ENGINEERING MATHEMATICS – III

CODE: 10 MAT 31 **IA Marks: 25**
Hrs/Week: 04 **Exam Hrs: 03**
Total Hrs: 52 **Exam Marks:100**

PART-A

Unit-I: FOURIER SERIES

Convergence and divergence of infinite series of positive terms, definition and illustrative examples*
Periodic functions, Dirichlet's conditions, Fourier series of periodic functions of period 2π and arbitrary period, half range Fourier series. Complex form of Fourier Series. Practical harmonic analysis. **[7 hours]**

Unit-II: FOURIER TRANSFORMS

Infinite Fourier transform, Fourier Sine and Cosine transforms, properties, Inverse transforms **[6 hours]**

Unit-III: APPLICATIONS OF PDE

Various possible solutions of one dimensional wave and heat equations, two dimensional Laplace's equation by the method of separation of variables, Solution of all these equations with specified boundary conditions. D'Alembert's solution of one dimensional wave equation.

[6 hours]

Unit-IV: CURVE FITTING AND OPTIMIZATION

Curve fitting by the method of least squares- Fitting of curves of the form $y = ax+b$, $y = a x^2 + b x + c$, $y = a e^{bx}$, $y = ax^b$

Optimization: Linear programming, mathematical formulation of linear programming problem (LPP), Graphical method and simplex method.

[7 hours]

PART-B

Unit-V: NUMERICAL METHODS - 1

Numerical Solution of algebraic and transcendental equations: Regula-falsi method, Newton - Raphson method. Iterative methods of solution of a system of equations: Gauss-seidel and Relaxation methods. Largest eigen value and the corresponding eigen vector by Rayleigh's power method.

[6 hours]

Unit-VI: NUMERICAL METHODS – 2

Finite differences: Forward and backward differences, Newton's forward and backward interpolation formulae. Divided differences - Newton's divided difference formula, Lagrange's interpolation formula and inverse interpolation formula.

Numerical integration: Simpson's one-third, three-eighth and Weddle's rules (All formulae/rules without proof)

[7 hours]

Unit-VII: NUMERICAL METHODS – 3

Numerical solutions of PDE – finite difference approximation to derivatives, Numerical solution of two dimensional Laplace's equation, one dimensional heat and wave equations

[7 hours]

Unit-VIII: DIFFERENCE EQUATIONS AND Z-TRANSFORMS

Difference equations: Basic definition; Z-transforms – definition, standard Z-transforms, damping rule, shifting rule, initial value and final value theorems. Inverse Z-transform. Application of Z-transforms to solve difference equations.

[6 hours]

Note: * In the case of illustrative examples, questions are not to be set.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Latest edition, Khanna Publishers
2. Erwin Kreyszig, Advanced Engineering Mathematics, Latest edition, Wiley Publications.

Reference Book:

1. B.V. Ramana, Higher Engineering Mathematics, Latest edition, Tata Mc. Graw Hill Publications.
2. Peter V. O'Neil, Engineering Mathematics, CENGAGE Learning India Pvt Ltd.Publishers

MATERIAL SCIENCE AND METALLURGY

Sub Code : 10AU32A/10AU42A **IA Marks : 25**
Hrs/week : 04 **Exam Hours : 03**
Total Lecture Hrs : 52 **Exam Marks: 100**

PART - A

UNIT – 1 Crystal Structure:

BCC, FCC and HCP Structures, coordination number and atomic packing factors, crystal imperfections -point line and surface imperfections. Atomic Diffusion: Phenomenon, Flick's laws of diffusion, factors affecting diffusion.

06 Hours

UNIT – 2 Mechanical Behaviour:

Stress-strain diagram showing ductile and brittle behaviour of materials, linear and non linear elastic behaviour and properties, mechanical properties in plastic range, yield strength offset yield strength, dutility, ultimate tensile strength, toughness. Plastic deformation of single crystal by slip and twinning.

06 Hours

UNIT – 3

Fracture:

Type I, Type II and Type III.

Creep:

Description of the phenomenon with examples. three stages of creep, creep properties, stress relaxation.

Fatigue:
Types of fatigue loading with examples, Mechanism of fatigue, fatigue properties, fatigue testing and SN diagram.

07 Hours

UNIT – 4 Solidification:

Mechanism of solidification, Homogenous and Hetrogeneous nucleation, crystal growth, cast metal structures.

Phase Diagram I:
Solid solutions Hume Rothary rule substitional, and interstitial solid solutions, intermediate phases, Gibbs phase rule.

07 Hours

PART - B

UNIT – 5 Phase Diagram II:

Construction of equilibrium diagrams involving complete and partial solubility, lever rule. Iron carbon equilibrium diagram description of phases, solidification of steels and cast irons, invariant reactions.

06 Hours

UNIT – 6 Heat treating of metals:

TTT curves, continous cooling curves, annealing and its types. normalizing, hardening, tempering, martempering, austempering, hardenability, surface hardening methods like carburizing, cyaniding, nitriding, flarne hardening and induction hardening, age hardening of aluminium-copper alloys.

07 Hours

UNIT – 7 Ferrous and non ferrous materials:

Properties, Compostion and uses of

- Grey cast iron, malleable iron, S.G iron and steel
- Copper alloys-brasses and bronzes.
- Aluminium alloys-Al-Cu,Al-Si,Al-Zn alloys.

06 Hours

UNIT – 8 Composite Materials:

Definition, classification, types of matrix materials & reinforcements, fundamentals of production of FRP' sand MMC's advantages and application of composites.

07 Hours

TEXT BOOKS:

1. **Foundations of Materials Science and Engineering,** Smith, 3rd Edition McGraw Hill, 2009
2. **Materials Science, Shackleford., & M. K. Muralidhara,** Pearson Publication – 2007.

REFERENCE BOOKS:

1. **An introductionn to Metallurgy; Alan Cottrell**, University Press India Oriental Longman Pvt. Ltd., 1974.
2. **Engineering Materials Science**, W.C.Richards, PHI, 1965
3. **Physical Metallurgy**; Lakhtin, Mir Publications
4. **Materials Science and Engineering,** V.Raghavan , PHI, 2002
5. **Elements of Materials Science and Engineering,** H. VanVlack, Addison- Wesley Edn., 1998
6. **Materials Science and Engineering,**William D. Callister Jr., John Wiley & Sons. Inc, 5th Edition, 2001.
7. **The Science and Engineering of Materials,** Donald R. Askland and Pradeep.P. Phule, Thompson Learning, 4lh Ed., 2003.

MECHANICAL MEASUREMENTS AND METROLOGY

Sub Code	**: 10AU32B/10AU42B**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks:**	**100**

PART- A

UNIT-1: Standards of measurement:

Definition and Objectives of metrology, Standards of length-International prototype meter, Imperial standard yard, Wave length standard, subdivision of standards, line and end standard, calibration of end bars (Numerical), Slip gauges, Wringing phenomena, Indian Standards (M-81, M-12), Numerical problems on building of slip gauges.

06 Hours

UNIT-2: System of Limits, Fits, Tolerance and Gauging:

Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly limits of size, Indian standards, concept of limits of size and tolerances, compound tolerances, accumulation of tolerances, definition of fits, types of fits and their designation (IS919-1963), geometrical tolerance, positional-tolerances, hole basis system, shaft basis system, classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials.

07 Hours

UNIT-3: Comparators and Angular measurement:

Introduction to comparators, characteristics, classification of comparators, mechanical comparators-Johnson Mikrokator, sigma comparators, dial indicator, optical comparators-principles, Zeiss ultra optimeter, electric and electronic comparators-principles, LVDT, pneumatic comparators, back pressure gauges, solex comparators. Angular measurements, bevel protractor, sine principle and use of sine bars, sine centre, use of angle gauges (numericals on building of angles), clinometers.

07 Hours

UNIT-4: Interferometer and screw thread, gear measurement:

Interferometer, interferemetry, autocollimator. Optical flats. Terminology of screw threads, measurementof major diameter, minor diameter, pitch, angle and effective diameter of screw threadsby 2-wire and 3-wire methods, best size wire. Tool maker's microscope, gear to, terminology, use of gear tooth vernier caliper and micrometer.

06 Hours

PART-B

UNIT-5: Measurements and measurement systems:

Definition, significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysterisis, repeatability, linearity, loading effect, system response-times delay. Errors in measurement, classification of errors. Transducers, transfer efficiency, primary and secondary transducers, electrical, mechanical, electronic transducers, advantages of each type transducers.

07 Hours

UNIT-6 Intermediate: modifying and terminating devices:
Mechanical systems, inherent problems, electrical intermediate modifying devices, input circuitry, ballast circuit, electronic amplifiers and telemetry. Terminating devices, mechanical, cathode ray oscilloscope, oscillographs, X-Y plotters.

06 Hours

UNIT-7:Measurement of force, torque and pressure:
Principle, analytical balance,platform balance, proving ring. Torque measurement, Prony brake, hydraulicdynamometer. Pressure measurements, principle, use of elastic merijbers, Bridgemangauge, Mcloed gauge, Pirani gauge.

06 Hours

I
UNIT-8:Temperature and strain measurement:
Resistance thermometers, thermocouple, law of thermo couple, materials used for construction, pyrometer, optical pyrometer. Strain measurements, strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement.

07 Hours

TEXT BOOKS:

1. **Mechanical Measurements,** Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.
2. **Engineering Metrology,** R.K. Jain, Khanna Publishers, 1994.

REFERENCE BOOKS:

1. **Engineering Metrology,** I.C. Gupta, Dhapat Rai Publications,Delhi.
2. **Mechanical Measurements,** R.K. Jain
3. **Industrial Instrumentation,** Alsutko, Jerry. D. Faulk, Thompson Asia Pvt. Ltd.2002.
4. **Measurement Systems Applications and Design,** Ernest O. Doblin, McGraw Hill Book Co.

