

BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA

<u>3rd SEMESTER</u>				<u>4th SEMESTER</u>			
<i>THEORY</i>		<i>Contact Hours</i>		<i>THEORY</i>		<i>Contact Hours</i>	
<i>Code</i>	<i>Subject</i>	<i>L-T-P</i>	<i>Credits</i>	<i>Code</i>	<i>Subject</i>	<i>L-T-P</i>	<i>Credits</i>
BSCM1205	Mathematics – III	3-1-0	4	BSCM1210	Mathematics – IV	3-1-0	4
HSSM3204	Engineering Economics & Costing	3-0-0		HSSM3205	Organisational Behaviour	3-0-0	
	OR		3		OR		3
HSSM3205	Organisational Behaviour	3-0-0		HSSM3204	Engineering Economics & Costing	3-0-0	
PCAT4201	Fluid Mechanics & Machinery	3-1-0	4	PCME4204	Kinematics & Dynamics of Machines	3-1-0	4
PCME4203	Introduction to Physical Metallurgy & Engg Materials	3-1-0	4	PCAT4204	Automotive Engines	3-1-0	4
PCAT4202	Automotive Thermodynamics	3-1-0	4	PCME4206	Basic Manufacturing Processes	3-0-0	3
PCME4202	Mechanics of Solids	3-0-0	3	PCAT4205	Automotive Chasis	3-0-0	3
			Credits (Theory) 22				Credits (Theory) 21
	<i>PRACTICALS/SESSIONALS</i>				<i>PRACTICALS/SESSIONALS</i>		
PCME7202	Mechanical Engg. Lab (Applied Mechanics, FM & Hy. Machines)	0-0-3	2	PCAT7201	Basic Manufacturing Process	0-0-3	2
PCME7201	Machine Drawing Laboratory	*1-0-3	3	PCAT7202	Auto Servicing & Maintenance Lab	0-0-3	2
				PCAT7203	Material Testing & Fluid Power Laboratory	0-0-3	2
			Credits (Practicals / Sessionals) 5				Credits (Practicals/ Sessionals) 6
TOTAL SEMESTER CREDITS			27	TOTAL SEMESTER CREDITS			27
TOTAL CUMULATIVE CREDITS				TOTAL CUMULATIVE CREDITS			

* – There will be no University examination but internal examination at institute level for theory in Machine Drawing.

BSCM1205 **Mathematics - III**

Module-I (18 hours)

Partial differential equation of first order, Linear partial differential equation, Non-linear partial differential equation, Homogenous and non-homogeneous partial differential equation with constant co-efficient, Cauchy type, Monge's method, Second order partial differential equation The vibrating string, the wave equation and its solution, the heat equation and its solution, Two dimensional wave equation and its solution, Laplace equation in polar, cylindrical and spherical coordinates, potential.

Module-II (12 hours)

Complex Analysis:

Analytic function, Cauchy-Riemann equations, Laplace equation, Conformal mapping,

Complex integration: Line integral in the complex plane, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of analytic functions

Module –III (10 hours)

Power Series, Taylor's series, Laurent's series, Singularities and zeros, Residue integration method, evaluation of real integrals.

Text books:

1. E. Kreyszig, "Advanced Engineering Mathematics:", Eighth Edition, Wiley India
Reading Chapters: 11,12(except 12.10),13,14,15
2. B.V. Ramana, "Higher Engineering Mathematics", McGraw Hill Education, 2008
Reading chapter: 18

Reference books:

1. E.B. Saff, A.D.Snyder, "Fundamental of Complex Analysis", Third Edition, Pearson Education, New Delhi
2. P. V. O'Neil, "Advanced Engineering Mathematics", CENGAGE Learning, New Delhi

HSSM3204 **Engineering Economics & Costing**

Module-I: (12 hours)

Engineering Economics – Nature and scope, General concepts on micro & macro economics. The Theory of demand, Demand function, Law of demand and its exceptions, Elasticity of demand, Law of supply and elasticity of supply. Determination of equilibrium price under perfect competition (Simple numerical problems to be solved). Theory of production, Law of variable proportion, Law of returns to scale.

Module-II: (12 hours)

Time value of money – Simple and compound interest, Cash flow diagram, Principle of economic equivalence. Evaluation of engineering projects – Present worth method, Future worth method, Annual worth method, internal rate of return method, Cost-benefit analysis in public projects. Depreciation policy, Depreciation of capital assets, Causes of depreciation, Straight line method and declining balance method.

Module-III: (12 hours)

Cost concepts, Elements of costs, Preparation of cost sheet, Segregation of costs into fixed and variable costs. Break-even analysis-Linear approach. (Simple numerical problems to be solved)
Banking: Meaning and functions of commercial banks; functions of Reserve Bank of India. Overview of Indian Financial system.

Text Books:

1. Riggs, Bedworth and Randhwa, "Engineering Economics", McGraw Hill Education India.
2. M.D. Mithani, Principles of Economics.

Reference Books :

1. Sasmita Mishra, "Engineering Economics & Costing", PHI
2. Sullivan and Wicks, "Engineering Economy", Pearson
3. R.Paneer Seelvan, "Engineering Economics", PHI
4. Gupta, "Managerial Economics", TMH
5. Lal and Srivastav, "Cost Accounting", TMH

HSSM 3205 **Organizational Behaviour**

Module I :

The study of Organizational Behaviour : Defination and Meaning, Why Study OB Learning – Nature of Learning, How Learning occurs, Learning and OB. Foundations of Individual Behaviour : Personality – Meaning and Defination, Determinants of Personality, Personality Traits, Personality and OB. Perception – Meaning and Definition, Perceptual Process, Importance of Perception in OB. Motivation – Nature and Importance, Herzberg's Two Factor Theory, Maslow's Need Hierarchy Theory, Alderfer's ERG Theory, Evaluations.

Module II :

Organizational Behaviour Process : Communication – Importance, Types, Gateways and Barriers to Communication, Communication as a tool for improving Interpersonal Effectiveness, Groups in Organizations – Nature, Types, Why do people join groups, Group Cohesiveness and Group Decision-making Managerial Implications, Effective Team Building. Leadership-Leadership & Management, Theories of Leadership-Trait theory, Leader Behaviour theory, Contingency Theory, Leadership and Followership, How to be an effective Leader, Conflict-Nature of Conflict and Conflict Resolution. An Introduction to Transactional Analysis (TA).

Module-III :

Organization : Organizational Culture – Meaning and Definition, Culture and Organizational Effectiveness. Introduction to Human Resource Management-Selection, Orientation, Training and Development, Performance Appraisal, Incentives Organizational Change – Importance of Change, Planned Change and OB techniques. International Organisational Behaviour – Trends in International Business, Cultural Differences and Similarities, Individual and Interpersonal Behaviour in Global Perspective.

Text Books :

1. Keith Davis, Organisational Behaviour, McGraw-Hill.
2. K.Aswathappa, Organisational Behaviour, Himalaya Publishing House.

Reference Books :

1. Stephen P. Robbins, Organisational Behaviour, Prentice Hall of India
2. Pradip N. Khandelwal, Organizational Behaviour, McGraw-Hill, New Delhi.
3. Uma Sekaran, "Organizational Behaviour", TATA McGraw-Hill, New Delhi.
4. Steven L McShane, Mary Ann Von Glinow, Radha R Sharma" Organizational Behaviour" , TATA McGraw- Hill.
5. D.K. Bhattachayya, "Organizational Behaviour", Oxford University Press
6. K.B.L.Srivastava & A.K.Samantaray, "Organizational Behaviour" India Tech

Fluid Mechanics and Machinery (3-1-0)

Module I

Introduction: Classification of fluids. Properties of fluids: viscosity, Newton's laws of viscosity, surface tension, capillarity etc.

Fluid Statics: hydrostatic law, measurement of pressure with different manometers, Total pressure and Centre of pressure for Plane and curved surfaces, Buoyancy and stability of floating bodies, metacentric height .

Fluid Dynamics: Laws of kinematics of fluid flow. Lagrangian and Eulerian method. Convective and local acceleration, Stream line , Streak line and path line, concept of circulation and vorticity, Continuity equation in differential form, Stream function and potential functions with inter relations, concept of flow nets.

Module II

Energy equations: Bernoulli's equations and its applications in pitot static tube, venturimeter, and orifice meter, energy correction factor, Momentum equation, Applications of momentum equations in pipe bends, impact of jets on moving and stationary ,plane and curved vanes, moment of momentum equations, force exerted on a series of radial curved vanes

Dimensional Analysis: Buckingham's theorem, Non-dimensional numbers, similarities of flow. Model studies.

Laminar and Turbulent Flows: Reynolds experiments. Shear stress and velocity distribution for viscous flow through circular pipes and flat plates, Hagen Poiseuille's equation, concept of boundary layer theory and separation of fluid flow, causes of turbulence, Characteristics of turbulent flow.

Flow through pipes: major and minor energy losses in pipes, pipes in series and parallel, equivalent cavitation, water hammer

Module III

Flow around submerged bodies: basic concept of lift and drag, coefficient of lift and drag.

Fluid Machinery: Pumps: Principles of operations and work done of centrifugal pumps, efficiencies, specific speed ,net positive suction head, problems, Principles and working of gear, vane and reciprocating pumps.

Turbines: classification, Principles of operations and work done Pelton, Francis and Kaplan, efficiencies, specific speed,.

Text books:

- 1 R.K.Bansal, Fluid mechanics and Machinery, Laxmi Publications. 2005
- 2 S.K.Som, G. Biswas, Introduction To Fluid Mechanics And Fluid Machines, TataMcGraw Hill 2008

References:

- 3 Modi and Seth: Fluid Mechanics and Hydraulic Machines, Standard Publications, New delhi
- 4 Jagdish Lal: fluid Mechanics and Hydraulic Machines, Metropolitan Books Pvt. Ltd, New Delhi
- 5 Streeter and Wiley , Fluid Mechanics, McGraw Hill Pub. 1983
- 6 A.K.Jain, Fluid Mechanics, Khanna Pub.
- 7 Domkundwar and Domkundwar, Fluid mechanics and Hydraulic Machines, Dhanpat Rai Publication. 2006
8. R.K.Rajput , A text Book Of Hydraulic Machines, S. Chand and Co. 2002

PCME4203 Introduction to Physical Metallurgy and Engineering Materials

MODULE-I (16 Lectures)

Classification of Engineering Materials, Engineering properties of materials. Characteristic property of metals, bonding in solids, primary bonds like ionic, covalent and metallic bond, crystal systems, common crystal structure of metals, representations of planes and directions in crystals, atomic packing in crystals, calculation of packing density, voids in common crystal structures and imperfections crystals. Concept of plastic deformation of metals, critical resolve shear stress, dislocation theory, deformation by slip and twin, plastic deformation in polycrystalline metals, yield point phenomenon and related effects, concept of cold working preferred orientation. Annealing ; recovery; recrystallization and grain growth; hot working.

