	T	P	Marks		
Theory						**CA**	**EA**	**Total**
308PET01	Transforms And Partial Differential Equation	3	3	1	0	25	75	100
308PET02	Basic Machining Process	2	3	0	0	25	75	100
308PET03	Basic of Thermodynamics and Thermal Engineering	3	3	1	0	25	75	100
308PET04	Engineering Metallurgy	2	3	0	0	25	75	100
308PET05	Fluid Mechanics and Machinery	3	3	1	0	25	75	100
308PET06	Electrical Drives and Control	2	3	0	0	25	75	100
Practical								
308PEP01	Basic Machining Process Lab	1	0	0	3	25	75	100
308PEP02	Fluid Mechanics and Machinery Lab	1	0	0	3	25	75	100
308PEP03	Electrical Engineering Lab	1	0	0	3	25	75	100
	Total	**18**	**18**	**3**	**9**	**225**	**675**	**900**

SEMESTER IV

(Applicable to the students admitted from the Academic year 2008 – 2009 onwards)

Code No.	Course Title	Credit	L	T	P	Marks		
Theory						**CA**	**EA**	**Total**
408PET01	Statistics and Numerical Methods	3	3	1	0	25	75	100
408PET02	Strength of Materials	3	3	1	0	25	75	100
408PET03	Advanced Machining Process	2	3	0	0	25	75	100
408PET04	Theory of Machines	2	3	0	0	25	75	100
408PET05	Fluid Power Drives and Control	3	3	1	0	25	75	100
408PET06	Electronics and Micro-Processors	2	3	0	0	25	75	100
Practical								
408PEP01	Metallurgy Lab	1	0	0	3	25	75	100
408PEP02	Strength of Materials Lab	1	0	0	3	25	75	100
408PEP03	Computer Aided Machine Drawings Lab	1	0	0	4	25	75	100
	Total	**18**	**18**	**3**	**10**	**225**	**675**	**900**

SEMESTER III

308PET01 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATION 3 1 0 4
(Common to all branches)

OBJECTIVES

The course objective is to develop the skills of the students in the areas of Transforms and Partial Differtial Equations. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

UNIT I 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 II FOURIER TRANSFORMS 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 III PARTIAL DIFFERENTIAL EQUATIONS 9 +3

Formation of partial differential equations – Lagrange's linear equation – Solutions of standard types of first order partial differential equations - Linear partial differential equations of second and higher order with constant coefficients.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9 + 3

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in cartesian coordinates.

UNIT V Z -TRANSFORMS AND DIFFERENCE EQUATIONS 9 + 3

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

Lectures : 45 Tutorials : 15 Total : 60 Periods

TEXT BOOKS

1. Grewal, B.S, 'Higher Engineering Mathematics' 40th Edition, Khanna publishers, Delhi, (2007)

REFERENCES

1. Bali.N.P and Manish Goyal 'A Textbook of Engineering Mathematics', Seventh Edition, Laxmi Publications(P) Ltd. (2007)
2. Ramana.B.V. 'Higher Engineering Mathematics' Tata Mc-GrawHill Publishing Company limited, New Delhi (2007).
3. Glyn James, 'Advanced Modern Engineering Mathematics', Third edition-Pearson Education (2007).
4. Erwin Kreyszig 'Advanced Engineering Mathematics', Eighth edition-Wiley India (2007).

308PET02 BASIC MACHINING PROCESSES 3 0 0 3

OBJECTIVE:

(i) To impart the knowledge on basic concepts of various machining processes and machine tools

UNIT I LATHE 9

Introduction to production processes – types of production (job, batch and mass) – production processes – Casting, Forming, Machining and Welding, Machine and Machine Tool – Lathe – Engine Lathe – block diagram – sketch – functions of each part – work holding devices in lathe – functions – Chuck, Centre, Dogs, Steady Rest and Follower Rest, mechanism of lathe – Apron, Feed, Tumbler Gear, various operations performed in Lathe – facing, turning, chamfering and knurling – relative positions of tool and job – Taper turning operations (three methods_ thread cutting – thread – RH and LH, single start and multi start with application – Method of thread cutting – selection and arrangement of tool and work. Problems in metric and inch thread conversion – Specifications of Lathe – Burnishing.