BASIC THERMODYNAMICS

Sub Code	**: 10AU33**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks:**	**100**

PART-A

UNIT – 1Fndamental Concepts & Definitions:

Thermodynamis; definition and scope, Microscopic and Macroscopic approaches. Engineering thermodynamics; definition, some practical applications of engineering thermodynamic. System (Closed system) and Control Volume (open system); Characteristics of system boundary and control surface, examples. Thermodynamic properties; definition and units, intensive and extensive properties. Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic preesses; Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium, Zeroth law of thermodynamics, Temperature; concepts, scales, measurement. Internal fixed points.

07 Hours

UNIT – 2Work and Heat:

Mechancis, defintion of work and its limitations. Thermodynamic definition of work; examples, sign convention. Displacement work; at part of a system boundary, at whole of a system boundary, expressions for displacement work in various processes through p-v diagrams. Shaft work; Electrical work. Other types of work. Heat; definition, units and sign convention, what heat is not.

06 Hours

UNIT – 3First Law of Thermodynamics:

Joules expriments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes, energy, energy as a property, modes of energy, pure substance; definition, two-property rule, Specific heat at constant volume, enthalpy, specific heat constant pressure. Extension of the First law to control volume; steady state-steady flow energy equation, important applications, analysis of unsteady processes such as filmg and evacuation of vessels with and without heat transfer.

06 Hours

UNIT – 4Second Law of Thermodynamics:

Devices converting heat to work; (a) in a thermodynacmic cycle, (b) in a mechanical cycle. Thermal reservoir. Direct heat engine; schematic representation and efficiency. Devices converting work to heat in a theromodynamic cycle; reserved heat engine, schematic representation, coefficients of performace. Keivin - Planck statement of the Secnd law of Thermodynamics; PMM II and PMM I, Clasius statement of Second law of Thermodynamics,Equivalence of the two statements; Reversible and irrevesible processes; factors that make a process irreversible, reversible heat engines, Carnot cycle, Carnot principles. Thermodynamic temperature scale.

07 Hours

PART-B

UNIT – 5Entropy:

Clasius inequality; Statement, proof, application to a reversible cycle. Entropy; definition, a property, principle of increase of entropy, entropy as a quantitative test for irreversibility, calculation of entropy using Tds relations, entropy as a coordinate. Available and unavailable energy.

06 Hours

UNIT – 6 Pure Substances:

P-T and P-V diagrams, triple point and critical points. Sub-cooled liquid, saturated liquid, mixture of saturated liquid and vapour, saturated vapour and superheated vapour states of pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness fraction (quality), T-S and H-S diagrams, representation of various processes on these diagrams. Steam tables and its use. Throttling calorimeter, separating and throttling calorimeter.

07 Hours

UNIT – 7 Thermodynamic relations:

Maxwell relation, Causius Clayperon's equation. Ideal gas; equation of state, internal energy and enthalpy as functions of temperature only, universal and partiuclar gas constans, specific heats, perfect and semi-perfect gases. Evaluation of heat, work, change in internal energy. enthalpy and entropy in various quasi-static processes.

07 Hours

UNIT – 8 Ideal gas mixture :

Ideal gas mixture;Dalton's laws of partial pressures, Amagat's law of additive volumes, evaluation of properties, Analysis of various process. Real Gases: Introduction. Vander Waal's Equation of state, Vander Waal's constants in terms of critical properties, law of corresponding states, compressiblity factor; compressibility chart

06 Hours

TEXT BOOKS:

1. **Basic and Applied Thermodynamics,** P.K.Nag, Tata McGraw Hul Pub. 2002
2. **Thermodynamcis**, An Engineering Approach, Yunus A.Cenegal and Michael A.Boles, Tata McGraw Hill publications, 2002

REFERENCE BOOKS:

1. **K.A.Venkatesh Basic Engineering Thermodynomics,** Thermodynomic data hand book by B.T. Nijaguna. (To be supplied in the examination)
2. **Engineering Thermodynamics**, J.B.Jones and G.A.Hawkins, John Wiley and Sons..
3. **Fundamentals of Cloassical Thermodynamics**, G.J.Van Wylen and R.E.Sonntag, Wiley Eastern.
4. **An Introduction to Thermodynamcis**, Y.V.C.Rao, Wiley Eastern, 1993,
5. **B.K Venkanna "Basic Thermodynomics,** PHI New Delhi

MECHANICS OF MATERIALS

Sub Code	**: 10AU34**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks:**	**100**

PART-A

UNIT 1: Simple Stress and Strain:

Introduction, Stress, strain, mechanical properties of materials, Linear elasticity, Hooke's Law and Poisson's ratio, Stress-Strain relation - behaviour in tension for Mild steel, cast iron and non ferrous metals. Extension / Shortening of a bar, bars with cross sections varying in steps, bars with continuously varying cross sections (circular and rectangular), Elongation due to self weight, Principle of super position.

07 Hours

UNIT 2: Stress in Composite Section:

Volumetric strain, expression for volumetric strain, elastic constants, simple shear stress, shear strain, temperature stresses (including compound bars).

06 Hours

UNIT 3: Compound Stresses:

Introduction, Plane stress, stresses on inclined sections, principal stresses and maximum shear stresses, Mohr's circle for plane stress.

07 Hours

UNIT 4:

Energy Methods:

Work and strain energy, Strain energy in bar/beams, castiglinios theorem, Energy methods.

Thick and Thin Cylinder Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume). Thick cylinders Lame's equation (compound cylinders not included).

06 Hours

PART-B

UNIT 5: **Bending Moment and Shear Force in Beams**:

Introduction, Types of beams, loads and reactions, shear forces and bending moments, rate of loading, sign conventions, relationship between shear force and bending moments. Shear force and bending moment diagrams for different beams subjected to concentrated loads, uniformly distributed load, (UDL) uniformly varying load (UVL) and couple for different types of beams.

07 Hours

UNIT 6: Bending and Shear Stresses in Beams:

Introduction, Theory of simple bending, assumptions in simple bending. Bending stress equation, relationship between bending stress,radius of curvature, relationship between bending moment and radius of curvature.Moment carrying capacity of a section.Shearing stresses in beams, shear stress across rectangular, circular, symmetrical I and T sections. (composite / flotched beams not included).

07 Hours

UNIT 7:Deflection of Beams:

Introduction, Differential equation for deflection. Equations for deflection, slope and bending moment. Double integration method for cantilever and simply supported beams for point load, UDL, UVL and Couple. Macaulay's method

06 Hours

UNIT 8:Torsion of Circular Shafts and Elastic Stability of Columns:

Introduction. Pure torsion,assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts. Power transmitted by solid and hollow circular shafts

Columns: Euler's theory for axially loaded elastic long columns. Derivation of Euler's load for various end conditions, limitations of Euler's theory, Rankine's formula.

06 Hours

TEXT BOOKS:

1. **"Mechanics of Materials",** by R.C.Hibbeler, Printice Hall. Pearson Edu., 2005
2. **"Mechanics of materials",** James.M.Gere, Thomson, Fifth edition 2004.
3. **"Mechanics of materials",** in S.I. Units, Ferdinand Beer & Russell Johnstan, TATA Mc GrawHill- 2003.

REFERENCE BOOKS:

1. **"Strength of Materials",** S.S. Rattan, Tata McGraw Hill, 2009
2. **"Strength of Materials",** S.S.Bhavikatti, Vikas publications House -1 Pvt. Ltd., 2nd Ed., 2006.
3. **"Mechanics of Materials",** K.V. Rao, G.C. Raju, First Edition, 2007
4. **"Engineering Mechanics of Solids**", Egor.P. Popov, Pearson Edu. India, 2nd, Edison, 1998.
5. **"Strength of Materials",** W.A. Nash, Sehaum's Outline Series, Fourth Edition-2007.

MANUFACTURING PROCESS – I

Sub Code	**: 10AU35**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks:**	**100**

PART – A

CASTING PROCESS

UNIT 1: Introduction:

Concept of Manufacturing process, its importance. Classification of Manufacturing processes. Introduction to Casting process & steps involved. Varieties of components produced by casting process. Advantages & Limitations of casting process.

Patterns: Definition, functions, Materials used for pattern, various pattern allowances and their importance. Classification of patterns, BIS colour coding of Patterns.

Binder: Definition, Types of binder used in moulding sand.

Additives: Need, Types of additives used.

06 Hours

UNIT 2: Sand Moulding :

Types of base sand, requirement of base sand. Moulding sand mixture ingredients (base sand, binder & additives) for different sand mixtures. Method used for sand moulding, such as Green sand, dry sand and skin dried moulds.

Cores: Definition, Need, Types. Method of making cores, Binders used,core sand moulding.

Concept of Gating & Risering. Principle and types.

Fettling and cleaning of castings. Basic steps, Casting defects, Causes, features and remedies.

Moulding Machines : Jolt type, Squeeze type, Jolt & Squeeze type and Sand slinger.

07 Hours

UNIT 3: Special moulding

Process: Study of important moulding processes, No bake moulds, Flaskless moulds, Sweep mould, CO_2 mould, Shell mould, Investment mould.

Metal moulds: Gravity die-casting, Pressure die casting, Centrifugal casting, Squeeze Casting, Slush casting, Thixocasting and Continuous Casting Processes.

07 Hours

UNIT 4: Melting Furnaces:

Classification of furnaces. Constructional features & working principle of coke fired, oil fired and Gas fired pit furnace, Resistance furnace, Coreless Induction furnace, Electric Arc Furnace, Cupola furnace.

06 Hours

PART – B

WELDING

UNIT 5: Welding process:

Definition, Principles, Classification, Application, Advantages & limitations of welding.

Arc Welding: Principle, Metal Arc welding **(MAW)**, Flux Shielded Metal Arc Welding **(FSMAW)**, Inert Gas Welding **(TIG & MIG)** Submerged Arc Welding **(SAW)** and Atomic Hydrogen Welding processes. **(AHW)**

Gas Welding: Principle, Oxy – Acetylene welding, Chemical Reaction in Gas welding, Flame characteristics. Gas torch construction & working. Forward and backward welding.