MODULE-II (16 Lectures)

Concept of alloy formation, types of alloys, solid solutions, factors governing solids solubility viz. size factor, valency factor, crystal structure factor and chemical affinity factor; order-disorder transformation. Binary phase diagrams a) Isomorphism system, (b) Eutectic system, (c) Peritectic system, (d)Eutectoid system and (e) Peritectoid system. Allotropic transformation. Lever rule and its application, Interpretation of solidification behaviors and microstructure of different alloys belonging to those systems, Effect of non-equilibrium cooling, coring and homogenization.

Iron-cementite and iron-graphite phase diagrams, microstructure and properties of different alloys (alloy steels; stainless steel, tool steel, HSS, high strength low alloy steel) types of cast iron, their microstructures and typical uses. Specification of steel.

T.T.T. diagram: concept of heat treatment of steels i.e. annealing, normalizing, hardening and tempering; microstructural effects brought about by these processes and their influences on mechanical properties; factor affecting hardenability.

MODULE-III (12 Lectures)

Optical properties of Materials: Scattering, Refraction, Theory of Refraction and absorption, Atomic Theory of optical properties. Lasers, Optical fibres- Principle, structure, application of optical fibres.

Plastic:- Thermosetting and thermoplastics.

Ceramics: Types, structure, Mechanical properties, application

Composite Materials: Agglomerated Materials: Cermets .Reinforced Materials: Reinforced Concrete. Glass fiber reinforced plastics, Carbon fibre reinforced plastics, fibre reinforced plastics, Laminated plastic sheets. Tefnol, Properties of composites, Metal matrix composites, manufacturing procedure for fiber reinforced composite. Introduction to Nano-materials

Text Books:

1. Engineering Physical Metallurgy and Heat Treatment by Y.Lakhtin, Mir Publisher, Moscow.
2. Introduction to Physical Metallurgy by Avner, Tata McGraw Hill
3. Materials Science and Engineering by W.D.Callister, Wiley and Sons Inc.

Reference Books

1. Elements of Material Science and Engineering, L.H.Van Vlack, Addison Wesley
2. Physical Metallurgy: Principles and Practice by Ragahvan, PHI
3. The Science & Engg of Materials by Donald R. Askeland & Pradeep P Phule, Thomson Learning (India Ed)
4. Materials Science and Engineering by V.Raghavan, Prentice Hall of India Pvt.Ltd.
5. Essentials of Material Sc. & Engineering by Donald R. Askeland and Pradeep P Phule, Thomson Learning
6. Processes and Material of manufacture by Lindberg, PHI.
7. Elements of Materials Science & Engineering by Van Vlack, Pearson
8. Mechanical Metallurgy by Dieter, Tata MacGraw Hill
9. Materials Science and Metallurgy By Daniel Yesudian, Scitech
10. Material Science and Metallurgy by C.K.Dutta, Dhanpat Rai
11. Materials Science and Metallurgy by R.B.Choudhary, Khanna Publishers
12. Principles of Engineering Metallurgy by L.Krishna Reddy, New Age International
13. Material Science & Processes by S.K.Hazra Chowdhury, Indian Book distributing Co.
14. Engineering Materials, Properties and Selection by Kenneth G. Budinski and Michael K. Budinski, PHI.
15. Materials Science by M.S. Vijaya , G.Rangarajan, TMH
16. Materials Science by V. Rajendra, A. Marikani, , TMH

AUTOMOTIVE THERMODYNAMICS (3-1-0)

Module-I (13 Hours)

1. Review of First and Second laws: First law analysis of unsteady flow control volumes, Entropy generation, Reversible work, Availability, and Irreversibility.
2. Gas and Vapour Power cycle: Air standard cycles- Otto, Diesel, Dual Combustion and Brayton cycles, The Brayton cycle with non-isentropic flow in compressors and turbines, The Brayton cycle with regeneration, reheating and intercooling, ideal jet propulsion cycle. The Carnot vapor cycle and its limitations, The Rankine cycle, Means of increasing the Rankine cycle efficiency, In brief concepts of the binary vapour cycle, the gas-vapor coupled cycles, Cogeneration (Back pressure and Pass-out turbines).

Module- II (15 Hours)

3. Fuels and Combustion:
Fuels: solid, liquid and gaseous, Chemical equations – conservation of mass, 1st law applied to combustion process, calorific value of the fuel, calorific value of fuels, efficiency of combustion processes, limitations of thermodynamic analysis. Alternative fuels for automobiles
4. Refrigeration and air conditioning
Principles of refrigeration, Vapour compression and vapour absorption system, COP, properties of refrigeration, Psychometric, Type of air conditioning system.

Module- III (12 Hours)

5. Basics of Gas dynamics and Isentropic flow through Nozzles
6. Air Compressors:
Introduction (Uses of compressed air), The reciprocating cycle neglecting and considering clearance volume, Volumetric efficiency and its effect on compressor performance, Limitations of single stage compression, Multistage compression and intercooling, Optimum intercooler pressure, Performance and design calculations of reciprocating compressors, Air motors.
Centrifugal and axial flow compressor, blowers and fans: Components, working principles and applications.

Text Books

1. Basic and Applied thermodynamics, P.k.Nag, TMH publications
2. Fundamentals of Engineering Thermodynamics, E. Rathakrishnan (PHI)
3. Engineering Thermodynamics, Mayhew A and Rogers B, Longman Green and Co Ltd., ELBS Edition, 1990

Reference

4. A course in Thermodynamic and Heat Engine: Kothandaraman and Domkundwar, Dhanpat Rai publication
5. Applied Thermodynamics: P.L.Balany, Khanna publications
6. Engineering Thermodynamics: R.K.Rajput, S. Chand and Co

PCME4202 **Mechanics of Solids**

MODULE - I (14 Lectures)

1. Load, Stress, Principle of St.Venant, Principle of Superposition, Strain, Hooke's law, Modulus of Elasticity, Stress-Strain Diagrams, Working Stress, Factor of safety, Strain energy in tension and compression, Resilience, Impact loads,
Analysis of Axially Loaded Members : Composite bars in tension and compression - temperature stresses in composite rods, Statically indeterminate problems.
Shear stress, Complimentary shear stress, Shear strain, Modulus of rigidity, Poisson's ratio, Bulk Modulus, Relationship between elastic constants.
2. Members in Biaxial State of Stress : Stresses in thin cylinders, thin spherical shells under internal pressure - wire winding of thin cylinders. Analysis of Biaxial Stress. Plane stress, Principal stress, Principal plane, Mohr's Circle for Biaxial Stress.
3. Strain Deformation :Two dimensional state of strain, Mohr's circle for strain, Principal strains and principal axes of strain measurements, Calculation of principal stresses from principal strains.

MODULE - II (13 Lectures)

4. Shear Force and Bending Moment for Simple Beams :
Shear force and bending moment. Types of load and Types of support. Support reactions, Relationship between bending moment and shear force, Point of inflection. Shear Force and Bending Moment diagrams.
5. Simple Bending of Beams : Theory of simple bending of initially straight beams, Bending stresses, Shear stresses in bending, Distribution of normal and shear stress, beams of two materials, Composite beams.
6. Deflection of Beams : Differential equation of the elastic line, Slope and deflection of beams by integration method and area - moment method.

MODULE - III (12 Lectures)

7. Theory of Columns: Eccentric loading of a short strut, Long columns, Euler's column formula, Lateral buckling, Critical Load, Slenderness ratio
8. Torsion in solid and hollow circular shafts, Twisting moment, Strain energy in shear and torsion, strength of solid and hollow circular shafts. Stresses due to combined bending and torsion, Strength of shafts in combined bending and twisting.
9. Close - Coiled helical springs.

TEXT BOOKS

1. Elements of Strength of Materials by S.P.Timoshenko and D.H.Young, Affiliated East-West Press
2. Strength of Materials by G. H. Ryder, Macmillan Press
3. Strength of Materials by James M. Gere and Barry J. Goodno, Cengage Learning

REFERENCE BOOKS

1. Mechanics of Materials by Beer and Johnston, Tata McGraw Hill
2. Mechanics of Materials by R.C.Hibbeler, Pearson Education
3. Mechanics of Materials by William F.Riley, Leroy D.Sturges and Don H.Morris, Wiley Student Edition
4. Mechanics of Materials by James M. Gere, Thomson Learning
5. Engineering Mechanics of Solids by Egor P. Popov, Prentice Hall of India
6. Strength of Materials by S.S.Rattan, Tata Mc Graw Hill
7. Strength of Materials by R.Subramaniam, Oxford University Press
8. Strength of Materials by Sadhu Singh, Khanna Publishers

Sessional/Practical

Mechanical Engineering Laboratory (0-0-3) Credits: 02

Applied Mechanics Lab.

1. Determination of Moment of Inertia of Flywheel,
2. Determination of velocity ratio and efficiency of Screw jack
3. Determination of velocity ratio and efficiency of winch crab
4. Deflection of beam

Fluid Mechanics Lab

1. Determination of met centric height
2. Verification of Bernoulli's Theorem
3. Determination of CD and CV of Venturimeter and Orifice meter
4. Determination of coefficient of friction for flow through pipes

Measurement of Basic Parameters

1. Measurement of Pressure (Manometer, Pressure gauge)
2. Measurement of Temperature (Thermocouples and resistance thermometer)
3. Measurement of Fluid Flow (Rotameter, turbine flow meter)
4. Measurement of Velocity (Orificemeter)
5. Measurement of Speed (contact and non-contact type)

N.B.: Total experiments to be conducted 12 and minimum 3 experiments form each group.

Machine Drawing(1-0-3) Credits:03

Orthographic and Sectional drawing of Machine components: (Any seven)

Screw threads, Screwed fastenings, Turn Buckle, Keys, Cotter joints and Knuckle joints; Pulley; Flanged coupling, Pedestal Bearing or Plummer Block, connecting rod, Piston and piston assembly and valves.

Fundamentals of AutoCAD (Two classes)

1. Dimension & annotations
2. Use of Layers
3. Working with constraint in dimension
4. Creating assembly
5. Axi-symmetrical parts
6. Creating surface features
7. Working with bill of material

Drawing of the following using AUTOCAD: (Any two)

1. Projection of solids
2. Nut & bolt and Fasteners
3. Cotter joint
4. Expansion joint
5. Shaft coupling

Text Books:

1. Machine Drawing by N.D.Bhatt, V.M.Panchal, Charotar Publishing House.
2. Machine Drawing by N.D.Junarkar, Pearson Education
3. Machine Drawing with AutoCAD by Goutam Pohit and Goutam Ghosh, Pearson Education
4. Machine Drawing includes AutoCAD by Ajeet Singh, Tata MacGraw Hill

Reference Books:

1. Machine Drawing by K.L.Narayana, P.Kannaiah, K.Venkata Reddy, New Age International
2. Engineering Drawing and Graphics using AUTOCAD by T.Jayapoovan, Vikas Publishing
3. Engineering Drawing by N.D.Bhatt, Charotar
4. Engineering Drawing and Graphics + AutoCAD by K.Venugopal, New Age International

BSCM1205 **MATHEMATICS – IV** (3-1-0)

Module-I (20 hours)

Numerical methods:

Approximation and round of errors, Truncation error and Taylor's series

Roots of equation: The bisection method, the false-position method, fixed point iteration, the Newton-Raphson method, Muller's method

Linear algebraic equation: LU decomposition, the matrix inverse, Gauss-Seidel method

Interpolation: Newton divided difference interpolation, Lagrange Interpolation, Newton's forward and backward interpolation.