UNIT II SHAPER, PLANER & SLOTTER 9

Purpose of shaping – block diagram – functions of each part. Purpose of planer – block diagram – functions of each part. Purpose of slotting machine – block diagram – functions and working principle. Operations carried out – horizontal plane, vertical plane, v type with relative position – Comparison of planer with shaper – work holding devices in shaper and planer – Quick return mechanism in shaper – mechanical and hydraulic – cross feed mechanism –Types of planer with application – mechanism in planer – Comparison of shaping with slotting – tool holding devices in shaper, planer and slotter – specifications of shaper, planer and slotter simple problems to calculate the velocity – speed, feed and depth of cut.

UNIT III DRILLING 9

Purpose of drilling – block diagrm and function – types of drilling machines – portable drilling – bench type – sensitive drilling – radial arm drilling – functions of parts – purpose and operation – gang milling, multiple drill head, upright drilling, relative operations – reaming, boring, tapping, counter boring, courses sinking, trepanning and spot facing (with simple sketch, purpose and application). Work holding devices – specification torque calculation – speed, feed and depth of cut.

UNIT IV MILLING 9

Milling machine purpose – up and down milling – classification of milling machines – slot, keyway machining – methods of milling – single piece, string, rotary, index, gang, progressive, copy. Horizontal milling machine – block diagram – functions of each part-applications – Vertical milling machine – block diagram – functions of each part applications – Gear cutting using milling machine – procedure with neat sketch – milling cutters – peripheral, face, end T slot, form etc. – attachments and special accessories for milling – rotary, slotting attachment – indexing mechanism – methods of indexing – direct, plain, compound and differential indexing – problems – specifications – cutting conditions and parameters.

UNIT V GRINDING 9

Purpose – classification – surface finish – applications – grinding wheel – types – specifications – selection – surface grinding machine – block diagram – functions of each part – cylindrical grinding – Centreless grinding – Comparison – infeed, end feed and through feed. Balancing, dressing, loading and Truing of wheel – special grinding machines – specification of machine – cutting condition.

For all machines, demonstration to be done in a Workshop or using CD to explain the actual operation.

TOTAL: 45 PERIODS

TEXT BOOK

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

REFERENCES

1. R.K. Jain, "Production Technology", Khanna Publishers, New Delhi, 2001.
2. Hajra Choudhary etal, "Elements of Production Technology –Vol.II", Asia Publishing House, 2000.
3. B.Kumar, "Manufacturing Technology", Khanna Publishers, New Delhi 2000.
4. P.Radhakrishnan, "Manufacturing Technology, Vol.I", Scitech Publications, 2002.

308PET03 - BASICS OF THERMODYNAMICS AND THERMAL ENGINEERING 3 1 0 4

OBJECTIVE

To introduce fundamental concepts in thermodynamics, heat tramsfer, propulsion and refrigeration and air conditioning.

UNIT I BASIC THERMODYNAMICS 16

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

UNIT II AIR CYCLE AND COMPRESSORS 12

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

UNIT III STEAM AND JET PROPULSION 12

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

UNIT IV REFRIGERATION AND AIR-CONDITIONING 10

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

UNIT V HEAT TRANSFER 10

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

L = 45, T = 15, Total = 60 Periods

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

TEXT BOOKS

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

REFERENCES

1. Ramalingam K.K. “Thermodynamics”, Sci-Tech Publications, 2006
2. Holman.J.P., “Thermodynamics”, 3rd Ed. McGraw-Hill, 2007.
3. Venwylen and Sontag, “Classical Thermodynamics”, Wiley Eastern, 1987
4. Arora C.P, “ Thermodynamics”, Tata McGraw-Hill, New Delhi, 2003.
5. Merala C, Pother, Craig W, Somerton, “ Thermodynamics for Engineers”, Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.