07 Hours

UNIT 6: Special types of welding:

Resistance welding - principles, Seam welding, Butt welding, Spot welding and projection welding. Friction welding, Explosive welding, Thermit welding, Laser welding and Electron beam welding.

07 Hours

UNIT 7: Metallurgical aspect, in welding :

Structure of welds, Formation of different zones during welding. Heat affected zone **(HAZ).** Parameters affecting **HAZ**. Effect of carbon content on structure and properties of steel. Shrinkage in welds & Residual stresses.
Concept of electrodes, Filler rod and fluxes. Welding defects – Detection causes & remedy.

06 Hours

UNIT 8: Principles of soldering & brazing:

Parameters involved & Mechanism. Different Types of Soldering & Brazing Methods.

Inspection Methods:

Methods used for Inspection of casting and welding. Visual, Magnetic particle, Fluorescent particle, Ultrasonic, Radiography, Eddy current, Holography methods of Inspection.

06 Hours

TEXT BOOKS:

1. **"Manufacturing Process-I",** Dr.K.Radhakrishna, Sapna Book House, 5th Revised Edition 2009.
2. **"Manufacturing & Technology**: Foundry Forming and Welding", P.N.Rao 2nd Ed., Tata McGraw Hill, 2003.

REFERENCE BOOKS:

1. **"Manufacturing Technology**", Serope Kalpakjain, Steuen.R.Sechmid, Pearson Education Asia, 5th Ed. 2006.
2. **"Process and Materials of Manufacturing**", Roy A Lindberg, 4th Ed. Pearson Edu. 2006.

COMPUTER AIDED MACHINE DRAWING

Sub Code : 10AU36A/10AU46A **IA Marks : 25**
Hrs/week : 04(1 Hrs. Theory & 2 Hrs Practical) **Exam Hours : 03**
Total Lecture Hrs : 52 **Exam Marks : 100**

PART A (2D Only)

Introduction:
Review of graphic interface of the software. Review of basic sketching commands and navigational commands. Starting a new drawing sheet. Sheet sizes. Naming a drawing. Drawing units, grid and snap. 2Hrs

Unit – 1: Sections of Solids:
Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on, axis inclinations, spheres and hollow solids). True shape of sections. **Orthographic views:** Conversion of pictorial views into orthographic projections of simple machine parts with or without section. (Bureau of Indian Standards conventions are to be followed for the drawings) Hidden line conventions. Precedence of lines. 8Hrs

Unit – 2: Thread Forms :
Thread terminology, forms of threads – BSW Thread, Sellers thread, ISO Metric thread, square and Acme thread. Conventional representation of threads. **Fasteners**: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly). Types of Bolt heads, special types of nuts, locking of nuts, Studs, set screws, grub screws. 8Hrs

PART B (2D Only)

Unit – 3: Keys, Cotter and knuckle Joints: Types of Keys, Cotter and knuckle Joints,
Riveted Joints: lap joints- single and double riveted lap joints, butt joints with single/double cover straps (Chain and Zigzag, using snaphead rivets). 8Hrs

Unit – 4: Automotive Components:
Clutch lever, Spark plug, IC Engine valve, Valve tappet lever, crank lever, rocker arm, Cylinder liner, Cylinder and Cylinder head of two stroke petrol engine, Crank shaft and cam shaft, stubaxle Oldham's coupling and universal coupling (Hooks' Joint) 8**Hrs**

PART C
Assembly Drawings
(Part drawings should be given)

Assembly drawing of following machine parts (3D parts to be created and assembled and then getting 2D drawing with required views, along with 3D part drawings).
1. Plummer block (Pedestal Bearing)
2. Petrol Engine piston
3. I.C. Engine connecting rod
4.Fuel Injector
5.Clutches(Single and multi Plate)
6. Master Cylinder and Wheel Cylinder
7. Carburettor 18**Hrs**

Text books

1. 'Machine Drawing' , K.R. Gopala Krishna, Subhash Publication.
2. 'A Primer on Computer Aided Machine Drawing', Published by VTU, Belgaum.
3. 'Machine Drawing', N.D.Bhat & V.M.Panchal
4. 'Machine Drawing' , N. Siddeshwar, P. Kanniah, V.V.S. Sastri,published by Tata Mc GrawHill,2006
5. 'Automobile Engineering Drawing', R.B.Gupta, Satya Prakashan, New Delhi

Reference Books

1. 'A Text Book of Computer Aided Machine Drawing', S. Trymbaka Murthy, CBS Publishers, New Delhi, 2007
2. 'Machine Drawing with Auto CAD'. Goutam Purohit & Goutham Ghosh, 1st Indian print Pearson Education, 2005
3. 'Auto CAD 2006, for engineers and designers'. Sham Tickoo. Dreamtech 2005

NOTE:

Internal assessment: 25 Marks

All the sheets should be drawn in the class using software. Sheet sizes should be A3/A4. All sheets must be submitted at the end of the class by taking printouts.

Scheme of Examination:

Two questions to be set from each Part-A, Part-B and Part-C
Student has to answer one question each from Part-A and Part-B for 20 marks each. And one question from Part-C for 60 marks.

i.e.	**PART-A 1x20**	**= 20 Marks**
	PART-B 1x20	**= 20 Marks**
	PART-C 1x60	**= 60 Marks**
	Total	**= 100 Marks**

FLUID MECHANICS

Sub Code	**: 10AU36B/ 10AU46B**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART – A

UNIT-1: **Properties of Fluids:**

Introduction, Properties of fluids, viscosity, thermodynamic properties, surface tension, capillarity, vapour pressure and cavitation

06 Hours

UNIT-2: **Fluid Statics** :

Fluid pressure at a point, Pascal's law, pressure variation in a static fluid, absolute, gauge, atmospheric and vacuum pressures, simple manometers and differential manometers. Total pressure and center of pressure on submerged plane surfaces; horizontal, vertical and inclined plane surfaces, curved surface submerged in liquid.

07 Hours

UNIT-3: **Buoyancy and Fluid Kinematics**:

Buoyancy, center of buoyancy, metacentre and metacentric height, conditions of equilibrium of floating and submerged bodies, determination of Metacentric height experimentally and theoretically.
Kinematics: Types of fluid flow, continuity equation in 2D and 3D (Carversian Co-ordinates only, velocity and acceleration, velocity potential function and stream function.

07 Hours

UNIT-4: **Fluid Dynamics**:

Introduction equation of motion, Euler's equation of motion, Bernoulli's equation from first principles and also from Euler's equation, limitations of Bernoulli's equation.

06 Hours

PART-B

UNIT-5: **Fluid Flow Measurements** :

Venturimeter, orificemeter, pitot-tube, vertical orifice, V-Notch and rectangular notches.

Dimensional Analysis : Introduction, derived quantities, dimensions of physical quantities, dimensional homogeneity, Rayleigh's method, Buckingham π theorem, dimensionless numbers, similitude, types of similtudes.

07 Hours

UNIT-6: **Flow through pipes** :

Minor losses through pipes. Darey's and Chezy's equation for loss of head due to friction in pipes. HGL andTEL.

06 Hours

UNIT-7: **Laminar flow and viscous effects** :

Reyonold's number, critical Reynold's number, laminar flow through circular pipe-Hagen Poiseille's equation, laminar flow between parallel and stationary plates.

06 Hours

UNIT-8: **Flow past immersed bodies** :

Drag, Lift, expression for lift and drag, boundary layer concept, displacement, momentum and energy thickness.

Introduction to compressible flow : Velocity of sound in a fluid, Mach nuber, Mach cone, propogation of pressure waves in a compressible fluid.

07 Hours

TEXT BOOKS:

1. Fluid Mechanics by Oijush.K.Kundu, IRAM COCHEN, ELSEVIER, 3rd Ed. 2005.
2. Fluid Mechancis by Dr. Bansal, R.K.Lakshmi Publications, 2004.

REFERENCE BOOKS:

1. Fluid Mechanics and hydraulics, Dr.Jagadishlal: Metropolitan Book Co-Ltd., 1997.
2. Fluid Mechanics (SI Units), Yunus A. Cingel John M.Oimbala. Tata MaGrawHill, 2006.
3. Fluid Mechanics by John F.Douglas, Janul and M.Gasiosek and john A.Swaffield, Pearson Education Asia, 5th ed., 2006
4. Fluid Mechanics and Fluid Power Engineering, Kumar.D.S, Kataria and Sons., 2004
5. Fluid Mechanics -. Merle C. Potter, Elaine P.Scott. Cengage learning

METALLOGRAPHY AND MATERIAL TESTING LABORATORY

Sub Code	**: 10AUL 37A /10AUL47A**	**IA Marks**	**: 25**
Hrs/week	**: 03**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 48**	**Exam Marks**	**: 50**

PART – A

1. Preparation of specimen for Metallograpic examination of different engineering materials. Identification of microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & composites.
2. Heat treatment: Annealing, normalizing, hardening and tempering of steel. Hardness studies of heat-treated samples.
3. To study the wear characteristics of ferrous, non-ferrous and composite materials for different parameters.
4. Non-destructive test experiments like,
   (a). Ultrasonic flaw detection
   (b). Magnetic crack detection
   (c). Dye penetration testing. To study the defects of Cast and Welded specimens

PART – B

1. Tensile, shear and compression tests of metallic and non metallic specimens using Universal Testing Machine
2. Torsion Test
3. Bending Test on metallic and nonmetallic specimens.
4. Izod and Charpy Tests on M.S,C.I Specimen.
5. Brinell, Rockwell and Vickers's Hardness test.
6. Fatigue Test.