Numerical integration: The trapezoidal rule, The Simpson's rules, Gauss quadrature

Ordinary differential equation: Euler's method, Improvement of Euler's method, Runge-Kutta methods

Module-II (10 Hours)

Probability:

Probability, Random variables, Probability distributions, Mean and variance of distribution, Binomial, Poisson and Hypergeometric distributions, Normal distribution, Distribution of several random variables.

Module-III (10 Hours)

Mathematical Statistics:

Random sampling, Estimation of Parameters, Confidence Intervals, Testing of hypothesis, Acceptance sampling, Chi square test for goodness of fit , Regression Analysis, Fitting Straight Lines, Correlation analysis.

Text books:

1. S. C. Chapra and R. P. Canale, “ *Numerical methods for Engineers*”, Fifth Edition, McGraw Hill Education. Reading Chapters : 2, 3(3.1, 3.2), 4(4.2, 4.3), 5(5.1, 5.2, 5.3), 6(6.4), 9(9.1, 9.2), 10(10.2), 13(13.1,13.2,13.5), 16(16.1, 16.2), 17(17.3), 20(20.1, 20.2, 20.3)

2. E. Kreyszig,” *Advanced Engineering Mathematics*:, Eighth Edition, Wiley India
Reading Chapters: 22, 23(except 23.5 and 23.8)

Reference books:

1. Jay L. Devore, “Probability and Statistics for Engineering and Sciences”, Seventh Edition, Thomson/CENGAGE Learning India Pvt. Ltd

2. P. V.O'Neil, “*Advanced Engineering Mathematics*”, CENGAGE Learning, New Delhi

PCME4204 **KINEMATICS & DYNAMICS OF MACHINES** (3-1-0)

Module - I (13Lectures)

1. Mechanisms : Basic Kinematic concepts and definitions, Mechanism, Link, Kinematic Pair, Classification of kinematic pairs, Degrees of freedom, Kinematic chain, Binary Ternary and Quaternary joints and links, Degrees of freedom for plane mechanism, Gruebler's criterion, Inversion of mechanism, Four bar chains and their inversions, Single slider crank chain, Double slider crank chain and their inversion.
2. Kinematic Analysis : Determination of velocity using graphical and analytical techniques, Instantaneous centre method, Relative velocity method, Kennedy theorem, Velocity in four bar mechanism, Slider crank mechanism, Rubbing velocity at a Pin-joint. Acceleration Diagram for a slider - crank mechanism, Corioli's component of acceleration and its application.

Module - III (14 Lectures)

3. Inertia forces in reciprocating Parts : Velocity and acceleration of piston by analytical method, Angular velocity and angular acceleration of connecting rod by analytical method and by graphical method, Piston effort, force acting along the connecting rod, Crank effort, Turning moment on crank - shaft.
4. Dynamically equivalent system, compound Pendulum, correction couple. Turning moment diagrams for different types of engines, Fluctuation of energy and fluctuation of speed.
5. Friction of a screw and nut, Square threaded screw, V-threaded screw, Pivot and collar friction, friction circle, Friction axis, Friction clutches, Transmission of power by single plate, mutiplate and cone clutches.

Module - III (13Lectures)

6. Brakes & Dynamometers : Classification of brakes, Analysis of simple block, Band and internal expanding shoe brake, Braking of a vehicle. Absorption and transmission dynamometers, Prony brake, Rope brake, Band brake dynamometer, Belt transmission dynamometer, Torsion dynamometer.
7. Gear Trains : Simple Train, Compound train, Reverted train, Epicyclic train and their applications.
8. Belt, rope and chain drives, Initial tension, Effect of centrifugal tension on power transmission, Maximum power transmission capacity, Belt creep and slip.

Text Books

1. Theory of Machines by Thomas Bevan, CBS Publications
2. Theory of Machines by S.S.Rattan, Tata MacGraw Hill

Reference

1. Kinematics and Dynamics of Machinery by Charles E. Wilson and J.Peter Saddler, Pearson Ed.
2. Theory of Machines and Mechanisms (India Ed.) by John J. Uicker Jr., Gordon R. Pennock & Joseph E. Shigley, Oxford University Press
3. Theory of Machines and Mechanisms by P.L.Ballaney, Khanna Publishers.
4. Mechanism and Machine Theory by J.S.Rao and R.V.Dukipatti, New Age International.
5. Theory of Mechanisms & Machines by C.S.Sharma & K.Purohit, Prentice Hall of India.
6. Theory of Machines by R.S.Khurmi and J.K.Gupta, S.Chand Publication.
7. Theory of Machines by Shah Jadwani, Dhanpat Rai.
8. A Textbook of Theory of Machines by R. K. Bansal, Laxmi Publication.
9. Theory of Machines by Abdulla Shariff, Dhanpat Rai Publishers.
- 10.Theory of Machines by Sadhu Singh, Pearson Education.

PCAT4204 **AUTOMOTIVE ENGINES** (3-1-0)

Module I

Introduction and Fuel supply systems: -

12 hours

Classification of I.C Engines, two stroke petrol and diesel engines construction, working and port timing diagrams, four stroke petrol and diesel engines-construction, working and valve timing diagram, comparison of two stroke and four stroke engines, differences between petrol and diesel engines, firing order, fuel supply system for SI engines-carburettors(simple and solex), fuel supply system for CI engines- fuel filter, fuel pump and injector, calculation of air fuel ratio for petrol and diesel, air fuel ratio for modern automotive vehicles .

Module II

Lubrication, cooling systems and performance: -

14 hours

Function of lubrication systems, types of lubrication systems- mist, wet and dry sump lubrication systems, properties and designation of lubricants.

Need for cooling systems-air and liquid cooling systems-properties of coolants, cooling agents.

Performance tests in IC engines and heat balances.

Module III

Combustion and Power boosters: -

14 hours

Phenomenon of combustion in SI engines, stages of combustion, flame propagation, rate of pressure rise, abnormal combustion, effect of engine variables on knocking, fuel quality for SI engines, octane rating, combustion chambers for SI engines.

Phenomenon of combustion in CI engines, stages of combustion, ignition delay, factors affecting delay period, knock in CI engines, comparison of knock in SI and CI engines, direct and indirect injection diesel engines, combustion chambers, supercharging and turbo-charging methods.

Text Books:

1. Ganesan . V, "Internal Combustion Engines", Tata-Mc Graw Hill Publishing Co., New Delhi, 1994.
2. Ramalingam .K. K, "Automobile Engineering", Sci-tech publication Pvt. Ltd, 2005.

Reference books:

1. Heywood, Internal Combustion Engines
2. Obert E .F, Internal Combustion Engine Analysis and Practice, International Text Book Co., Scranton, Pennsylvania , 1988.
3. Heldt P.M, High Speed Combustion Engines, Oxford IBH Publishing Co, 1964.
4. Dicksee . C.B, Diesel Engines, Blackie and Son Ltd, London, 1964.
5. Malvee V.M, Diesel Engine Operation And Maintenance, McGraw Hill, 1974.

Module - I (12 Lectures)

1. Foundry :

- (a) Types of patterns, pattern materials and pattern allowances.
- (b) Molding Materials - sand molding, metal molding, investment molding, shell molding.
- (c) Composition of molding sand, Silica sand, Zircon sand, binders, additives, Binders - clay, binders for CO₂ sand, binder for shell molding, binders for core sand.
- (d) Properties of molding sand and sand testing.
- (e) Melting furnaces - cupola, resistance furnace, induction and arc furnace.
- (f) Solidification of castings, design of risers and runners, feeding distance, centre line freezing resistance chills and chaplets.
- (g) Degasification and inoculation of metals.
- (h) Casting methods like continuous casting, centrifugal casting, disc casting.
- (i) Casting defects.

Module – II (12 Lectures)

2. Welding and cutting: Introduction to gas welding, cutting, Arc welding and equipment's. TIG (GTAW) and MIG (GMAW) welding, resistance welding and Thermit welding. Weldability Modern Welding methods like plasma Arc, Laser Beam, Electron Beam, Ultrasonic, Explosive and friction Welding, edge preparation in butt welding.
Brazing and soldering, welding defects.
Destructive and non-destructive testing of castings and welding.
3. Brief introduction to powder metallurgy processes.

Module – III (14 Lectures)

4. Plastic deformation of metals: Variables in metal forming and their optimization. Dependence of stress strain diagram on Strain rate and temperature. Hot and cold working of metals, classification of metal forming processes.
5. Rolling: Pressure and Forces in rolling, types of rolling mills, Rolling defects.
6. Forging: Smith Forging, Drop and Press forging, M/c forging, Forging defects.
7. Extrusions: Direct, Indirect, Impact and Hydrostatic extrusion and their applications, Extrusion of tubes.
8. Wire drawing methods and variables in wire-drawing, Optimum dies shape for extrusion and drawing.
9. Brief introduction to sheet metal working: Bending, Forming and Deep drawing, shearing.
10. Brief introduction to explosive forming, coating and deposition methods.

Text Books

- 1. Manufacturing technology - by P.N.Rao, Tata McGraw Hill publication.
- 2. Welding Technology by R.A. Little, TMH
- 3. Manufacturing Science by A.Ghosh and A K Malick, EWP

Reference Books

- 1. Fundamentals of metal casting technology by P.C. Mukherjee, Oxford PIBI.
- 2. Mechanical Metallurgy by Dieter, Mc-Graw Hill
- 3. Processes and Materials of Manufacture by R.A Lindberg, Prentice hall (India)
- 4. A Text Book of Production Engineering by P.C.Sharma, S.Chand

PCAT4205 AUTOMOTIVE CHASSIS (3-0-0)

Module I

Frames, front axle and steering systems: -

12 hours

Types of frames, unitised frame body construction- loads acting on frames, types of front axle, construction details and materials, front wheel geometry i.e. camber, castor, king pin inclination, toe-in and toe-out. Condition for true rolling motion. Steering geometry. Ackerman and Davis steering system constructional details of steering linkages and layouts. Different types of steering gear levers-construction and operation, power and power assisted steering .

Module II

Driveline, rear axles and final drive: -

12 hours

Effect of driving thrust and torque reaction, Hotchkiss drive, torque tube drive. Propeller shaft, universal joint, constant velocity joint and front wheel drive. Construction of rear axles. Types of load acting on axles. Full floating, three-quarter floating and semi-floating rear axles construction of different rear axle housing.

Different types of final drives such as straight bevel gear, spiral bevel gear and hypoid gear. Differential principle and operation construction of differential. Differential locks.