308PET04 ENGINEERING METALLURGY 3 0 0 3

OBJECTIVE: (i) To introduce the various concepts of metallurgy, metallurgical structures and mechanical properties, testing of metals
(ii) To impart the knowledge on metallurgy with respect to foundry and welding processes

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 10

Crystal structure – BCC, FCC and HCP structure – unit cell – crystallographic planes and directions, miller indices – crystal imperfection, point, line, planner and volume defects – Grain size, ASTM grain size number. Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions, Iron – Iron carbide and Iron – Charbide & Iron Graphite equilibrium diagram. Classification of steel and cast iron - microstructures of Steels & Cast irons - properties and application.

UNIT II HEAT TREATMENT 10

Defintion – Full annealing, stress relief, recrystallisation and spheroidizing – normalizing, hardening and tempering of steel, Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram CCR – Hardenability, Jominy end quench test – Austempering martempering – case hardening, carburizing, nitriding cyaniding, carbonitriding – Flame, Induction Laser and Electron beam and plasma phase hardening – Special and Duplex surface hardening processes.

UNIT III 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 – Gray, white, malleable spheroidal, graphite, alloy cast irons Copper and Copper alloys, Brass, Bronze and Cupronickel – Aluminium and AI-Cu – precipitation strengthening treatment – Bearing alloys, Alloys of Ti, Zn Mg and Ni – Intermetallics, Ni, Ti Aluminides – Shape memory alloys.

UNIT IV MECHANICAL PROPERTIES AND TESTING 8

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) micro and nano hardness test impact test, Izod and charpy, fatigue and creep mechanisms – types of wear – preventions.

UNIT V WELDING AND FOUNDRY METALLURGY 8

Weld thermal cycle – Microstructure of HAZ in Steel and Aluminium alloys – weldability of steel, cast iron and non-ferrous alloys – Pre and Post weld heat treatment – Residual stress and distortion – casting solidification – Formation of dendrite, columnar and equiaxed grains – castability of steel, cast iron, Stainless Steel Al and Cu alloys.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Donald R.Askeland – The Science and Engineering of materials – 4th Edition – Thomson Engineering – 2002
2. Keneth G.Budinski and Michael K.Budinski “Engineering Materials” Prentice Hall of India Private Limited, 7th Edition Indian Reprint 2004”.

REFERENCES

1. Sydney H.Avner “Introduction to Physical Metallurgy” McGraw Hill Book Co., 2001
2. Raghavan V. Materials Science & Engg” Prentice Hall of India Pvt.Ltd., 2004
3. William D Callister “Material Science & Engg – John Wiley & Sons, 2002
4. L.H.Van Vlack, “Materials Engg. Concepts and Applications, 2001.

308PET05 FLUID MECHANICS AND MACHINERY 3 1 0 4

(Common to Aeronautical, Mechanical, Automobile & Production)

OBJECTIVES

a. The student is introduced to the mechanics of fluids through a thorough understanding of the properties of the fluids. The dynamics of fluids is introduced through the control volume approach which gives an integrated under standing of the transport of mass, momentum and energy.

b. The applications of the conservation laws to flow though pipes and hydraulics machines are studied

UNIT I INTRODUCTION 12

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

UNIT II FLOW THROUG CIRCULAR CONDUITS 12

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

UNIT III DIMENSIONAL ANALYSIS 9

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

UNIT IV ROTO DYNAMIC MACHINES 16

Homologus units. Specific speed. Elementary cascade theory. Theory of turbo machines. Euler's equation. Hydraulic efficiency. Velocity components at the entry and exit of the rotor. Velocity triangle for single stage radial flow and axial flow machines. Centrifugal pumps, turbines, performance curves for pumps and turbines.