Scheme of Examination:

ONE question from part -A:	20 Marks
ONE question from part -B:	**20 Marks**
Viva -Voice:	10 Marks
Total:	50 Marks

MECHANICAL MEASUREMENTS AND METROLOGY LABORATORY

Sub Code	**: 10AUL 37B /10AUL47B**	**IA Marks**	**: 25**
Hrs/week	**: 03**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 48**	**Exam Marks**	**: 50**

PART-A: MECHANICAL MEASUREMENTS

1. Calibration of Pressure Gauge
2. Calibration of Thermocouple
3. Calibration of LVDT
4. Calibration of Load cell
5. Determination of modulus of elasticity of a mild steel specimen using strain gauges.

PART-B: METROLOGY

1. Measurements using Optical Projector / Toolmaker Microscope.
2. Measurement of angle using Sine Center / Sine bar / bevel protractor
3. Measurement of alignment using Autocollimator / Roller set
4. Measurement of cutting tool forces using
    a. Lathe tool Dynamometer
    b. Drill tool Dynamometer.
5. Measurement of Screw thread Parameters using Two wire or Three-wire method.
6. Measurements of Surface roughness, Using Tally Surf/Mechanical Comparator
7. Measurement of gear tooth profile using gear tooth vernier /Gear tooth micrometer
8. Calibration of Micrometer using slip gauges
9. Measurement using Optical Flats

Scheme of Examination:

ONE question from Metrology (part -A)	20 Marks
ONE question from Instrumentation (part -B)	20 Marks
Viva –Voce	10 Marks
Total	**50 Marks**

FOUNDRY AND FORGING LABORATORY

Sub Code	**: 10AUL 38A /10AUL48A**	**IA Marks**	**: 25**
Hrs/week	**: 03**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 48**	**Exam Marks**	**: 50**

PART – A

1. Testing of Moulding sand and Core sand

Preparation of sand specimens and conduction of the following tests:

1 Compression, Shear and Tensile tests on Universal Sand Testing Machine.
2 Permeability test
3 Core hardness & Mould hardness tests.
4 Sieve Analysis to find Grain Finest number of Base Sand
5 Clay content determination in Base Sand

PART – B

2. Foundry Practice

Use of foundry tools and other equipments.
Preparation of moulds using two moulding boxes using patterns or without patterns. (Split pattern, Match plate pattern and Core boxes).
Preparation of one casting (Aluminum or cast iron-Demonstration only)

PART – C

3. Forging Operations

• Calculation of length of the row material requited to do the modle.

• Preparing minimum three forged models involving upsetting, drawing and bending operations.
• Out of these three models, at least one model is to be prepared by using Power Hammer.

Scheme of Examination:

One question is to be set from Part-A: 10 marks

One question is to be set from either

Part-B or Part-C: 30 marks

Calculation part in case of forging is made compulsory

Calculation (Forging)	+ Foundry Model	= 05 +25 = 30 Marks

Viva-Voce: 10 marks.

Total: 50 marks.

MACHINE SHOP

Sub Code	**: 10AUL38B / 10AUL48B**	**IA Marks**	**: 25**
Hrs/week	**: 03**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 48**	**Exam Marks**	**: 50**

PART – A

Preparation of three models on lathe involving Plain turning, Taper turning, Step turning, Thread cutting, Facing, Knurling, Drilling, Boring, Internal Thread cutting and Eccentric turning.

PART – B

Cutting of V Groove/ dovetail / Rectangular groove using a shaper.

Cutting of Gear Teeth using Milling Machine.

Scheme of Examination:

One Model from Part – A	30 marks
One Model from Part – B	10 marks
Viva – Voce	10 marks
Total	**50 marks**

ENGINEERING MATHEMATICS – IV

CODE: 10 MAT 41 **IA Marks: 25**
Hrs/Week: 04 **Exam Hrs: 03**
Total Hrs: 52 **Exam Marks:100**

PART-A

Unit-I: NUMERICAL METHODS - 1

Numerical solution of ordinary differential equations of first order and first degree; Picard's method, Taylor's series method, modified Euler's method, Runge-kutta method of fourth-order. Milne's and Adams - Bashforth predictor and corrector methods (No derivations of formulae).

[6 hours]

Unit-II: NUMERICAL METHODS – 2

Numerical solution of simultaneous first order ordinary differential equations: Picard's method, Runge-Kutta method of fourth-order.
Numerical solution of second order ordinary differential equations: Picard's method, Runge-Kutta method and Milne's method.

[6 hours]

Unit-III: Complex variables – 1

Function of a complex variable, Analytic functions-Cauchy-Riemann equations in cartesian and polar forms. Properties of analytic functions.
Application to flow problems- complex potential, velocity potential, equipotential lines, stream functions, stream lines.

[7 hours]

Unit-IV: Complex variables – 2

Conformal Transformations: Bilinear Transformations. Discussion of Transformations: $w = z^2$, $w = e^z$, $w = z + (a^2 / z)$. Complex line integrals- Cauchy's theorem and Cauchy's integral formula.

[7 hours]

PART-B

Unit-V: SPECIAL FUNCTIONS

Solution of Laplace equation in cylindrical and spherical systems leading Bessel's and Legendre's differential equations, Series solution of Bessel's differential equation leading to Bessel function of first kind. Orthogonal property of Bessel functions. Series solution of Legendre's differential equation leading to Legendre polynomials, Rodrigue's formula.

[7 hours]

Unit-VI: PROBABILITY THEORY - 1

Probability of an event, empherical and axiomatic definition, probability associated with set theory, addition law, conditional probability, multiplication law, Baye's theorem.

[6 hours]

Unit-VII: PROBABILITY THEORY- 2

Random variables (discrete and continuous), probability density function, cumulative density function. Probability distributions – Binomial and Poisson distributions; Exponential and normal distributions.

[7 hours]

Unit-VIII: SAMPLING THEORY

Sampling, Sampling distributions, standard error, test of hypothesis for means, confidence limits for means, student's t-distribution. Chi -Square distribution as a test of goodness of fit

[6 hours]

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Latest edition, Khanna Publishers
2. Erwin Kreyszig, Advanced Engineering Mathematics, Latest edition, Wiley Publications.

Reference Book:

1. B.V. Ramana, Higher Engineering Mathematics, Latest edition, Tata Mc. Graw Hill Publications.
2. Peter V. O'Neil, Engineering Mathematics, CENGAGE Learning India Pvt Ltd.Publishers

APPLIED THERMODYNAMICS

Sub Code	**: 10AU43**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks:**	**100**

PART-A

Unit 1: Combustion thermodynamics:

Theoritical (Stoichiometeric) air for combustion of fuels. Excess air, mass balance, actual combustion. Exhaust gas analysis. A./ F ratio, Energy balance for a chemical reaction, enthalpy of formation, enthalpy and internal energy of combustion, Combustion efficiency

07 Hours

Unit 2: I.C.Engine:

Testing of two stroke and four stroke SI and CI engines for performance Related numerical problems, heat balance , Morse test. **06 Hours**

Unit 3: Gas power cycle:Air Standard cycles: Carnot, Otto, Diesel, Dual and Stirling cycles,P-V and T-S diagrams, description, efficiencies and mean effective pressures, Comparision of Otto and Diesel cycles.

06 Hours

Unit 4: Vapour Power Cycles:

Carnot vapour power cycles, drawbacks as a reference cycle, Simple Rankine cycle, description, T- S diagram, analysis for performance , comparision of Carnot and Rankine cycles. Effects of pressure and temperature on Rankine cycle performance. Actual vapour power cycles. Ideal and practical regenerative Rankine cycle, open and closed feed water heaters, Reheat Rankine cycle.

07 Hours

PART-B

Unit 5: Reciprocating Compressors:

Operation of a single stage reciprocating compressors, work input through P-V diagram and steady state steady flow analysis. Effect of clearance and volumetric efficiency. Adiabatic, isothermal and mechanical efficiencies. Multistage compressor, saving in work, optimum intermediate pressure, inter- cooling, minimum work for compression.

06 Hours

Unit 6: Gas turbine and Jet propulsion:

Classification of Gas turbines, Analysis of open cycle gas turbine cycle. Advantages and disadvantages of closed cycle. Methods to improve thermal efficiency, Jet propulsion and Rocket propulsion.

07 Hours

Unit 7 Refrigeration:

Vapour compression refrigeration system ; description, analysis, refrigerating effect, capacity , power required, units of refrigeration, COP , Refrigerants and their desirable properties. Air cycle refrigeration; reversed Carnot cycle, reversed Brayton cycle, Vapour absorption refrigeration system, steam jet refrigeration.

06 Hours

Unit 8 Psychrometry:

Atmospheric air and psychrometric properties; Dry bulb temperature, wet bulb temperature, dew point temperature; partial pressures, specific and relative humidifies and the relation between the two enthalpy and adiapatic saturation temperature. Construction and use of psychrometric chart . Analysis of various processes; heating, cooling , dehumidifying and humidifying. Adiabatic mixing of moist air. Summer and winter air conditioning.

07 Hours

NOTE:

1. **Thermodynamics data hand book,** B.T.Nijaguna (to be supplied in the examination)
2. A copy of Psychrometry chart to be given along with answer book to the candidates (if needed)

TEXT BOOK

1. **Basic and applied Thermodynamics**, P.K. Nag, Tata Mc Graw Hill Pub.Co,2002
2. **Applied Thermodynamics**, Rajput, Laxmi Publication
3. **Applied Thermodynamics**, B.K. Venkahna, PHI, New Delhi

REFERENCE BOOKS

1. **Thermodynamics , An engineering approach**, Yunus, A. Cenegal and Michael A.Boies, Tata Me Graw Hill pub. Co., 2002,
2. **Fundamental of Classical Thermodynamics,** G.J. Van Wylen and R.E. Sontang Wiley eastern.
3. **"Applied Thermodynamics",** B.K Venkanna, PHI New Delhi

KINEMATICS OF MACHINES

Sub Code	**: 10AU44**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART - A

UNIT 1: Introduction:

Definitions Link or element, kinematic pairs, Degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, Structure, Mobility of Mechanism, Inversion, Machine.

Kinematic Chains and Inversions: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain.

07 Hours

UNIT 2: Mechanisms:

Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism.