Module III

Suspension System and Braking System: -

12 hours

Need of suspension system, types of suspension construction details of suspension springs such as leaf springs. Coil springs and torsion bar springs. Shock absorbers-telescopic type shock absorber. Independent suspension system. Introduction to rubber and pneumatic suspension system.

Classification of brakes- drum and disc brakes. Different types of breaking system as mechanical , hydraulic, cylinder and pneumatic breaking system. Master cylinder, tandem master cylinder and wheel power and power assisted brakes. Anti-locking braking systems.

Text Books

1. K. K. Ramalingam, "Automotive Engineering ". Scitech Publication Pvt Ltd, 2005.
2. Kirpal Singh, "Automobile Engineering" vol1 and vol2. Standard Publishers, 2003.

References

3. John Heizler, "Automotive Mechanics", East West Press, 1999.
4. Jack E RJavee, "Automotive Technology", Thomson Asia Pvt Ltd, 3rd Edition, 2004.

PCAT 7201 **BASIC MANUFACTURING PROCESS LAB** (0-0-3)

FOUNDRY AND CASTING

2 credits

Pattern making, pattern material, pattern allowances, types of pattern, moulding tools, green sand moulding, gating, riser and core.

Any two moulds to be given as exercises (solid with core, flange, gear).

Casting demonstrations.

LATHE

Parts of a lathe, exercise on facing, turning, step turning, taper turning, threading, knurling.

BASIC EXERCISES ON ANY THREE OF THE FOLLOWING MACHINES

1. Shaper - Cube and V Block.
2. Drilling - Drilling and Tapping.
3. Milling - Making a square block.
4. Grinding - Surface grinding on a plate.
5. Slotting - Making a rectangular slot.

PCAT 7202 **AUTO SERVICING & MAINTENANCE LAB** (0-0-3)

1. Study of various types of 2 – stroke SI Engines.
2. Study of various types of 4 – stroke SI Engines.
3. Study of various types of 4 – stroke CI Engines.
4. Dismantling & assembly of multi cylinder petrol engines – Measurement & drawing of various components.
5. Dismantling and assembly of multi cylinder diesel engines – Measurement of drawing of various components.
6. Dismantling & assembly of single – plate & multiplate clutches. Drawing of components of clutch.
7. Dismantling and assembly of sliding mesh & constant mesh gear boxes.
8. Study of front & rear suspension systems. Drawing of sketches.
9. Study of (disc / drum) hydraulic braking system & drawing of layout.
10. Study of manual / power assisted steering system & drawing of layout.
11. Cylinder reboring – checking of cylinder bore, setting the cool & reboring.
12. Minor & Major tune-up of gasoline & diesel engines.
13. Study and checking of wheel geometry – camber, caster, king-pin inclination & toe-in.

Note: Any “Ten” experiments have to be carried out.

PCAT 7203 **MATERIAL TESTING & FLUID POWER LAB** (0-0-3)

A) MATERIAL TESTING LAB (ANY FIVE OF SEVEN)

1. Tension Test
2. Torsion Test
3. Testing of springs
4. Impact Test (a) Izod (b) Charpy
5. Hardness Test (a)Vicker's (b)Brinell (c) Rockwell
6. Deflection of beam
7. Dye Penetrant Test

B) Fluid Power Laboratory

1. Determination of performance characteristics of centrifugal pump, gear pump, reciprocating pump (any two)
2. Determination of performance characteristics of reaction and impulse turbine (any one)
3. Determination of volumetric efficiency of a reciprocating air compressor

BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA

Automobile Engineering

<u>5th SEMESTER</u>				<u>6th SEMESTER</u>			
<i>THEORY</i>		<i>Contact Hours</i>		<i>THEORY</i>		<i>Contact Hours</i>	
<i>Code</i>	<i>Subject</i>	<i>L-T-P</i>	<i>Credits</i>	<i>Code</i>	<i>Subject</i>	<i>L-T-P</i>	<i>Credits</i>
HSSM3301	Principles of Managements	3-0-0	3	HSSM3303	Environmental Engineering & Safety	3-0-0	3
PCAT4301	Design of Machine Component	3-0-0	3	PCAT4303	Vehicle Body Engineering	3-0-0	3
PCAT4302	Automotive Transmission systems	3-0-0	3	PCAT4304	Automotive Pollution and Control	3-0-0	3
PCME4301	Machine Dynamics	3-0-0	3	PCAT4305	Vehicle Design	3-0-0	3
	Professional Elective – I (Any One)	3-0-0	3		Professional Elective – I (Any One)	3-0-0	3
PEAT5301	Two and Three Wheelers			PEAT5304	Automotive Electrical & Electronics		
PEAT5302	Automotive Test Instrumentation			PEAT5304	Combustion Thermodynamics & Heat Transfer		
PEAT5303	Advanced Production Processes for Automotive Components			PEAT5304	Automotive Air Conditioning		
	Free Elective – I (Any One)	3-0-0	3		Free Elective – I (Any One)	3-0-0	3
PEEL5301	Sensor and Transducers			HSSM3302	Optimization in Engineering		
PEME5302	Computer Aided Design & Computer Aided Manufacturing (CAD & CAM)			FEME6301	Finite Element Method		
PCEC4301	Microprocessors			PEME5308	Non Conventional Energy Sources		
		Credits (Theory)	18			Credits (Theory)	18
	PRACTICALS/SESSIONALS				PRACTICALS/SESSIONALS		
PCAT7301	Fuels and Combustion Lab	0-0-3	2	PCAT7304	Automotive Electrical and Electronics Lab.	0-0-3	2
PCAT7302	Production Lab	0-0-3	2	PCAT7305	Automotive Engine and Chassis Components Lab	0-0-3	2
PCAT7303	Drawing of Automotive Components using software Tools	0-0-3	2	PCAT7306	Computer Aided Engine Design Lab	0-0-3	2
		Credits (Practicals / Sessionals)	6			Credits (Practicals / Sessionals)	6
TOTAL SEMESTER CREDITS			24	TOTAL SEMESTER CREDITS			24
TOTAL CUMULATIVE CREDITS				TOTAL CUMULATIVE CREDITS			

HSSM3301 PRINCIPLES OF MANAGEMENT

Module I: Functions of Management

12Hr

Concept of management, Management as an Art or Science, Process of management, Managerial skills, Good Managers are born, not made, Management is concerned with ideas, Things and People, How a Manager induces workers to put in their best, Levels and types of management, **Evolution of management thought:** Managerial environment, The process of management-planning, organizing, directing, staffing, controlling.

Module II: Marketing Function of Management.

12Hr

Modern concept of marketing, the functional classification of marketing, functions of a marketing management, marketing mix, fundamental needs of customers, the role of distribution channels in marketing, advertising, marketing, consumerism and environmentalism.

Module III: Financial Function & HRM Functions.

12Hr

Financial functions, concept of financial management, project appraisal, tools of financial decisions making, overview of working capital.

HRM Function of Management: Human resource management, human resource development, importance of HRM, overview of job analysis, job description, job specification, labour turnover. Manpower planning, recruitment, selection, induction, training and development, placement, wage and salary administration, performance appraisal, grievance handling, welfare aspects.

Reference Books:

1. *Business Organization & Management*, CR Basu, TMH
2. *Business Organization & Management*, Tulsia, Pandey, Pearson
3. *Marketing Management*, Kotler, Keller, Koshi, Jha, Pearson
4. *Financial Management*, I.M. Pandey, Vikas
5. *Human Resource Management*, Aswasthapa, TMH.
6. *Modern Business Organisation & Management* by Sherlekar, Himalaya Publishing House.

DESIGN OF MACHINE COMPONENT

OBJECTIVE:

- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components

Module- I INTRODUCTION

12

Classification of design – Engineering materials and their physical properties as applied to design – Selection of materials – Factors of safety in design – Endurance limit of materials – Determination of endurance limit for ductile materials – Notch sensitivity – Principle of design optimization – Future trends – CAD Euler's formula – Rankine's formula – Tetmajer's formula – Johnson formula – Design of push rods and eccentricity loaded columns – Reduction of stress concentration.

Threaded fasteners - Design of bolted joints including eccentric loading – theory of bonded joints. (Riveted joints - self study)

Module- II DESIGN OF SHAFTS AND BEARING

12

Introduction – Fit and tolerance- Material and design stresses –Design of shafts on the basis of strength – Design of shaft on the basis of rigidity – Design of hollow shafts.

Types of Bearings- Design of journal bearings - Ball and Roller bearings – Types of Roller bearings – Bearing life – Static load capacity – Dynamic load capacity – Bearing material – Boundary lubrication – Oil flow and temperature rise.

Module- III SPRINGS AND FLYWHEELS

12

Design of close coiled helical spring subjected to axial loading – Torsion of helical springs.

Determination of the mass of a flywheel for a given co-efficient of speed fluctuation. Engine flywheels stresses of rim of flywheels. Design of hubs and arms of flywheel – Turning moment diagram.

TOTAL : 36 PERIODS

TEXTBOOKS:

1. Jain,R.K., "Machine Design", Khanna Publishers, 1992.
2. Sundararaja Murthy,T.V., "Machine Design", Khanna Publishers, New Delhi, 1991.
3. Bhandari,V.B., "Design of Machine Elements", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1990.

AUTOMOTIVE TRANSMISSION SYSTEMS

MODULE I

Mechanical and Hydrodynamic Drive

12 Hours

Requirement of transmission system. Different types of clutch, principle, Construction, torque capacity and design aspects. Different types of gear boxes – Sliding, Constant and Synchromesh gearbox.

Fluid coupling. Principle of operation. Constructional details. Torque capacity. Performance characteristics, Reduction of drag torque. Torque converter: Principle of operation, constructional details and performance characteristics.

MODULE II

Automatic transmission and Application

12 Hours

Ford-T-model gear box, Wilson Gear box, Cotal electromagnetic transmission, Hydraulic control system for automatic transmission and Chevrolet “Turboglide” Transmission system

MODULE III

Hydrostatic Drive and Electric Drive

12 Hours

Hydrostatic drive: Various types of hydrostatic systems – Principles of hydrostatic drive system, Advantages and limitations, Comparison of hydrostatic drive with hydrodynamic drive, construction and working of typical Janny hydrostatic drive.

Electric drive: Principle of early and modified Ward Leonard Control system. Advantages & limitations. Performance characteristics.

REFERENCES

1. Heldt. P.M., Torque converters, Chilton Book Co., 1992.
2. Newton and Steeds, Motor vehicles, Life Publishers, 1985.
3. Judge A.W., Modern Transmission Systems, Chapman and Hall Ltd., 1990.
4. SAE Transactions 900550 & 930910.
5. Hydrostatic transmissions for vehicle applications, I Mech. E Conference, 1981-88.
6. Course. W.H., Anglin., D.L., Automotive Transmission and Power Trains construction, McGraw-Hill, 1976.