UNIT V POSITIVE DISPLACEMENT MACHINES 11

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

TOTAL 60 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

308PET06 ELECTRICAL DRIVES AND CONTROLS 3 0 0 3

(Common to Mechanical, Production &Technology Faculty)

OBJECTIVES

- To understand the basic concepts of different types of electrical machines and their performance.
- To study the different methods of starting D.C motors and induction motors.
- To study the conventional and solid-state drives

UNIT I INTRODUCTION 8(L)

Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors

UNIT II DRIVE MOTOR CHARACTERISTICS 9(L)

Mechanical characteristics – Speed-Torque characteristics of various types of load and drive motors – Braking of Electrical motors – DC motors: Shunt, series and compound - single phase and three phase induction motors.

UNIT III STARTING METHODS 8(L)

Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors.

UNIT IV CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C. DRIVES 10(L)

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 10(L)

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

Total Number of Periods: L= 45 T= 0 45 PERIODS

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

REFERENCE BOOKS

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
3. H.Partab, “Art and Science and Utilisation of electrical energy”, Dhanpat Rai and Sons, 1994

308PEP01 BASIC MACHINING PROCESS LAB 0 0 3 2

LIST OF EXPERIMENTS:

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

TOTAL : 45 PERIODS

308PEP02 **FLUID MECHANICS AND MACHINERY LAB** **0 0 3 2**

(Common to Mechanical & Production)

LIST OF EXPERIMENTS

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

LIST OF EQUIPMENT

(for a batch of 30 students)

1. Orifice meter setup
2. Venturi meter setup
3. Rotameter setup
4. Pipe Flow analysis setup
5. Centrifugal pump/submergible pump setup
6. Reciprocating pump setup
7. Gear pump setup
8. Pelton wheel setup
9. Francis turbine setup
10. Kaplan turbine setup

Quantity: one each.

Total Number of Periods: P=45

308PEP03 **ELECTRICAL ENGINEERING LABORATORY** **0 0 3 2**

(Common to Mechanical & Production)

LIST OF EXPERIMENTS

1. Load test on DC Shunt & DC Series motor
2. O.C.C & Load characteristics of DC Shunt and DC Series generator
3. Speed control of DC shunt motor (Armature, Field control)
4. Load test on single phase transformer
5. O.C & S.C Test on a single phase transformer
6. Regulation of an alternator by EMF & MMF methods.
7. V curves and inverted V curves of synchronous Motor
8. Load test on three phase squirrel cage Induction motor
9. Speed control of three phase slip ring Induction Motor
10. Load test on single phase Induction Motor.
11. Study of DC & AC Starters

TOTAL : 45 PERIODS

LIST OF EQUIPMENT

(for batch of 30 students)

Equipment	**-**	**No.**
1. DC Shunt motor	-	2
2. DC Series motor	-	1
3. DC shunt motor-DC Shunt Generator set	-	1
4. DC Shunt motor-DC Series Generator set	-	1
5. Single phase transformer	-	2
6. Three phase alternator	-	2
7. Three phase synchronous motor	-	1
8. Three phase Squirrel cage Induction motor	-	1
9. Three phase Slip ring Induction motor	-	1
10. Single phase Induction motor	-	1

Total Number of Periods: P=45

SEMESTER IV

408PET01 STATISTICS AND NUMERICAL METHODS 3 1 0 4

(Common to Mechanical, Automobile & Production)

UNIT I TESTING OF HYPOTHESIS 9 + 3

Sampling distributions - Tests for single mean, Proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – chi-square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS 9 + 3

Completely randomized design – Randomized block design – Latin square design - 2^2 - factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9 +3

Newton-Raphson method- Gauss Elimination method – Pivoting - Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Matrix Inversion by Gauss-Jordan method - Eigenvalues of a matrix by Power method .

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9 + 3

Lagrange's and Newton's divided difference interpolation –Newton's forward and backward difference interpolation - Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal and Simpson's 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9+3

Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations - Milne's predictor-corrector methods for solving first order equations - Finite difference methods for solving second order equation.

L = 45 T = 15 Total = 60

TEXT BOOKS

1. R.A. Johnson and C.B. Gupta, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th edition, 2007 (For units 3, 4 and 5).
2. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, 2004.