Straight line motion mechanisms Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms -Geneva wheel mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph, Ackerman steering gear mechanism.

06 Hours

UNIT 3: Velocity and Acceleration Analysis of Mechanisms (Graphical Methods)

Velocity and acceleration analysis of Four Bar mechanism, slider crank mechanism and Simple Mechanisms by vector polygons: Relative velocity and acceleration of particles .in a common link, relative velocity and accelerations of coincident Particles on separate links- Coriolis component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing.

07 Hours

UNIT 4:

Velocity Analysis by Instantaneous Center Method: Definition, Kennedy's Theorem, Determination of linear and angular velocity using instantaneous center method
Klein's Construction: Analysis of velocity and acceleration of single slider crank mechanism.

06 Hours

PART - B

UNIT 5: Velocity and Acceleration Analysis of Mechanisms (Analytical Methods):

Analysis of four bar chain and slider crank chain using analytical expressions. (Use of complex algebra and vector algebra)

06 Hours

UNIT 6: Spur Gears:

Gear terminology, law of gearing, Characteristics of involute action, Path of contact. Arc of contact, Contact ratio of spur, helical, bevel and worm gears, Interference in involute gears. Methods of avoiding interference, Back lash. Comparison of involute and cycloidal teeth. Profile Modification.

07 Hours

UNIT 7:Gear Trains:

Simple gear trains, Compound gear trains for large speed. reduction, Epicyclic gear trains, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear trains.

07 Hours

UNIT 8:Cams:

Types of cams, Types of followers. Displacement, Velocity and, Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife-edge, roller and flat-face follower, Disc cam with oscillating roller follower. Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.

06 Hours

TEXT BOOKS:

1. **"Theory of Machines",** Rattan S.S, Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 3rd edition -2009.
2. **"Theory of Machines",** Sadhu Singh, Pearson Education (Singapore) Pvt. Ltd, Indian Branch New Delhi, 2nd Edi. 2006

REFERENCE BOOKS:

1. **"Theory of Machines & Mechanisms**", J.J. Uicker, , G.R. Pennock, J.E. Shigley. OXFORD 3rd Ed. 2009.
2. **Mechanism and Machine theory**, Ambakar, PHI

Graphical Solutions may be obtained either on the Graph Sheets or on the Answer Book itself.

MANUFACTURING PROCESS – II

Sub Code : 06 AU 45 **IA Marks : 25**
Hrs/week: 04 Exam Hours: 03
Total Lecture Hrs: 52 Exam Marks : 100

PART – A

UNIT – 1Theory of Metal Cutting:
Single point cutting tool nomenclature, geometry. Mechanics of Chip Formation,Types of Chips. Merchants circle diagram and analysis, Ernst Merchant's solution, shear angle relationship, problems of Merchant's analysis. Tool Wear and Tool failure, tool life. Effects of cutting parameters on tool life. Tool Failure Criteria, Taylor's Tool Life equation. Problems on tool life evaluation.

07 Hours.

UNIT – 2 Cutting Tool Materials:
Desired properties and types of cutting tool materials – HSS, carbides coated carbides, ceramics. Cutting fluids. Desired properties, types and selection. Heat generation in metal cutting, factors affecting heat generation. Heat distribution in tool and workpiece and chip. Measurement of tool tip temperature.

07 Hours.

UNIT – 3 Turning (Lathe), Shaping and Planing Machines:
Classification, constructional features of Turret and Capstan Lathe. Tool Layout, shaping Machine, Planing Machine, Driving mechanisms of lathe, shaping and planing machines, Different operations on lathe, shaping machine and planing machine. Simple problems on machinery time calculations

07 Hours.

UNIT – 4 Drilling machines:
Classification, constructional features, drilling & related operations. Types of drill & drill bit nomenclature, drill materials.
Introduction to CNC machines- Principles of operation. Axes of NC machine-Coordinate systems. Basics of Manual part programming methods.

06 Hours.

PART – B

UNIT – 5 Milling machines:
Classification, constructional features, milling cutters nomenclature, milling operations, up milling and down milling concepts. Various milling operations.
Indexing: Simple, compound, differential and angular indexing calculations. Simple problems on simple and compound indexing.

06 Hours.

UNIT – 6 Grinding machines:
Types of abrasives,Grain size, bonding process, grade and structure of grinding wheels, grinding wheel types. Classification, constructional features of grinding machines (Centreless , cylindrical and surface grinding). Selection of grinding wheel. Grinding process parameters. Dressiing and truing of grinding wheels.

07 **Hours.**

UNIT - 7: Broaching process –
Principle of broaching. Details of a broach. Types of broaching machines-constructional details. Applications. Advantages and Limitations.
Finishing and other Processes Laping and Honing operations – Principles, arrangement of set up and application. Super finishing process, polishing, buffing operation and application.

06 Hours.

UNIT – 8;Non-traditional machining processes:
Need for non traditional machining, Principle, equipment & operation of Laser Beam, Plasma Arc Machining, Electro Chemical Machining, Ultrasonic Machining, Abrasive Jet Machining, Water Jet Machining, Electron Beam Machining, Electron Discharge Machining and Plasma Arc Machining.

06 Hours

Text Books:

1. **Workshop Technology,** Hazara Choudhry, Vol-II, Media Promoters & Publishers Pvt. Ltd. 2004
2. **Production Technology,** R.K.Jain, Khanna Publications, 2003.
3. **Production Technology,** HMT, Tata MacGraw Hill, 2001.

Reference Books:

1. **Manufacturing Science**, Amitabha Ghosh and Mallik, affiliated East West Press, 2003.
2. **Fundamentals of Metal Machining and Machine Tools,** G. Boothroyd, McGraw Hill, 2000.

MANAGEMENT AND ENTREPRENEURSHIP

Sub Code	**: 10AL 51**	**IA Marks**	**: 25**
Hrs/week	**: 04**	**Exam Hours**	**: 03**
Total Lecture Hrs	**: 52**	**Exam Marks**	**: 100**

PART – A

MANAGEMENT

UNIT - 1

MANAGEMENT: Introduction - Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as a science, art of profession - Management & Administration - Roles of Management, Levels of Management, Development of Management Thought - early management approaches - Modem management approaches.

7 Hours

UNIT - 2

PLANNING: Nature, importance and purpose of planning process Objectives - Types of plans (Meaning Only) - Decision making Importance of planning - steps in planning & planning premises - Hierarchy of plans.

6 Hours

UNIT - 3

ORGANIZING AND STAFFING: Nature and purpose of organization Principles of organization - Types of organization - Departmentation Committees- Centralization Vs Decentralization of authority. and responsibility - Span of control - MBO and MBE (Meaning Only) Nature and importance of staffing--:Process of Selection & Recruitment (in brief).

6 Hours

UNIT - 4

DIRECTING & CONTROLLING: Meaning and nature of directing Leadership styles, Motivation Theories, Communication - Meaning and importance - coordination, meaning and importance and Techniques of Co Ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control (in brief):

7 Hours

PART-B

ENTREPRENEURSHIP

UNIT - 5

ENTREPRENEUR: Meaning of Entrepreneur; Evolution of .the Concept; Functions of an Entrepreneur, Types of Entrepreneur, Entrepreneur - an emerging. Class. Concept of Entrepreneurship - Evolution of Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship - its Barriers.

6 Hours

UNIT – 6

SMALL SCALE INDUSTRIES: Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI Steps to start and SSI - Government policy towards SSI; Different Policies of SSI; Government Support for SSI during 5 year plans. Impact of Liberalization, Privatization, Globalization on SSI Effect of WTO/GA TT Supporting Agencies of Government for SSI, Meaning, Nature of support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry (Definition Only)

7 Hours

UNIT - 7

INSTITUTIONAL SUPPORT: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI; NSIC; SIDBI; KSFC.

7 Hours

UNIT - 8

PREPARATION OF PROJECT: Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; Formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of business opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.

7 Hours

TEXT BOOKS:

1. **Principles of Management –** P. C.Tripathi, P.N. Reddy – Tata McGraw Hill,
2. **Dynamics of Entrepreneurial Development & Management** Vasant Desai - Himalaya Publishing House
3. **Entrepreneurship Development** – Poornima. M. Charantimath Small Business Enterprises - Pearson Education - 2006 (2 & 4).

REFERENCE BOOKS:

1. **Management Fundamentals** - Concepts, Application, Skill Development - Robers Lusier - Thomson
2. **Entrepreneurship Development** - S.S.Khanka - S.Chand & Co.
3. **Management** - Stephen Robbins - Pearson Education/PHI - 17th Edition, 2003.

DESIGN OF MACHINES ELEMENTS-I

Sub Code: 10AU52 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART – A

UNIT – 1 INTRODUCTION

Designation and Mechanical properties of Engineering Materials, design considerations, basic design concept (strength consideration), Failure of brittle materials, Failure of ductile materials, factor of safety, criteria for selection of factor of safety, design of simple machine members subjected to static loading (including eccentric load) [limited to biaxial stresses (normal, shear, bending, torsional, crushing/bearing, principal stresses)]. **06 Hrs**

UNIT – 2

THEORIES OF FAILURE - Maximum normal stress theory, Maximum shear stress theory, Distortion energy theory.

STRESS CONCENTRATION, Stress concentration factor, design of simple elements with stress raisers.

IMPACT STRENGTH: Introduction, Impact stresses due to axial, bending and torsional loads, effect of inertia. **06 Hrs**

UNIT – 3 DESIGN OF MACHINE MEMBERS SUBJECTED TO FLUCTUATING LOAD:

Introduction, types of fluctuating stresses, fatigue and endurance limit, S-N Diagram, Low cycle fatigue, High cycle fatigue, endurance limit modifying factors: load, size and surface factors, Stress concentration effects; notch sensitivity, design for infinite life, combined steady and variable stress, Soderberg and Goodman relationship, stresses due to combined loading, cumulative fatigue damage – Miner's equation.