PCME4301 **MACHINE DYNAMICS** (3-0-0)

Module – I (12 hours)

1. Mechanisms with lower pairs : Motor Vehicle Steering Gears - Davis Steering Gear & Ackermann Steering Gear, Hooke's Joint.
2. Gyroscope : Concept on Gyroscopic Couple for Plane Disc & Two-bladed airscrew, Effect of Gyroscopic Couple on Ships & Aeroplanes, Stability of Two Wheelers and Four Wheelers. Analysis on bearing reactions due to Forced Precession of Rotating Disc mounted on Shafts, Introduction on Gyroscopic Stabilisation.
3. Toothed gears : : Gear terminology, law of gearing , Theory of shape and action of tooth properties and methods of generation of standard tooth profiles, Standard proportions, Path of contact, Arc of contact, Contact ratio, Interference and Under – Cutting, Methods for eliminating Interference, Minimum number of teeth to avoid interference.

Module II (12 hours)

4. Cams : Types of cams, Types of followers, Types of follower motions - Simple Harmonic, Uniform Velocity and Constant Acceleration & Retardation Types, Analysis for Displacement, velocity and Acceleration of Follower, Generation of Cam Profiles by Graphical Method, Introduction on Cams with specified contours.
5. Governors : Centrifugal Governors - Watt, Porter, Proell and Spring Loaded Governor of Hartnell type, Controlling Force & Controlling Force Curve, Sensitiveness, Stability, Isochronism, Hunting, Governor Effort and Power, Effect of Friction & Coefficient of insensitiveness.
6. Dynamics of Machines : Dynamic Force Analysis of Four-Bar Mechanism and Slider Crank Mechanism. using D'Alemberts Principle, Flywheel and Determination of its size from Turning Moment Diagram & Maximum Fluctuation of Energy.

Module III (12 hours)

7. Balancing : Static and Dynamic Balancing, Balancing of Single Rotating Mass by Balancing Masses in Same plane and in Different planes. Balancing of Several Rotating Masses rotating in Same plane and in Different planes. Effect of Inertia Force due to Reciprocating Mass on Engine Frame, Partial balance of single cylinder engines. Primary and Secondary Balance of Multi-cylinder In-line Engines. Direct and Reverse Crank method of balancing for radial engines.
8. Vibrations: Introduction to Mechanical Vibration – Longitudinal, Torsional & Transverse Systems, Concept on Degrees of Freedom. Free and Forced Vibration of Un-damped and Damped Single Degree Freedom Systems, Vibration isolation and transmissibility, Whirling of shafts and Evaluation of Critical Speeds of shafts..

Text Books

1. Theory of Machines by Thomas Bevan, CBS Publications
2. Theory of Machines by S.S.Rattan, Tata MacGraw Hill
3. Theory of Mechanisms and Machines by A.. Ghosh and A.. K.. Mallik, EWP

Reference

1. Kinematics & Dynamics of Machinery-Charles E. Wilson & J.Peter Sessler, Pearson Ed.
2. Theory of Machines and Mechanisms (India Edition) by John J. Uicker Jr., Gordon R. Pennock and Joseph E. Shigley, Oxford University Press
3. Kinematics and Dynamics of Machinery by R.L.Norton, Tata MacGraw Hill
4. Theory of Machines and Mechanisms by P.L.Ballaney, Khanna Publishers
5. Mechanism and Machine Theory by J.S.Rao and R.V.Dukipatti, New Age International
6. Theory of Mechanisms and Machines by C.S.Sharma and K.Purohit, PHI
6. Theory of Machines by R.S.Khurmi and J.K.Gupta, S.Chand Publication
7. Theory of Machines by Shah Jadwani, Dhanpat Rai
8. A Textbook of Theory of Machines by R. K. Bansal, Laxmi Publication
9. Theory of Machines by Abdulla Shariff, Dhanpat Rai Publishers
10. Theory of Machines by Sadhu Singh, Pearson Education.

TWO AND THREE WHEELERS

MODULE I

The Power Unit

12 Hours

Two stroke and four stroke SI engine, merits and demerits, Symmetrical and unsymmetrical port timing diagrams.

Types of scavenging processes, merits and demerits, scavenging efficiency. Scavenging pumps.

Fuel system. and Lubrication system.

Magneto coil and battery coil spark ignition system. Electronic Ignition System. Starting system. Kick starter system.

MODULE II

CHASSIS AND SUB-SYSTEMS

12 Hours

Main frame, its types. Chassis and shaft drive. Single, multiple plates and centrifugal clutches. Gear box and gear controls.

Front and rear suspension systems. Shock absorbers.

Panel meters and controls on handle bar.

Drum brakes, Disc brakes, Front and rear brake links lay-outs. Spoked wheel, cast wheel. Disc wheel, Disc types, Tyres and tubes.

MODULE III

Two Wheelers

6 Hours

Case study of major Indian models of motor cycles, scooters and mopeds.

Bajaj, Vespa, Lambretta Scooters. Enfield, TVS-Suzuki, Hero Honda, Yamaha RX-100, Kawasaki Bajaj Motor cycles. Kinetic Spark, Hero Majestic, TVS mopeds.

Servicing and maintenance.

Three Wheelers

6 Hours

Case study of Indian models. Front engine and Rear engine.

Auto rickshaws.

Pick up van. Delivery van and Trailer.

TEXT

Irving . P.E., Motor cycle Engineering, Temple Press Book, London, 1992.

REFERENCE:

1. The cycle Motor Manual, Temple Press Ltd., London, 1990.
2. Encyclopedia of Motor cycling, 20 volumes, Marshall Cavensih, New York and London, 1989.
3. Bryaut. R.V., Vespa Maintenance and Repair series.
Raymond Broad, Lambretta – A practical guide to maintenance and repair, 1987.

AUTOMOTIVE TEST INSTRUMENTATION

Module- I MEASUREMENT SYSTEMS

12

Static and Dynamic Measurement systems- Requirements and characteristics – Analysis of experimental detail.

Transducers for Automotive Applications – Amplifiers- filters –data Acquisition- Indicators, Printers and displays –Signal Analyzing.

Module- II ENGINE EXPERIMENTAL TECHNIQUES

12

I.S Code for Engine testing – Instrumentation for performance testing of engine, Instrumentation for Research and development, Instrumentation for noise, vibration, in cylinder gas flow, flame temperature Dynamic Cylinder pressure measurements

Module- III VEHICLE EXPERIMENTAL TECHNIQUES

12

Laboratory tests – test tracks – Endurance Tests – crash tests – wind tunnel tests – Brake tests. Instrumentation for Measuring Weight, Force, torque, pressure power, temperature, fluid flow, vibration, rotational speed, velocity, acceleration and angular motion.

TOTAL : 36 PERIODS

REFERENCES:

1. A.W. JUDGE, Engineering Precision Measurement, Chapman and Hall Ltd, Essex Street W.C.,1951,
2. T.G. Beckwith and Buck, Mechanical Measurements, Oxford and IBH Publishing House, New Delhi, 1995
3. D.Patambis, Principle of Industrial Instrumentation, Tata McGraw Hill Publishing Co, New Delhi, 1990.
4. Rangan, Sharma and Mani, Instrumentation Devices and systems, Tata McGraw Hill Publishing Co., Ltd., 1990
5. J.G. Giles, Engine and Vehicle Testing, Illiffe books Ltd., London,1968.

ADVANCED PRODUCTION PROCESSES FOR AUTOMOTIVE COMPONENTS

Module- I FORMING PROCESS

12

Forging – process flow chart, forging of valves – connecting rod, crank shaft, cam shaft, propeller shaft, transmission gear blanks, foot brake linkage, steering knuckles. Extrusions: Basic process steps, extrusion of transmission shaft, steering worm blanks, brake anchor pins, rear axle drive shaft, axle housing spindles, piston pin and valve tappets. Hydroforming: Process, hydroforming of manifold and comparison with conventional methods – Hydro forming of tail lamp housing. Stretch forming – Process, stretch forming of auto body panels – Super plastic alloys for auto body panels.

Module- II GEAR MANUFACTURING & POWDER METALLURGY

12

Process flow chart – Production of metal powders and their raw materials – Manufacture of friction lining materials for clutches and brakes – Testing and inspection of PM parts.

Different methods of Gear manufacture – Gear hobbing 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.

Module- III RECENT TRENDS IN MANUFACTURING OF AUTO COMPONENTS

12

NC, CNC & DNC – types of CNC – constructional features – drives and control systems – feed back devices – manual part programming – steps involved – sample program in Lathe & milling.

Powder injection moulding – Shot peen hardening of gears – Production of aluminum MMC liners for engine blocks – Plasma spray coated engine blocks and valves – Recent developments in auto body panel forming – Squeeze casting of pistons – aluminum composite brake rotors.

TOTAL: 36 PERIODS

TEXT BOOK

1. Heldt, P.M., "High Speed Combustion Engines", Oxford Publishing Co., New York, 1990.

REFERENCES

1. Haslehurst, S.E., "Manufacturing Technology", ELBS, London, 1990.
2. Rusinoff, "Forging and Forming of metals", D.B. Taraporevala Son & Co. Pvt.Ltd., Mumbai, 1995.
3. Subroff, A.M. & Others, "Forging Materials & Processes", Reinhold Book Corporation, New York, 1988.
4. "High Velocity Forming of Metals", ASTM, Prentice Hall of India (P) Ltd., New Delhi, 1990.
5. Groover, M.P., Automatic production systems and computer integrated manufacturing, Prentice-Hall, 1990.
6. GE Thyer, Computer Numerical Control of Machine Tools, BH. Newners, 1991.

PEEL5301 **SENSORS AND TRANSDUCERS** (3-0-0)

Module –1 10 lectures

Elements of a general measurement system;

Static Characteristics: systematic characteristics, statistical characteristics, calibration;

Dynamic characteristics of measurement systems: transfer functions of typical sensing elements, step and frequency response of first and second order elements, dynamic error in measurement systems. (Bentley: Chapters 1-4)

Module-2 14 lectures

Sensing elements: Resistive sensing elements: potentiometers, Resistance Temperature Detector (RTD), thermistors, strain gages.

Capacitive sensing elements: variable separation, area and dielectric;

Inductive sensing elements: variable reluctance and LVDT displacement sensors;

Electromagnetic sensing elements: velocity sensors,

Thermoelctric sensing elements: laws, thermocouple characteristics, installation problems, cold junction compensation.

IC temperature sensor

Elastic sensing elements: Bourdon tube, bellows, and diaphragms for pressure sensing, force and torque measurement.

(Bentley: Sections 8.1 to 8.6; Ghosh: Section 10.3 to 10.4).

Module-3 10 lectures

Signal Conditioning Elements:

Deflection bridges: design of resistive and reactive bridges, push-pull configuration for improvement of linearity and sensitivity

Amplifiers: Operational amplifiers-ideal and non-ideal performances, inverting, non-inverting and differential amplifiers, instrumentation amplifier, filters. A.C. carrier systems, phase sensitive demodulators and its applications in instrumentation.