BOOKS FOR REFERENCES:

1. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia , 8th edition, 2007.
2. M.R. Spiegel, J. Schiller and R.A. Srinivasan, "Schaum's Outlines Probability and Statistics", Tata McGraw Hill edition, 2004.
3. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, New Delhi, 2007.
4. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, New Delhi, 2006.

408PET02 STRENGTH OF MATERIALS 3 1 0 4

(Common to Mechanical, Automobile & Production)

OBJECTIVES

- To gain knowledge of simple stresses, strains and deformation in components due to external loads.
- To assess stresses and deformations through mathematical models of beams, twisting bars or combinations of both.
- Effect of component dimensions and shape on stresses and deformations are to be understood.
- The study would provide knowledge for use in the design courses

UNIT I STRESS STRAIN DEFORMATION OF SOLIDS 9

Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses; Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

UNITII BEAMS - LOADS AND STRESSES 9

Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever, Simply supported and Overhanging beams – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Effect of shape of beam section on stress induced – Shear stresses in beams – Shear flow

UNITIII TORSION 9

Analysis of torsion of circular bars – Shear stress distribution – Bars of Solid and hollow circular section – Stepped shaft – Twist and torsion stiffness – Compound shafts – Fixed and simply supported shafts – Application to close-coiled helical springs – Maximum shear stress in spring section including Wahl Factor – Deflection of helical coil springs under axial loads – Design of helical coil springs – stresses in helical coil springs under torsion loads

UNIT IV BEAMDEFLECTION 9

Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope: Double integration method, Macaulay Method, and Moment-area Method –Columns – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio – Rankine formula for columns

UNIT V ANALYSIS OF STRESSES IN TWO DIMENSIONS 9

Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr's circle for biaxial stresses – Maximum shear stress - Strain energy in bending and torsion.

TUTORIALS 15

TOTAL: 60

TEXT BOOKS

1. Popov E.P, “Engineering Mechanics of Solids”, Prentice-Hall of India, New Delhi, 1997

2. Beer F. P. and Johnston R,” Mechanics of Materials”, McGraw-Hill Book Co, Third Edition, 2002.

REFERENCES

1.Nash W.A, “Theory and problems in Strength of Materials”, Schaum Outline Series, McGraw-Hill Book Co, New York, 1995

2.Kazimi S.M.A, “Solid Mechanics”, Tata McGraw-Hill Publishing Co., New Delhi, 1981.
3.Ryder G.H, “Strength of Materials, Macmillan India Ltd”., Third Edition, 2002
4.Ray Hulse, Keith Sherwin & Jack Cain, “Solid Mechanics”, Palgrave ANE Books, 2004.
5.Singh D.K “Mechanics of Solids” Pearson Education 2002.
6.Timoshenko S.P, “Elements of Strength of Materials”, Tata McGraw-Hill, New Delhi, 1997.

408PET03 ADVANCED MACHINING PROCESS 3 0 0 3

OBJECTIVES: (i) To understand the theory of metal cutting
(ii) To understand the concepts of gear manufacture
(iii) To understand CNC machines constructional features, working and programming

UNIT I MECHANICS OF METAL CUTTING 10

Cutting tool angles – tool signature – orthogonal & oblique cutting – cutting forces, Merchant circle diagram – force & velocity relation.

UNIT I TOOL MATERIAL, TOOL WEAR AND TOOL LIFE 9

Requirement of tool materials – types of tool materials – Tool wear – Types, mechanism – Tool life - Machinability - types of chips – cutting fluids.

UNIT I GEAR MANUFACTURE 8

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

UNIT I CNC MACHINES 9

NC, CNC & DNC – types of CNC – constructional features – drives and control systems – feed back devices – Interchangeable tooling system – preset & qualified tools – ISO specification – Machining center – Turning center – CNC wire cut EDM.

UNIT I CNC PROGRAMMING 9

Manual part programming – steps involved – sample program in lathe & milling. - Computer aided part programming – APT program - CAM package – canned cycles –– Programming.