08 Hrs

UNIT – 4 DESIGN OF SIMPLE MACHINE ELEMENTS

Design of Cotter and Knuckle joints. Keys: Types of keys, Design of keys, Couplings, types of couplings, design of flange type of rigid coupling, design of Bush and Pin type of flexible couplings.

06 Hrs

PART - B

UNIT – 5 DESIGN OF SHAFTS

Introduction, types of shafts, shafts subjected to combined bending and twisting, shaft design (including hollow shafts) based on strength, shaft design based on torsional rigidity, ASME code for shaft design.

07 Hrs

UNIT - 6

THREADED JOINTS: Introduction, basic terminology of screw threads, types
Of screw threads, types of screw fastenings, designations of screw threads, Stresses in threaded fasteners due to static loading, Effect of initial tension, threaded joints for cylinder covers, design of eccentrically loaded bolted joints. **06 Hrs**

UNIT - 7

RIVETED JOINTS – Introduction, methods of riveting, Types of rivets, rivet materials, types of riveted joints, failures of riveted joints, joint efficiency, design of boiler Joints.

06 Hrs

UNIT – 8

WELDED JOINTS Introduction, types of welded joints, design of welded joints (butt joints, fillet welds, axially loaded unsymmetrical welded joints, eccentrically loaded welded joints),

POWER SCREWS: Introduction, Types of screw threads used for power screws, Design of Power Screws, efficiency, self-locking and over hauling. **07 Hrs**

DESIGN DATA HAND BOOKS:

1. **Design Data Hand Book** by K. Mahadevan and Balaveera Reddy, CBS Publication
2. **Design Data Hand Book** – K. Lingaiah, McGraw Hill, 2nd Ed.2003.
3. **PSG design data handbook** by PSG College of Technology, Coimbatore.

TEXT BOOKS:

1. **Design of Machine Elements:** V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007.
2. **A text book of Machine Design:** R.S. Khurmi and J.K. Gupta, S.Chand & co.

REFERENCE BOOKS:

1. Mechanical Engineering Design: Joseph E Shigley and Charles R. Mischke. Tata McGraw Hill Publishing Company, 8th Edition 2008.
2. **Theory and problems of Machine Design:** Hall, Holowenko, Laughlin (Schaum's Outlines series), Tata McGraw Hill Publishing Company Ltd., New Delhi.
3. **Machine design:** Paul H. Black, McGraw-Hill International Book Company.
4. Machine design-I: J.B.K. Das, Sapna book house, Bangalore.

5. Machine design: Robert L Norton, Prentice hall.

AUTOMOTIVE ENGINES AND COMPONENTS

Sub Code: 10AU53 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART - A

UNIT-I Introduction

Historical development of automobiles, Heat Engines & their classification. Reciprocating IC Engines - Basic Engine Components & Nomenclature, Principle of engine operation, Comparison of SI & CI Engines, Comparison of Two Stroke & Four Stroke Engines, Classification of I C engines, applications of IC Engines **Four stroke engines,** Principles of engine operation (SI & CI), Actual Valve timing - mechanical and dynamic factors, Relative merits & demerits of petrol & diesel engines.

7 Hrs

UNIT-2 Two stroke engines

Principles of engine operation (SI & CI), Port timing diagrams.

Types - Three port engine, Separate pumps or blowers, Symmetrical & unsymmetrical timing, Cross flow, loop flow & uniflow type Scavenging systems. Scavenging Process – Pre blow down, Blow down, Scavenging, Additional Charging. Theoretical Scavenging processes, Scavenging parameters, Comparison of Different Scavenging Systems; port design, scavenging pumps. Relative merits & demerits of petrol & diesel engines. **7 Hrs**

II - Engine components

- **Classification/types, function, materials, construction details, manufacturing, Troubles & Remedies and Design of major dimensions of the following engine components**

UNIT-3 Cylinder heads & Cylinder Block

Cylinder heads, Gaskets, cylinder wear, water jacket, Cylinder liners, and valve seats. Production of engine block – casting, cleaning, treatment, machining operations and transfer machines

6 **Hrs**

UNIT-4 Crank Case, Manifolds and Mufflers

Crank Case – General form of crank case, oil sumps and cooling features, flywheel mountings, Engine mountings, Front & Rear mountings. Manifolds and Mufflers - inlet and exhaust manifolds, mixture distribution, heating by exhaust gas, dual manifolds, General Design of Manifolds, effect of firing order, Mufflers, general design. **6 Hrs**

PART – B

UNIT-5 Piston, piston rings, piston pin

Piston Temperatures, piston slap, compensation of thermal expansion in pistons. Piston Rings, forms of gap, stresses in piston rings, ring collapse, heat treatment, piston ring selection, shape. Piston pin, locking of piston pins, length of piston. **7 Hrs**

UNIT-6 Connecting rod

Length of rod, Cross section, Buckling, Drilled connecting rods, piston pin bearing, offset connecting rods, effects of whipping, bearing materials, lubrication . **6 Hrs**

UNIT-7 Crank shaft

Balance weights, local balance, Crankshaft proportions, oil holes drilled in crank shafts, balancing , vibration dampers, firing order, bearings, lubrication. **6 Hrs**

UNIT-8 Valve and valve mechanism

No. of Valves per cylinder, Angle of seat, Operating Conditions, operating temperatures, valve cooling, Sodium cooled valves, Valve rotators, valve seats, valve guides, , valve springs, valve clearance, valve timing, OHV, OHC, dual valves, types of valve operating mechanisms. Valve train component details, Camshaft,-drives of cams, cam types, tappets,-automatic zero clearance tappets, push rods, rocker arms & rocker Shaft. **7 Hrs**

TEXT BOOKS:

1. High Speed Engines - P.M.Heldt, Oxford & IBH, 1965
2. Auto Design – R.B Gupta, Satya Prakash, New Delhi 1999

REFERENCE BOOKS:

1. A course in I.C. Engine - Mathur & Sharma , Dhanpat Rai & Sons, Delhi, 1994
2. Internal Combustion Engines-V Ganesan, Tata McGraw Hill, Delhi, 2002
3. Automobile Engineering Vol. II - Kirpal Singh, Standard publications, New Delhi, 2005
4. Modern Petrol Engine - A.W.Judge, B.I. Publications. 1983
5. I.C. Engine - Maleev & Litchy, McGraw Hill
6. I.C.Engines - H.B.Keshwani, Standard Pub New Delhi., 1982
7. Fundamentals of I.C.Engines - J.B.Heywood, McGraw Hill International Edition

8. Machine design exercises - S.N.Trikha, Khanna publications, Delhi
9. Machine design - P.C. Sharma & D.K. Aggarwal, S.K Kataria & sons, Delhi
10. Machine design exercises - R K Jain, Khanna Publishers, New Delhi
11. Automotive mechanics - William H. Crouse, Tata Mc, Graw Hill Publications Co. New Delhi
12. Theory & practice in I C Engines (vol. I & II)- C F Taylor

DYNAMICS OF MACHINES

Sub Code: 10AU54 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART – A

UNIT – 1 Static force analysis

Introduction, Static equilibrium, Equilibrium of two force, three force and four force members, Members with two forces and torque, Free body diagrams, Static force analysis (graphical) of four bar mechanism and slider-crank mechanism without friction, effect of sliding friction, friction in pin joints, Static force analysis (graphical) of four bar mechanism and slider-crank mechanism with friction. **06 Hours**

UNIT – 2 Dynamic/Inertia force analysis

Introduction, D'Alembert's principle, Inertia force, inertia torque, dynamically equivalent systems, correction couple, line of action of inertia force in a link, inertia force analysis (graphical) of a four bar mechanism, inertia force analysis (analytical) of slider crank mechanism [(i) neglecting the mass of the connecting rod; (ii) considering the mass of the connecting rod].

07 Hours

UNIT – 3 Flywheels

Introduction, Turning moment diagrams, Fluctuation of Energy and speed, energy stored in a flywheel, determination of size of flywheels. **07 Hours**

UNIT – 4 Analysis of cams

Introduction, Analysis of (i) tangent cam with roller follower (ii) Circular arc cam with flat faced follower.

05 Hours

PART - B

UNIT – 5 Balancing of rotating masses

Introduction, Static and dynamic balancing, balancing of single revolving mass by balancing masses in same plane and in different planes, Balancing of several masses revolving in the same plane, balancing of several masses revolving in different planes.

06 Hours

UNIT – 6 Balancing of reciprocating masses

Introduction, primary balancing, secondary balancing, Inertia effect of crank and connecting rod, balancing of single cylinder engine, balancing of multi cylinder-inline engine, balancing of radial engines, balancing of V - engines. **08 Hours**

UNIT – 7 Governors:

Introduction, Types of governors; force analysis of Porter and Hartnell governors. Controlling force, stability, condition for stability, sensitiveness, isochronisms, hunting, effort and power of governor.

06 Hours

UNIT – 8 Gyroscopes

Introduction, Vectorial representation of angular motion, gyroscopic couple, effect of gyroscopic couple on bearings, aircraft, ship, stability of two wheelers and four wheelers.

07 Hours

TEXT BOOKS:

1. Theory of Machines: V.P. Singh, Dhanpat Rai & Co.
2. Theory of Machines: Rattan S.S. Tata McGraw Hill Publishing Company Ltd.
3. Theory of Machines: Sadhu Singh, Pearson Publications

REFERENCE BOOKS:

1. Theory Of Machines And Mechanisms by Joseph E. Shigley, Jr. Uicker John, McGrawhill publications.
2. Dynamics of Machinery by A.R.Holowenko, John Wiley & sons.
3. Kinematics & Dynamics of Machinery by R L. Norton, Tata - McGraw Hill.
4. Theory of Machines by R.S.Khurmi and J.K.Gupta, S.Chand and Co.
5. Theory of Machines by P.L. Ballaney, Khanna Publishers.
6. Theory of Machines by Dr. R.K. Bansal, Laxmi Publications.
7. Theory of Machines-2 by J.B.K.Das, Sapna book house.