(Bentley: Sections 9.1 to 9.3; Ghosh: Sections 15.1 and 15.2) .

Text Books:

1. Principles of Measurement Systems- J.P. Bentley (3/e), Pearson Education, New Delhi, 2007.
2. Introduction to Measurement and Instrumentation- A.K. Ghosh(3/e), PHI Learning, New Delhi, 2009.
3. Transducers and Instrumentation- D.V.S. Murthy (2/e), PHI Learning, New Delhi, 2009.

Reference Books:

1. Measurement Systems Application and Design- E.O. Doebelin (4/e), McGraw-Hill, International, NY.
2. Instrumentation for Engineering Measurements- J.W. Dally, W.F. Riley and K.G. McConnel (2/e), John Wiley, NY, 2003.
3. Industrial Instrumentation- T.R. Padmanabhan, Springer, London, 2000.

PEME5302 **COMPUTER AIDED DESIGN AND COMPUTER AIDED MANUFACTURING (CAD & CAM)** (3-0-0)

Module I (11 hour)

Fundamentals of CAD: Design process, Applications of computer for design, Creating the Manufacturing Database, The Design workstation, Graphical Terminal, Operator input Devices, Plotters and other devices, Central Processing Unit, Memory types.

Module II (11 hour)

Computer graphics Software and Database: Configuration, Graphics Packages, Constructing the Geometry, Transformations of geometry, Database structure and content, Wire frame versus solid modeling, Constraint– Based modeling, Geometric commands, Display control commands, Editing.

Module III (14 hour)

CAM - Numerical Control and NC Part Programming: Numerical Control, Numerical Control elements, NC Coordinate system, NC motion control system, Manual and Computer Aided programming, the APT language, Miscellaneous Functions, M, Advanced part-programming methods.

Problems with conventional NC, NC technology: CNC, DNC, Combined DNC/ CNC system, Adaptive control manufacturing systems, Computer Integrated Manufacturing system, Machine Tools and related equipment, Materials Handling system: AGV, Robots, Lean manufacturing.

Text Books

1. CAD/CAM Computer Aided Design and Manufacturing, M.P.Goover and E.W.Zimmers, Jr., Pearson

Reference Books

1. CAD/CAM Theory and Practice, Zeid and Subramanian, TMH
2. CAD/CAM Principles, Practice and Manufacturing Management, McMahon and Browne, Pearson Education
3. CAD/CAM Concepts and Applications, C.R.Alavala, PHI
4. Computer Aided Design and Manufacturing, Lalit Narayan, Mallkarjuna Rao and Sarcar, PHI
5. CAD/CAM Theory and Concepts, K.Sareen and C.Grewal, S.Chand Publication
6. CAD/CAM/CAE, N.K.Chougule, Scitech
7. Principle of Interactive Computer Graphics, W.W.Newman, R.F.Sproull, TMH

PCEC4301 **MICROPROCESSORS** (3-0-0)

Module-I : (10 Hours)

Organization of Microprocessor

Introduction to the general concept of microprocessor organization, I/O sub-systems, programming the system, ALU, instruction execution, instruction word format, addressing modes, address/data/control bus, tristate bus, interfacing I/O devices, data transfer schemes, architectural advancements of microprocessor, evolution of microprocessors.

Module-II : (12 Hours)

Intel 8086- Hardware Architecture:

Introduction, Bus interface unit(BIU), Execution unit(EU), pin description, register organization, instruction pointer, data register, pointer and index registers, status register, stack, external memory addressing, bus cycle (minimum mode):memory or I/O read/write for minimum mode, clock generator Intel- 8284A, bidirectional bus trans-receiver 8286/8287, bus controller 8288, bus cycle memory read/write for minimum mode, 8086 system configuration (minimum mode as well as maximum mode), memory interfacing, interrupt processing; software interrupts, single step interrupt, non-maskable interrupt, maskable interrupt, interrupt priority, DMA, Halt State, Wait for Test state, comparison between 8086 and 8088.

Module-III : (13 Hours)

Instruction set and programming:

Programmer's model of Intel 8086, operand type, addressing modes 8086 assembler directives, instruction set, programming examples on data transfer group, arithmetic-logical groups, control transfer groups (loop and loop handling instruction), conditional and unconditional group, procedures and stack operations, string instructions.,branch program structure like IF-THEN-ELSE REPEAT-UNTIL and WHILE-DO,

I/O Interfacing :

8-bit input- output port 8255 PPI, memory mapped i/o ports,8254 programmable Interval Timer, 8273 Programmable Direct Memory Access Controller, 8251 USART, 8279 Programmable Keyboard/Display Controller.

Text Books:

- 1.The 8088 and 8086 Microprocessors Programming, Interfacing, Softw, Hardware and Application; by Walter A. Triebel & Avtar Singh ; Pearson India.
2. Microprocessors and Interfacing; by Douglas V Hall ; McGraw Hill.

Reference Book:

1. Microprocessors and Micro controllers Architecture, programming and system Design 8085, 8086, 8051, 8096: by Krishna Kant; PHI.
2. The 8086 Microprocessor: Programming & Interfacing the PC- Kenneth J. Ayala, Delmar Cengage Learning, Indian Ed.

FUELS AND COMBUSTION LAB

- 1 ASTM distillation apparatus
- 2 Lubricant viscosity tests-Redwood(or)Saybolt viscometers
- 3 Determination of flash and fire point of fuel and lubricant (each one)
- 4 Aniline point tester
- 5 Pour point tester
- 6 Determination of fuel calorific value of fuel using Bomb calorimeter
7. Reid vapour pressure test.
8. Drop point of grease and mechanical penetration in grease
- 9.Ash, Volatile, Moisture contents of coal and oil
- 10.Orsat gas analysis

PRODUCTION LAB

(Minimum 06 experiments)

1. Determination of grain size, clay content, permeability and green compressive strength of molding sand. (2 to 3 experiments)
2. Foundry Practice
3. Determination of strength of brazed and soldered joints.
4. Study of non-traditional machining process (ultrasonic machining/ abrasive jet machining/ electro-discharge machining)
5. Determination of cutting forces in turning using lathe tool dynamometer
6. Determination of cutting forces in drilling using drilling tool dynamometer
7. Study on C. N.C. Machines and demonstration of making of job through CNC machine.
8. Calibration of slip gauge using sine bar
9. Measurement of roughness / straightness / flatness of surfaces
10. Study of microstructure of steel specimen

DRAWING OF AUTOMOTIVE COMPONENTS USING SOFTWARE TOOLS

At the end of this Lab.; the students will be able to acquire basic knowledge on automobile part designing using design software apart from automobile production.

1. **INTRODUCTION:** Introduction to Automobile CAD software's; industrial looks on CAD software's;. Any of the Software tools like CATIA/PRO-E(Creo), the student has to practise the followings

2. **SKETCHER & AUTO CONSTRAINTS:**

Introduction to Sketching tools like Line; Rectangular; Circle; Arc; Splines; and Fillet etc to built complex profiles; general concept and best process to constraint (Auto and Manually) a profile in Pro/E / CATIA.

3. **PART DESIGN FUNDAMENTALS:** Introduction to Design tools like Extrude; Revolve; Shell; Pad etc needed to generate solid models using various software; Material addition and subtraction about axis and plane; types of geometrical dimensional limits; numerous approaches to specify solid feature creation.

4. **ASSEMBLY DESIGN FUNDAMENTALS:** Design tools needed to create and manage assemblies and sub assemblies; analyzing and modeling an assembly; designing in context; process to insert parts from given and maintained catalogue

On the basis of above fundamentals any four of the followings

- (i) Screw jack
- (ii) Piston, Cylinder and connecting rod
- (iii) Carburettor body
- (iv) Fuel injector
- (v) Gear box
- (vi) Differential

Animation: Fundamentals and use of animation for drawing automobile components

Reference:

Manuals of Pro-E and CATIA

Shyam and Tickoo Maini., "CATIA V5 R17 Engineers Designing".

HSSM3303 ENVIRONMENTAL ENGINEERING & SAFETY

Module – I

Ecological Concepts: Biotic components, Ecosystem Process: Energy, Food Chain, Water cycle, Oxygen cycle, Nitrogen cycle etc., Environmental gradients, Tolerance levels of environment factor, EU, US and Indian Environmental Law. Chemistry in Environmental Engineering: Atmospheric chemistry, Soil chemistry. Noise pollution- Noise standards, measurement and control. Water Treatment: water quality standards and parameters, Ground water. Water treatment processes, Pre-treatment of water, Conventional process, Advanced water treatment process.

Module – II

(a)Waste Water Treatment: DO and BOD of Waste water treatment process, pretreatment, primary and secondary treatment of waste water, Activated sludge treatment: Anaerobic digestion, Reactor configurations and methane production.

(b)Air Pollution : Air pollution and pollutants, criteria pollutants, Acid deposition, Global climate change –greenhouse gases, non-criteria pollutants, air pollution meteorology, Atmospheric dispersion. Industrial Air Emission Control. Flue gas desulphurization, NOx removal, Fugitive emissions.

(c) Solid waste, Hazardous waste management, Solid Waste Management, Source classification and composition of MSW: Separation, storage and transportation, Reuse and recycling, Waste Minimization Techniques. Hazardous Waste Management, Hazardous waste and their generation, Transportation and treatment: Incinerators, Inorganic waste treatment. E.I.A., Environmental auditing,

Module – III

Occupational Safety and Health Acts, Safety procedures, Type of Accidents, Chemical and Heat Burns, Prevention of Accidents involving Hazardous substances, Human error and Hazard Analysis. Hazard Control Measures in integrated steel industry, Petroleum Refinery, L.P.G. Bottling, Pharmaceutical industry. Fire Prevention – Detection, Extinguishing Fire, Electrical Safety, Product Safety. Safety Management- Safety Handling and Storage of Hazardous Materials, Corrosive Substances, Gas Cylinders, Hydro Carbons and Wastes. Personal Protective Equipments.

Text Book :

1. Environmental Engineering Irwin/ McGraw Hill International Edition, 1997, G. Kiely,
2. Environmental Engineering by Prof B.K. Mohapatra, Seven Seas Publication, Cuttack
3. Industrial Safety Management, L. M. Deshmukh, Tata McGraw Hill Publication.

Reference Books

1. Environmental Engineering by Arcadio P. Sincero & Gergoria A. Sincero PHI Publication
2. Principles of Environmental Engineering and Science, M. L. Davis and S. J. Masen, McGraw Hill International Edition, 2004
3. Environmental Science, Curringham & Saigo, TMH,
4. Man and Environment by Dash & Mishra
5. An Introduction to Environmental Engineering and Science by Gilbert M. Masters & Wendell P. Ela - PHI Publication.
6. Industrial Safety Management and Technology, Colling. D A – Prentice Hall, New Delhi.

VEHICLE BODY ENGINEERING

MODULE I

CAR BODY DETAILS

12 Hours

Types: Saloon, convertibles, Limousine, Estate Van, racing and sports car.

Visibility: regulations, driver's visibility, tests for visibility – Methods of improving visibility.