TOTAL : 45 PERIODS

TEXT BOOK

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

REFERENCES

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

408PET04 THEORY OF MACHINES 3 1 0 4

OBJECTIVES: To understand the basic concepts of mechanisms and machinery

UNIT I MECHANISMS 14

Definition – Machine and Structure – Kinematic link, pair and chain – classification of Kinematic pairs – Constraint & motion – Degrees of freedom - Slider crank – single and double – Crank rocker mechanisms – Inversions, applications – Introduction to Kinematic analysis and synthesis of simple mechanisms – Determination of velocity and acceleration of simple mechanisms.

UNIT II FRICTION 12

Types of friction – friction in screw and nut – screw jack – pivot, collar and thrust bearings – plate and cone clutch – belt (flat & vee) and rope drives – creep in belts – open and crossed belt drives – Ratio of tensions – Effect of centrifugal and initial tensions – condition for maximum power transmission.

UNIT III GEARING AND CAMS 12

Gear – Types and profile – nomenclature of spur & helical gears – laws of gearing – interference – requirement of minimum number of teeth in gears – gear trains – simple, compound and reverted gear trains – determination of speed and torque in epicyclic gear trains – cams different types of followers – Cam – Types of cams and followers – Cam design for different follower motions.

UNIT IV BALANCING 11

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

5 UNIT V VIBRATION 11

Free, forced and damped vibrations of single degree of freedom systems – force transmitted to supports – vibration Isolation – vibration absorption – torsional vibration of shafts – single and multirotor systems – geared shafts – critical speed of shafts.

TOTAL : 60 PERIODS

TEXT BOOK

1. Bansal Dr.R.K. " Theory of Machines" Laxmi Publications (P) Ltd., New Delhi 2001
2. Rattan S.S."Theory of machines" Tata McGraw Hill publishing Co., New Delhi, 2002.

REFERENCES

1. Rao J.S.and Dukkipati R.V. "Mechanism and Machine Theory" Second Edition, Wiley Eastern Limited, 1992.
2. Malhotra D.R. and Gupta H.C "The Theory of machines" Satya Prakasam, Tech. India Publications, 1989
3. Gosh A and Mallick A.K. "Theory of Machines and Mechanisms" affiliated east west press, 1989
4. Shigley J.E. and Uicker J.J. Theory of Machines and Mechanisms" McGraw Hill, 1986.

408PET05 FLUID POWER DRIVES AND CONTROL 3 1 0 4

OBJECTIVES: (i) To understand the working principle of hydraulic and pneumatic components and its selection
(ii)To design hydraulic and pneumatic circuits for different applications

UNIT I INTRODUCTION TO FLUID POWER & HYDRAULICS PRINCIPLE 12

Introduction to fluid power controls – Hydraulics and pneumatics – Selection criteria, Application of Fluid power, Application of Pascal's Law, equation, Transmission and multiplication of force – Pressure Losses – Fluids, selection & properties – ISO symbols.

UNIT II FLUID POWER DRIVES 12

Fluid Power drives – Pumps – working principle and construction details of Gear, vane and piston pumps, Hydraulic motors, Hydrostatic transmission drives and characteristics, Hydraulic supply components Pneumatic power supply – compressors, air distribution, air motors.

UNIT III FLUID POWER ELEMENTS 12

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

UNIT IV HYDRAULIC AND PNEUMATIC CIRCUITS DESIGN 12

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

UNIT V ELECTRO PNEUMATICS AND PLC CIRCUITS 12

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

TOTAL: 60 PERIODS

TEXT BOOK:

1. Anthony Esposito "Fluid power with applications", 5th editor, Pearson education 2003.
2. Majumdar, "Oil hydraulics: Principles and Maintenance", Tata McGraw Hill, 2004
3. Majumdar, "Pneumatic system: Principles and Maintenance", Tata McGraw Hill, 2004

REFERENCES:

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

408PET06 ELECTRONICS AND MICROPROCESSORS 3 0 0 3

(Common to Mechanical, Automobile & Production)

OBJECTIVE

To enable the students to understand the fundamental concepts of Semi Conductors, Transistors, Rectifiers, Digital Electronics and 8085 Microprocessors