AUXILIARY SYSTEMS OF AUTOMOTIVE ENGINES

Sub Code: 10AU55 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART-A

UNIT-1 CARBURETION

Carburetor principal, Properties of air-petrol mixtures, Mixture requirements for steady state and transient operation, Mixture formation studies of volatile fuels, design of elementary carburetor, Chokes, Effects of altitude on carburetion, Carburetor for 2-stroke and 4-stroke engines, carburetor systems for emission control. 6 Hrs

UNIT-2 GASOLINE FUEL INJECTION

Petrol Injection Systems: Direct Injection, Indirect Injection, Injection considerations,Comparison of petrol injection and Carburetted fuel supply systems, K-jetronic fuel injectionsystem(Bosch), Ignition system. 8Hrs

DIESEL FUEL INJECTION:

UNIT-3 Fuel pump and Governors

Types, constructional features and operation, Factors influencing fuel spray atomization,penetration and dispersion of diesel and heavy oils and their properties, rate and duration of injection, fuel line hydraulics. 6 Hrs

UNIT-4 Types of diesel injection systems

CRDI, Inline Fuel Injection Pumps, Filters, transfer pumps (fuel feed pumps), injectors and nozzles – types, functions and necessities, fuel injection pump principle, ratio of piston displacement to fuel charge volume, delivery characteristics, injection lag, pressure waves in fuel lines. 6 Hrs

PART-B

UNIT-5 MANIFOLDS AND MIXTURE DISTRIBUTION

Intake system components, Discharge coefficient, Pressure drop, Air filter, Intake manifold, Connecting pipe, Exhaust system components, Exhaust manifold and exhaust pipe, Spark arresters, Waste heat recovery, Exhaust mufflers, Type of mufflers, exhaust manifold expansion. 6Hrs

UNIT-6 COOLING SYSTEM

Necessity, variation of gas temperature, Areas oh heat flow, heat transfer, piston and cylinder temperature,. Heat rejected to coolant, quantity of water required, cooling system, air cooling, water cooling, thermodynamics of forced circulation, thermostats, pressurized water cooling, regenerative cooling, comparison of air and water cooling, radiators – types, cooling fan – power requirement, antifreeze solution, types of coolant 8 Hrs

UNIT-7 LUBRICATION SYSTEM

Lubricants, lubricating systems, Lubrication of piston rings, bearings, oil consumption, Oil cooling. Heat transfer coefficients, liquid and air cooled engines, coolants, additives and lubricity improvers, concept of adiabatic engines, oil filters, pumps, and crankcase ventilation – types. 6 Hrs

UNIT-8 SUPERCHARGING AND TURBOCHARGING:

Purpose, thermodynamic cycle, effect on the performance, turbo charging, limits of supercharging for petrol and diesel engines. Modifications of an engine for super charging - methods of super charging – super charging and turbo charging of two stroke and four stroke engines. 6Hrs

TEXT BOOKS:

1.Mathur,M.L., and Sharma,R.P., “A Course in Internal Combustion Engines”, Dhanpat Rai Publications (P) Ltd., 1998.

2. Kirpal singh, “Automobile Engineering Vol I & II”, Standard Pub, New Delhi, 2005

3.Heinz Heisler, “Advanced Engine Technology”, SAE International Publication

REFERENCES BOOKS

1. Ramalingam,K.K, Internal Combustion Engine, Scitech Publication (India) Pvt.Ltd.2000.
2. Domkundwar, V.M, A Course in Internal Combustion Engines, Dhanpat Rai and Co., 1999.
3. Ganesan, V., Internal Combustion Engines, Tata McGraw-Hill Book Co., 1995.
4. Duffy Smith, Auto Fuel Sytstems, The Good Heart Willcox Company Inc., Publishers, 1987.
5. Edward F, Obert, Internal Combustion Engines and Air Pollution, Intext Education Publishers, 1980.
6. H.B. Keshwani, “ I.C engines”, Standard publication, New delhi, !982
7. R.K. Mohanty, “ Automobile Engineering Vol. I & II “ Standard Book house, New Delhi. 2006
8. Automotive mechanics - William H. Crouse, Tata Mc,Graw Hill Publications Co. New Delhi
9. Jack Erjavec, “ Automotive technology” 3rd Edition, Chennai, Micro Thomson Asia Pvt. Ltd, 2004

AUTOMOTIVE FUELS AND COMBUSTION

Sub Code: 10AU56 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART-A

UNIT-1 Energy Sources:

Exhaustible sources - crude oil, Natural gas, Inexhaustible sources - Solar energy, Wind power, Tidal Power, Geo-thermal power. Energy from Bio-gas, Synthetic fuels – Fuel Cells, Hydrogen- only a brief introduction. **4 Hrs**

UNIT-2 Liquid Fuels:

Origin of petroleum, its chemistry, normal paraffin’s, isoparaffins, olefins, naphthalene and aromatics. Refining of petroleum: Fractional distillation, Cracking, Reforming process, Thermal reforming, polymerization, alkylation, and isomerisation. Properties and tests : Specific Gravity, viscosity, flash and fire points, calorific value, rating of fuels, vapour pressure, cloud and pour point, annealing point, diesel index, carbon residue and ash content determination

6Hrs

UNIT-3 Combustion of Fuels:

Combustion equation, conversion of gravimetric to volumetric analysis. Determination of theoretical minimum quantity of air for complete combustion. Determination of air fuel ratio for a given fuel. Numerical problems, flue gas analysis, gas Chromatograph. **6 Hrs**

UNIT-4 Petrol and Diesel Fuels:

Properties and rating of fuels, chemical energy of fuels, Reaction Equation, Properties of A/F mixture, combustion temp, combustion charts, Lead free gasoline’s, low and ultra – low sulphur diesels, LPG, CNG, Alcohols, Biodiesels, Gaseous Fuel Injections, Dual Fueling and Controls – CNG and Gasoline, Hydrogen and Diesel, Alcohols and Diesels etc.

ENGINE PERFORMANCE: Performance parameters BHP, FHP, IHP, specific fuel consumption, volumetric efficiency, Thermal efficiency, heat Balance sheet, Testing of Engines, Numerical problems

6Hrs

UNIT-5 Cycle Analysis:

Otto, Diesel, Dual, sterling and Brayton cycles, comparison of air standard, fuel air and actual cycles, simple problems on the above topics. Rotary engines. Stirling engine, Stratified charge engine

6 Hrs

PART-B

UNIT-6 Combustion in S.I Engines

Initiation of combustion, flame velocities, effect of variables on flame propagation, normal and abnormal combustion, knocking combustion, pre-ignition, knock and engine variables, detonation, effects of engine variables on combustion, control of detonation, CFR engine, features and design consideration of combustion chambers, stratified charge combustion, concepts of lean burn engines, heat release correlations

9Hrs

UNIT-7 Combustion in C.I. Engines

Various stages of combustion, vaporization of fuel droplets and spray formation, air motion, swirl, squish, tumble flow, velocities, swirl measurement, and delay period correlations, diesel knock and engine variables, features and design considerations of combustion chambers, types, heat release correlations.

9Hrs

UNIT-8 Dual fuel and Multifuel Engines:

Combustion in dual fuel engines, Factor affecting combustion. Main types of gaseous fuels, Supercharge knock control & Performance of diesel fuel engines. Characteristics of multi fuel engines, Modification of fuel system, suitability of various engines as multi fuel unit, performance of multi fuel engines.

6Hrs

TEXT BOOKS

1. I.C. Engines By Mathur & Sharma, Dhanpat Rai & Sons, New Delhi, 1994
2. Fuels & Combustion by S.P. Sharma & Chandra Mohan, Tata McGraw-Hill, New Delhi,1987

REFERENCE BOOKS:

1. Ganesan, V, Internal Combustion Engines, Tata McGraw Hill Book Co., 1995.
2. John B.Heywood, Internal Combustion Engine Fundamentals, McGraw Hill Book, 1998
3. Obert, E.F., Internal Combustion Engine and Air Pollution, International Text Book Publishers, 1983.
4. Ram lingam, K.K., Internal Combustion Engines, SciTech Publications (India) Pvt. Ltd., 2000.
5. Fuels & Combustion by Smith & Stinson,
6. I.C. Engines by Lichty
7. I.C. Engines by Maleev, CBS Pub.

AUTOMOBILE ENGG. LAB. -I

Sub Code: 10AUL57 **IA Marks: 25**

Hrs/Week: 03 **Exam Hrs: 03**

Total Lecture Hrs: 42 **Exam Marks: 50**

1. Study of hand tools- sketching, materials used and their applications.

2. Writing technical specifications and description of all types of automobile engines.

3. Study of traffic rules as per M.V. Act 1988 and driving practice of four wheel vehicle.

4. Trouble shooting charts for all engine components.

5. Note the specifications of given engines and component standard dimensions. Dismantle & assemble of engine components of SI and CI engines (Two stroke and four stroke engines) of any commercial vehicles, using special tools needed. Note procedure of dismantling & assembly; identify the major components, noting their functions & materials used. Measurement & comparison of major components dimension with standard specifications. Inspection for wear and tear, crack, breakdown. Identify the service requirements of engine, such as decarburizing, degreasing, sparkplug cleaning, fuel injector cleaning, etc.

6. Compression test, vacuum test on diesel and petrol engines.

7. Study (Dismantling & assembly): Different carburetors, fuel injection pumps, injectors, fuel tanks, fuel filters, fuel pumps, turbo-chargers, cooling systems and lubricating systems. Identify location of above components in a vehicle and note their functions along with the brand names.