Safety : safety design, safety equipments for car.

Various body panels and Construction of Car body.

MODULE II

VEHICLE AERODYNAMICS

6 Hours

Objectives – Vehicle drag and types – various types of forces and moments – Effects of forces and moments – Side wind effects on forces and moments – Various body optimization techniques for minimum drag

BUS BODY DETAILS

6 Hours

Types: Mini bus, single decker, double decker, two level, split level and articulated bus.

Bus body lay out – Floor height – Engine location – Entrance and exit location.

Constructional details: Types of metal sections used – Regulations – Conventional and Integral type construction.

MODULE III

COMMERCIAL VEHICLE DETAILS

6 Hours

Types of body – Flat platform, drop side, fixed side, tipper body, tanker body.

Light commercial vehicle body types.

Dimensions of driver's seat in relation to controls – Drivers cab design.

BODY MATERIALS, TRIM AND MECHANISMS

6 Hours

Steel sheet, timber, plastics, GRP, properties of materials.

Corrosion – Anticorrosion methods – Selection of paint and painting process

Body trim items – Body mechanisms.

TEXT

Powloski.J.Vehicle Body Engineering, Business Books Ltd., 1989.

REFERENCE:

1. Giles J.C. Body construction and design, Life books Butterworth & Co., 1971.
2. John Fenton, Vehicle Body layout and analysis, Mechanical Engg. Publication Ltd., London, 1982.
3. Braithwaite. J.B., Vehicle Body building and drawing, Heinemann Educational Books Ltd., London, 1977.

AUTOMOTIVE POLLUTION AND CONTROL

Module I Introduction

12

Pollutant formation in SI Engines, mechanism of HC and CO formation in four stroke and two stroke SI engines, NO_x formation in SI engines, effects of design and operating variables on emission formation, control of evaporative emission. Two stroke engine pollution.

Pollutant formation in CI engines, smoke and particulate emissions in CI engines, effects of design and operating variables on CI engine emissions. Noise pollution from automobiles, measurement and standards.

Module II Control of Emissions from SI and CI Engines

12

Design of engine, optimum selection of operating variables for control of emissions, EGR, Thermal reactors, secondary air injection, catalytic converters, catalysts, fuel modifications, fuel cells, Two stroke engine pollution control.

Module III Measurement Techniques, Emission Standards and Test Procedure

12

NDIR, FID, Chemiluminescent analyzers, Gas Chromatograph, smoke meters, emission standards, chassis dynamometers, dilution tunnels.

Vehicle population assessment in metropolitan cities and contribution to pollution, effects on human health and environment, global warming.

Text books

1 John B. Heywood Paul Degobert – Automobiles and Pollution – SAE International ISBN-1-56091-563-3, 1991.

2 Ganesan, V- "Internal Combustion Engines"- Tata McGraw-Hill Co.- 2003.

Reference books

1 SAE Transactions- "Vehicle Emission"- 1982 (3 volumes).

2 Obert.E.F.- "Internal Combustion Engines"- 1988

3 Marco Nute- "Emissions from two stroke engines, SAE Publication – 1998

VEHICLE DESIGN

Module I

12

Introduction of Auto System Design: Aspects of Auto Design, Design Procedure, Principle of Design, Classification of design, Basic requirements of design, Quality of Design Engineer. Automotive chassis and chassis frame: general considerations related to chassis layout, power plant location, weight distribution, stability, types of frame, materials, calculation of stresses on sections construction details, loading points, testing of frames in bending and torsion.

Module II

12

Design of IC Engine Parts: General considerations of Engine Design, Principle of Similitude, and Design of Engine Components like: Piston, Cylinder, Connecting rod, Crank shaft, Valves.

Design of Clutch: Types of friction clutches, requirements of clutches, general design consideration, design the equation for power transmitted through single plate and multi plate clutch for Uniform wear and uniform pressure, design for dimensions of clutch, equation for centrifugal clutch.

Module III

12

Design of Brake: General design considerations, braking efficiency, braking torque on the shoe, effect of expanding mechanism of shoes on braking torque, braking of vehicle for two wheel drive and four wheel drive, braking of vehicle for curved path calculation of mean lining pressure and heat generation during brake operation.

Design of Suspension System: Function suspension system in automobile, design of helical coil spring, leaf spring, materials for spring, standard sizes of automobile suspension spring.

Propeller Shaft: Design of Propeller shaft, Design of universal Joint.

Books:

Automotive Mechanics:- Dr N.K.Giri, Khanna Publishers, 2007

Reference Book:

1. A Text Book of Machine Design, R.S.Khurmi and J.K.Gupta, S.Chand Publication
2. Design of Machine Elements, V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007.
3. Machine Design, P.C.Sharma and D.K.Agrawal, S.K.Kataria & Sons

AUTOMOTIVE ELECTRICALS & ELECTRONICS

OBJECTIVE :

To impart knowledge to the students in the principles of operation and constructional details of various Automotive Electrical and Electronic Systems like Batteries, Starting System, charging System, Ignition System, Lighting System and Dash – Board Instruments, Electronic ignition system, various sensors and the role of ECU.

Module I BATTERIES, STARTING AND CHARGING SYSTEM 12Hr

Different types of Batteries – Principle, Construction and Electrochemical action of Lead – Acid battery, Electrolyte, Efficiency, Rating, Charging, Testing and Maintenance. Starting System, Starter Motors – Characteristics, Capacity requirements. Drive Mechanisms. Starter Switches.

D.C. Generators and Alternators their Characteristics. Control cutout, Electrical, Electro-mechanical and electronic regulators. Regulations for charging. Wiring Requirements, Insulated and earth return system, details of head light and side light, LED lighting system, Dash board instruments, Horns, wiper, Trafficators, Warning system and safety devices.

Module II ELECTRONIC IGNITION AND INJECTION SYSTEMS 12Hr

Spark plugs, Advance mechanisms. Different types of electronic ignition systems - variable ignition timing, distributor less ignition. Spark timing control. Cold start and warm up phases, idle speed control, acceleration and full load enrichment, deceleration fuel cutoff. Fuel control maps, Integrated engine control system Electronic fuel injection systems. Engine mapping.

Module III SENSORS AND MICROPROCESSOR IN AUTOMOBILES 12Hr

Basic sensor arrangement. Types of sensors – Oxygen sensor, fuel metering/Vehicle speed sensor, mass air flow sensor, temperature sensor, altitude sensor, pressure sensor and detonation sensor. Various actuators and its application in automobiles.

Microprocessor And Microcomputer controlled devices in automobiles such as instrument cluster, Voice warning system, Travel information system, Keyless entry system, Automatic Transmission. Environmental requirements (vibration, Temperature and EMI).

TEXTBOOK:

1. Judge. A.W., Modern Electrical Equipment of Automobiles, Chapman & Hall, London, 1992.
2. William B. Ribbens -Understanding Automotive Electronics, 5th edition- Butter worth Heinemann, 1998
3. Young. A.P., & Griffiths. L., Automobile Electrical Equipment, English Language Book Society & New Press, 1990.

REFERENCES:

1. Vinal. G.W., Storage Batteries, John Wiley & Sons inc., New York, 1985.
2. Crouse.W.H., Automobile Electrical Equipment, McGraw Hill Book Co Inc., New York, 1980.
3. Spreadbury.F.G., Electrical Ignition Equipment, Constable & Co Ltd., London, 1962.
4. Robert N Brady Automotive Computers and Digital Instrumentation, Prentice Hall, Eagle Wood Cliffs, New Jersey, 1988.
5. Kohli P L., "Automotive Electrical Equipment", Tata McGraw Hill Publishing Co., Delhi, 2004

COMBUSTION THERMODYNAMICS AND HEAT TRANSFER

Module I THERMODYNAMICS OF COMBUSTION

12Hr

Definition for Fuel and Oxidizer – types – Various combustion modes- Combustion in premixed laminar and premixed turbulent combustion - Flame Speed – Burning Velocity - diffusion flames – Combustion process in IC engines.

Thermodynamics of combustion – Thermodynamic Properties – Ideal gas law – Gas mixture combustion – Stoichiometric combustion – Thermochemistry – Hess's law- Adiabatic flame temperature – Physics of combustion – Fick's law of species diffusion – Conservation equations – Boundary layer concept

Module II NORMAL, ABNORMAL COMBUSTION IN SI ENGINES

12Hr

Stages of combustion – Flame propagation — Flame Limits –Flame Extinction -Rate of pressure rise – Cycle to cycle variation – Abnormal combustion – Theories of detonation – Effect of engine operating variables on combustion –Example problems.

Module III COMBUSTION AND HEAT TRANSFER IN IC ENGINES

12Hr

Droplet and spray combustion theory – delay period – Peak pressure – Heat release – Gas temperature – Diesel knock. Basic definitions – Convective heat transfer – Radiative heat transfer – Heat transfer, temperature distribution and thermal stresses in piston – Cylinder liner – Cylinder head – fins and valves.

Photographic studies of combustion processes – P- θ diagrams in SI and CI engines, Assembly – Temperature measurement in piston – cylinder liner – Cylinder head and engine valves.

TEXT BOOK

1. Spalding.D.B., "Some fundamentals of Combustion", Butterworth Science Publications, London, 1985.

REFERENCES

1. Lewis,B., Pease,R.N. and Taylor,H.S., "Combustion Process, High Speed Gas dynamics and Jet Propulsion Series", Princeton University Press, Princeton, New Jersey, 1976.
2. Taylor,E.F., "The Internal Combustion Engines", International Text Book Co., Pennsylvania, 1982.
3. Ganesan,V., "Internal Combustion Engines", Tata McGraw Hill Co., 1994.
4. D.P.Mishra.,Fundamentals of Combustion, PHI .,2008

AUTOMOTIVE AIR CONDITIONING

MODULE I

Air conditioning Fundamentals

12 Hours

Basic air conditioning system – Location of air conditioning components in a car – Schematic layout of a refrigeration system. Compressor components – Condenser and high pressure service ports. Thermostatic expansion valve – Expansion valve calibration – Controlling evaporator temperature – Evaporator pressure regulator – Evaporator temperature regulator.

MODULE II

Air Conditioning – Heating System

6 Hours

Automotive heaters – Manually controlled air conditioner – Heater system – Ford automatically controlled air conditioner and heater systems – Automatic temperature control – Air conditioning protection – Engine protection.

Refrigerant

6 Hours

Containers – Handling refrigerants – Tapping into the refrigerant container – Refrigeration system diagnosis – Diagnostic procedure – Ambient conditions affecting system pressures.

MODULE III

Air Routing & Temperature Control

12 Hours

Objectives – Evaporator care air flow through the dash re-circulating unit – Automatic temperature control – Duct system – Controlling flow – Vacuum reserve – Testing the air control and handling systems.

TEXT

William H Crouse and Donald L Anglin, Automotive Air conditioning, McGraw Hill Inc, 1990.