UNIT I SEMICONDUCTORS AND RECTIFIERS 9(L)

Classification of solids based on energy band theory-Intrinsic semiconductors-Extrinsic semiconductors-P type and N type-PN junction-Zenor effect-Zenor diode characteristics-Half wave and full wave rectifiers -Voltage regulation

UNIT II TRANSISTORS AND AMPLIFIERS 12(L)

Bipolar junction transistor- CB, CE, CC configuration and characteristics-Biasing circuits-Class A, B and C amplifiers- Field effect transistor-Configuration and characteristic of FET amplifier-SCR, Diac, Triac, UJT-Characteristics and simple applications-Switching transistors-Concept of feedback-Negative feedback-Application in temperature and motor speed control.

UNIT III DIGITAL ELECTRONICS 9(L)

Binary number system - AND, OR, NOT, NAND, NOR circuits-Boolean algebra-Exclusive OR gate - Flip flops-Half and full adders-Registers-Counters-A/D and D/A conversion.

UNIT IV 8085 MICROPROCESSOR 9(L)

Block diagram of microcomputer-Architecture of 8085-Pin configuration-Instruction set-Addressing modes-Simple programs using arithmetic and logical operations.

UNIT V INTERFACING AND APPLICATIONS OF MICROPROCESSOR 6(L)

Basic interfacing concepts - Interfacing of Input and Output devices-Applications of microprocessor Temperature control, Stepper motor control, traffic light control.

Total Number of Periods: L= 45 T= 0 45

TEXT BOOKS

1. Milman and Halkias, “Integrated Electronics”, Tata McGraw-Hill publishers, 1995.
2. Ramesh Goankar, “Microprocessor Architecture”, Programming and Applications with 8085, Wiley Eastern, 1998.

REFERENCE BOOKS

1. Malvino and Leach, “Digital Principles and Applications”, Tata McGraw-Hill, 1996
2. Mehta V.K, “Principles of Electronics”, S. Chand and Company Ltd., 1994
3 Dougles V.Hall, “Microprocessor and Interfacing”, Programming and Hardware, Tata McGraw-Hill, 1999.
4 Salivahanan S, Suresh Kumar N, Vallavaraj A, “Electronic Devices and Circuits” First Edition, Tata McGraw-Hill, 1999.

408PEP01 METALLURGY LABORATORY 0 0 3 2

OBJECTIVE: (i) To train the students in observation and interpretation of Microstructure of Engineering materials.

(ii) To train students in Heat treatment, hardenability and surface treatment of Engineering Materials

(iii) To train the students in testing of Foundry sand

LIST OF EXPERIMENTS:

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

TOTAL : 45 PERIODS

408PEP02 **STRENGTH OF MATERIALS LAB** **0 0 3 2**

(Common to Auto, Mechanical & Production)

OBJECTIVE

To supplement the theoretical knowledge gained in Mechanics of Solids with practical testing for determining the strength of materials under externally applied loads. This would enable the student to have a clear understanding of the design for strength and stiffness

LIST OF EXPERIMENTS

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison

    (i) Unhardened specimen

    (ii) Quenched Specimen and

    (iii) Quenched and tempered specimen.
11. Microscopic Examination of

    Hardened samples and

    (ii) Hardened and tempered samples.

LIST OF EQUIPMENT

(for a batch of 30 students)

1.	Universal Tensile Testing machine with double shear attachment – 40 Ton Capacity	1
2.	Torsion Testing Machine (60 NM Capacity)	1
3.	Impact Testing Machine (300 J Capacity)	1
4.	Brinell Hardness Testing Machine	1
5.	Rockwell Hardness Testing Machine	1
6.	Spring Testing Machine for tensile and compressive loads (2500 N)	1
7.	Metallurgical Microscopes	3
8.	Muffle Furnace (800 °C)	1

Total Number of Periods: P=45

408PEP03 COMPUTER AIDED MACHINE DRAWING LAB 0 0 4 2

(Common to Automobile & Production)

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

TOTAL : 45

LIST OF EQUIPMENTS

(for a batch of 30 students)

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