REFERENCE:

1. Mitchell Information Services, Inc, Mitchell Automatic Heating and Air conditioning systems, Prentice Hall Inc, 1989.
 2. Paul Weisler, Automotive Air Conditioning, Reston Publishing Co Inc., 1990.
 3. MacDonald. K.L., Automotive Air Conditioning, Theodore Audel series, 1978.
- Goings. L.F., Automotive Air Conditioning, American Technical Services, 1974.

HSSM3302 **OPTIMIZATION IN ENGINEERING** (3-0-0)

Module-I (10 Hours)

Idea of Engineering optimization problems, Classification of optimization algorithms, Modeling of problems and principle of modeling.

Linear programming: Formulation of LPP, Graphical solution, Simplex method, Big-M method, Revised simplex method, Duality theory and its application, Dual simplex method, Sensitivity analysis in linear programming

Module -II (10 Hours)

Transportation problems: Finding an initial basic feasible solution by Northwest Corner rule, Least Cost rule, Vogel's approximation method, Degeneracy, Optimality test, MODI method, Stepping stone method

Assignment problems: Hungarian method for solution of Assignment problems

Integer Programming: Branch and Bound algorithm for solution of integer Programming Problems

Queuing models: General characteristics, Markovian queuing model, M/M/1 model, Limited queue capacity, Multiple server, Finite sources, Queue discipline.

Module -III (10 Hours)

Non-linear programming: Introduction to non-linear programming.

Unconstrained optimization: Fibonacci and Golden Section Search method.

Constrained optimization with equality constraint: Lagrange multiplier, Projected gradient method

Constrained optimization with inequality constraint: Kuhn-Tucker condition, Quadratic programming

Introduction to Genetic Algorithm.

Recommended text books

1. A. Ravindran, D. T. Philips, J. Solberg, "*Operations Research- Principle and Practice*", Second edition, Wiley India Pvt Ltd
2. Kalyanmoy Deb, "*Optimization for Engineering Design*", PHI Learning Pvt Ltd

Recommended Reference books:

1. Stephen G. Nash, A. Sofer, "*Linear and Non-linear Programming*", McGraw Hill
2. A.Ravindran, K.M.Ragsdell, G.V.Reklaitis," *Engineering Optimization*", Second edition, Wiley India Pvt. Ltd
3. H.A.Taha,A.M.Natarajan, P.Balasubramanie, A.Tamilarasi, "*Operations Research*", Eighth Edition, Pearson Education
4. F.S.Hiller, G.J.Lieberman, "*Operations Research*", Eighth Edition, TMH.
5. P.K.Gupta, D.S.Hira, "*Operations Research*", S.Chand and Company Ltd.

FEME6301 **FINITE ELEMENT METHOD** (3-0-0)

Module – I (12 hours)

Review of 2-D and 3-D stress analyses, vibration, fluid flow and heat conduction problems.
FEM fundamental concepts, Variational principles, Rayleigh Ritz and Galerkin Methods.
Finite Element Modeling of one dimensional problems.
Finite Element Analysis of 2-D and 3-D framed structures.

Module – II (12 hours)

FEM formulation of 2-D and 3-D stress analysis problems.
Axisymmetric solids subjected to axisymmetric loadings.
Two-dimensional isoparametric elements and numerical integration.

Module – III (12 hours)

FE modeling of basic vibration problems
Finite element modeling of fluid flow and heat conduction problems
Computer programs: preprocessing and post processing.
Exposure to commercial FE codes such as ANSYS, NASTRAN and IDEAS etc.

Text Books

1. Finite Elements in Engineering, T.R.Chandraputla and A.D.Belegundu, PHI
2. The Finite Element Method – Its Basis & Fundamentals, Zienkiewicz, Taylor and Zhu, Elsevier, 6th Edn

Reference

1. Introduction to Finite Element Method, C.Desai and J.F.Abel, CBS publishers
2. Introduction to Finite Element Method, J.N.Reddy, Tata McGraw Hill
3. Numerical Methods in Finite Element Analysis, K.J.Bathe and E.L.Wilson, PHI
4. Concepts & Applications of Finite Element Analysis, Cook, D.S.Malkus & M.E.Plesha, Wiley
5. The Finite Element Method in Engineering, S.S.Rao, Elsevier
6. A First Course in the Finite Element Method, D.L.Logan, Cengage Learning
7. Fundamentals of Finite Element Analysis, David V. Hutton, Tata McGraw Hill

PEME5308 **NON-CONVENTIONAL ENERGY SOURCES**(3-0-0)

Module I (10 Classes)

Energy, Ecology and environment: Introduction, Classification of Energy Resources, Common Forms of Energy, Energy Chain, Advantages and Disadvantages of Conventional Energy Sources, Importance and Salient Features of Non-Conventional Energy Sources, Environmental and ecological Aspects of Energy use, Environment-Economy-Energy and Sustainable Development, World Energy Status, Energy Scenario in India.

Energy Conservation and Energy Storage: Salient Features of “Energy Conservation Act, 2001”, Various Aspects of Energy Conservation, Principles of Energy Conservation, General Electrical ECO’s (Energy Conservation Opportunities),

Solar Energy: Basics, The Sun as a Source of Energy, Sun, Earth Radiation Spectrums, Extraterrestrial and Terrestrial Radiations, Spectral Energy Distribution of Solar Radiation, Depletion of Solar Radiation, Measurements of Solar Radiation, Solar Time (Local Apparent Time), Solar Radiation Geometry, Solar Day Length, Empirical Equations for Estimating Solar Radiation(Hourly Global, Diffuse and Beam Radiations) on Horizontal Surface Under Cloudless and Cloudy Skies, Solar Radiation on Inclined Plane Surface only (empirical relations for numerical)

Module II (15 Classes)

Solar Thermal Systems: Solar Collectors: Flat plate and concentric collectors, Solar Water Heater, Solar Passive Space - Heating and Cooling Systems, Solar Refrigeration and Air-Conditioning Systems, Solar Cookers, Solar Furnaces, Solar Green House, Solar Dryer, Solar Distillation (or Desalination of Water),

Solar Photovoltaic Systems: Solar Cell Fundamentals, Solar Cell Characteristics, Solar Cell Classification, Solar Cell, Module, Panel and Array Construction, Solar PV Systems, Solar PV Applications.

Wind Energy: Origin of Winds, Nature of Winds, Wind Turbine Siting, Major Applications of Wind Power, Wind Turbine Types and Their Construction, Wind Energy Conversion Systems (WECS), Effects of Wind Speed and Grid Condition (System Integration),

Module III (15 Classes)

Biomass Energy: Photosynthesis Process, Usable Forms of Biomass, their Composition and Fuel Properties, Biomass Resources , Biomass Conversion Technologies, Urban Waste to Energy Conversion, Biomass Gasification ,Biomass Liquefaction, Biomass to Ethanol Production, Biogas Production from Waste Biomass, Energy Farming.

Miscellaneous Non-conventional Technologies

Geothermal Energy: Applications, Origin and Distribution of Geothermal Energy, Types of Geothermal Resource.

Ocean Energy: Tidal Energy, Wave Energy, Ocean Thermal Energy

Fuel Cell Technology: Types, Principle of operation, Advantages and disadvantages.

Text Book:

1. Non Conventional Energy Sources: B.M Khan, TMH Publications
2. Renewable Energy Sources and Emerging Technology: D.P.Kothari and etal., PHI
3. Renewable Energy Sources & Conversion Technology: N.K.Bansal, Manfred Kleenman & Michael Meliss, TMH Publication.

Reference:

1. Renewable Energy Sources:Fundamentals & Applications:G.N.Tiwari & M.K.Ghosal, Narosa Pub
2. Non Conventional Energy Resources: D.S. Chauhan and S.K.Srivastava, New Age International
3. Non Conventional Energy Sources: H.P.Garg
4. Non-Conventional Energy Systems: G.D.Rai, Khanna publications
5. Solar Energy Technology: Sukhatme and Nayak, TMH
6. Renewable Energy, Godfrey Boyle, Oxford University Press

AUTOMOTIVE ELECTRICAL AND ELECTRONICS LAB

0-0-3-2

Students are required to do any ten experiments.

1. Study of rectifier and filters,
2. Study on characteristics of amplifiers,
3. Study of logic gates, adder and flip-flops,
4. Study of SCR and IC timer,
5. D/A and A/D converter,
6. Assembly language programming exercise,
7. Interfacing A/D converter and simple data acquisition,
8. Interfacing Stepper motor control and CRT terminal,
9. Micro controller programming and interfacing,
10. Study of battery charging system
11. Testing of regulators and cutout.
12. Study of automotive electrical wiring
13. Diagnosis of ignition system faults

AUTOMOTIVE ENGINE & CHASSIS COMPONENTS LAB

OBJECTIVE:

- To familiarize and train the students on the constructional arrangements of different engine & Chassis system.

Study of the following engines and its components by dismantling, comparing with recent engine components and assembling various parts:

- Tata engine
- Ambassador engine
- Maruthi 800 CC engine
- Ford Car engine
- Two stroke engines (TVS Suzuki, Hero Honda, Scooters, Mopeds etc.)
- MPFI Engine

Study and measurement of the following chassis

- Tata
- Ambassador
- Maruthi car (Front engine, front wheel drive & constant velocity joint)
- Mahindra & Mahindra Jeep

Study, dismantling & assembling

- Front axle – Rzeppa joint assembly
- Rear axle
- Clutch 2 types – Coil spring & Diaphragm spring clutches
- Gear box – Sliding mesh, Constant mesh & Synchromesh Gear Box
- Transfer case
- Steering system
- Braking system
- Differential mechanism
- Power steering mechanism

COMPUTER AIDED ENGINE DESIGN LAB

OBJECTIVE:

To make the students understand the design concept and principles of various engine components, their materials and manufacturing techniques. These concepts and principles are familiarized for design of components.

- Design of piston, piston pin and piston rings and drawing of these components.
- Designing of connecting rod small end and big end, shank design, design of big end cap bolts and drawing of the connecting rod assembly.
- Design of crankshaft, balancing weight calculations, development of short long crankarms, front end and rear end details, drawing of the crankshaft assembly.
- Design and drawing of flywheel, ring gear design, drawing of the flywheel including the development of ring gear teeth.
- Design and drawing of the inlet and exhaust valves.
- Design of Cam and Camshaft, Cam profile generation. Drawing of cam and camshaft.
- Design of combustion chamber.
- Design and drawing of engine complete assembly involved with cylinder block, cylinder head, crankcase, valve ports, water jackets.
- Computer aided design of the above components.

TEXT BOOK:

1. Heldt,P.M., "High Speed Combustion Engine", Chilton Books Co., 1952.

REFERENCES:

1. Giles,J.G., "Engine Design", Illiffe Books Ltd., London, 1962.
2. Newton,K. and Steeds,W., "The Motor Vehicle", The English Language Book Society and Newnes Butterworth, London, 1972.
3. Khovak," Motor Vehicle Engines", MIR Publishers.
4. Kolchin,A. and Demidov,V., "Design of Automotive Engines".