Scheme of Examination

ONE Question from Chapter 1,2,3,4	10 Marks
ONE Question from Chapter 5	20 Marks
ONE Question from Chapter 6 & 7	10 Marks
Viva-Voce	10 Marks

FUEL TESING AND FLUID MECHANICS LAB

Sub Code: 10AUL58 **IA Marks: 25**
Hrs/Week: 03 **Exam Hrs: 03**
Total Lecture Hrs: 42 **Exam Marks: 50**

1. Determination of Flash and Fire Points of fuels and lubricants
2. Determination of calorific values of solid, liquid and gaseous fuels
3. Determination of viscosity of oils using Redwood, Say bolts and Torsion viscometer.
4. Measurement of areas of irregular figure Using of Plan meters
5. Determination of Carbon residue and Moisture content in a fuel.
6. Determination of cloud and pour points of light, medium and heavy oils.
7. Drawing of Valve and port timing diagram for a given engine.
8. Determination of compression ratio for a given engine.
9. Performance testing of fluid pumps.
10. Performance testing of air blower.
11. Determination of coefficient of discharge of venturi meter, orifice meter.
12. Determination of major and minor losses in pipe flow (bend, sudden expansion, sudden contraction, entry and exit).

Scheme of Examination

ONE Question from Chapter 1 to 8	15 Marks
ONE Question from Chapter 9-12	25 Marks
Viva-Voce	10 Marks

Scheme of Examination:-Theory subjects
In general, One question to be set from each chapter. Students have to answer any FIVE full questions out of EIGHT questions, choosing at least TWO questions from Part A and TWO questions from Part B.

AUTOMOTIVE CHASSIS AND SUSPENSION

Sub Code: 10AU61 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART- A

UNIT-1 Introduction:

General consideration relating to chassis layout, power location, types of automobiles, layout of an automobile with reference to power plant, weight distribution, stability, Numerical problems.

5Hrs

UNIT-2 Frames:

Types of frames – Two, Three, four wheelers & HV, general form & dimensions, materials, frame stresses, frame sections, cross members, proportions of channel sections, constructional details, loading points, sub frames, passenger car frames, X member type frame, Box section type frame, testing of frames, bending and torsion test, effect of brake application of frame stresses, truck frames, defects, Numerical problems.

5 Hrs

UNIT-3 Front axle and steering systems:

Axle parts and materials, loads and stresses, centre sections, section near steering head, spring pads, front axle loads, steering heads, factors of wheel alignment, wheel balancing, centre point steering, correct steering angle, steering mechanisms, cornering force, self righting torque, under steer and over steer, Steering linkages, steering gears, special steering columns, power steering, trouble shooting, Numerical problems. **7 Hrs**

UNIT-4 Propeller shaft, Differential and Rear axle:

construction & types of propeller shafts, whirling of propeller shaft, universal joints, analysis of Hooke's joint- ratio of shafts velocities, maximum & minimum speeds of driven shaft, condition for equal speeds of thee driving & driven shafts, angular acceleration of the driven shaft, maximum fluctuation of speed, double Hooke's joint, Numerical problems.

Final drive – construction details, types, Differential-Principle, types of differential gears, conventional and non-slip differentials, backlash, differential lock, inter-axle differential, transaxle types.

Rear axle - Torque reaction, driving thrust, Hotchkiss drive, torque tube drive, construction of rear axle shaft supporting- fully floating and semi floating arrangements axle housings, trouble shooting, numerical problems **9 Hrs**

PART -B

UNIT-5 Brakes-1

Necessity, stopping distance and time, brake efficiency, weight transfer, brake shoe theory, determination of braking torque, classification of brakes, types, construction, function, operation, braking systems - mechanical, hydraulic, disc, drum, details of hydraulic system, mechanical system and components, types of master & wheel cylinders, bleeding of brakes, brake drums, brake linings, brake fluid, factors influencing operation of brakes such as operating temperature, lining, brake clearance, pedal pressure, linkages etc, Numerical problems. **8 Hrs**

UNIT-6 Brakes-2

Brake compensation, Parking and emergency brakes, hill holder, automatic adjustment, servo brakes, Power brakes-Air brakes, vacuum brakes and electric brakes and components brake valve, unloaded valve, diaphragm, air-hydraulic brakes, vacuum boosted hydraulic brakes, trouble shooting

6 Hrs

UNIT-7 Suspension:

Objects, basic considerations, Types of suspension springs, construction , operation & materials, leaf springs, coil springs, torsion bar, rubber springs, plastic springs, air bellows or pneumatic suspension, hydraulic suspension, constructional details of telescopic shock absorbers, independent suspension, front wheel independent suspension, rear wheel independent suspension, types, stabilizer, trouble shooting, Numerical problems. **6 Hrs**

UNIT-8 Wheels and Tyres:

Types of wheels, construction, structure and function, wheel dimensions, structure and function of tyres, static and dynamic properties of pneumatic tyres, types of tyres, materials, tyre section & designation, factors affecting tyre life, quick change wheels, special wheels, trouble shooting'

6 Hrs

Note: Numerical problems shall be simple and limited to the syllabus content of each chapter.

TEXT BOOKS:

1. Automotive Chassis – P.M. Heldt, Chilton & Co.
2. Automotive Mechanics – N.K. Giri , Khanna Publications, New Delhi,2004

REFERENCE BOOKS:

1. Automotive chassis and body – P.L. Kohli, TMH

2. Automobile Engineering Vol. I - Kirpal Singh, Standard publications, New Delhi,

3. Introduction to automobile engineering – N.R. Khatawate, Khanna pub. New Delhi

4. Automotive mechanics – Joseph I Heintner, Affiliated East West Press, New Delhi/Madras,1967

5. Automobile engineering – G.B.S. Narang, Khanna Publications, New Delhi, 1982

6. Automobile Engineering – T.R. Banga & Nathu Singh, Khanna Publications, 1993

AUTOMOTIVE TRANSMISSION

Sub Code: 10AU62 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART- A

UNIT-1 Power Required for Propulsion

Various Resistances to Motion of the Automobile, Traction, tractive effort Performance curves, acceleration gradeability, drawbar pull, Numerical Problems. **6 hrs**

UNIT-2 Clutch

Necessity of clutch in an automobile, different types of clutches, friction clutches namely Single plate clutch, multi plate clutch, cone clutch, centrifugal clutch, electromagnetic clutch, hydraulic clutches, Clutch - adjustment, Clutch troubles and their causes, requirements of a clutch , Clutch materials, clutch lining Vacuum operated clutch, Numerical problem

8 hrs

UNIT-3 Fluid Coupling & One way clutches:

Constructional details of various types, percentage slip, one way clutches (Over running clutch) like sprag clutch, ball and roller one way clutches, necessity and field of application, working fluid requirements, fluid coupling characteristics. **6 hrs**

UNIT-4 Hydrodynamic Torque converters:

Introduction to torque converters, comparisons between fluid coupling and torque converters, performance characteristics, slip, principles of torque multiplication, 3 and 4 phase torque converters, typical hydrodynamic transmission. **6 hrs**

PART -B

UNIT-5 Gear box

The need for transmissions, Necessity of gear box, Calculation of gear ratios for vehicles, Performance characteristics in different gears , Desirable ratios of 3speed & 4speed gear boxes, Constructional details of , Sliding-mesh gear box , Constant-mesh gear box, synchromesh gear box, auxiliary transmissions, compound transmissions , numerical problems

8 hrs

UNIT-6 Epicyclic Transmission

Principle of operation, types of planetary transmission, Calculation of gear ratio in different speeds, Wilson planetary transmission, Ford-T model gear box , Pre selective mechanism, Vacuum control, pneumatic control, hydraulic control in the planetary gear system , Over drives , Numerical problems

6 hrs

UNIT-7 Hydrostatic Drives

Principles of hydrostatic drives, different systems of hydrostatic drives, constant displacement pump and constant displacement motor, variable displacement pump and constant displacement motor and variable displacement motor, variable displacement pump and variable displacement motor, applications, plunger type pump and plunger type motor, advantages and limitations, typical hydrostatic drives, hydrostatic shunt drives.

6 hrs

UNIT-8 Automatic & Electric Transmissions

Automatic transmission - Principle, general description and Working of representative types like Borge-warner and general arrangement & description of electric transmission, their working principle & control mechanisms, limitations 6 hrs

TEXT BOOKS:

1. N.K Giri, 'Automotive Mechanics', Khanna Publication, New Delhi, 2004
2. Automatic vehicle transmission, John Wiley Publications 1995
3. Auto Design by R.B.Gupta, Satya Prakash Publications

REFERAENCE BOOKS:

1. Crouse W.H. "automotive transmissions and power trains", McGraw Hill Co. 5th edn, 1976
2. Newton K and Steeds. W. "motor Vehicle", Butter Worth's & Co., Publishers Ltd, 1997
3. Kirpal Singh, "Automobile engineering –. Vol.1, Standard Pub. 2004
4. G.B.S.Narang "Automobile Engineering', Khanna publication, New Delhi
5. Joseph I Heitner, "Automotive mechanics ", Affiliated East West Press, New Delhi
6. Fundamentals of Automatic Transmission by William Hasselbee.
7. P.M. Heldt,"Torque converters", Oxford & IBH, 1975

DESIGN OF MACHINES ELEMENTS-II

Sub Code: 10AU63 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART – A

UNIT – 1 Bending stresses in curved beams

Introduction, Analysis of stresses in curved beams, stresses in beams of standard cross sections.

05 Hrs

UNIT – 2 Cylinders & cylinder heads

Introduction, thick cylindrical shells subjected to internal pressure, Lame's Equations, Clavarino's equations, Birnie's equations, Barlow's equations, compound cylinders, stresses due to different types of fits, cylinder heads and cover plates. **07 Hrs**

UNIT - 3 Springs

Introduction, types of springs, terminology, stresses and deflection in helical coil springs of circular and non-circular cross sections, springs under fluctuating loads, concentric springs. Leaf Springs, stresses in leaf springs, equalized stresses, length of spring leaves.

08 Hrs

UNIT - 4 Clutches & brakes

Introduction, types of clutches, design of Clutches (single plate, multi plate and cone clutches). Brakes, energy absorbed by a brake, heat dissipated during braking, single block brakes and simple band brakes.

07 Hrs

PART - B

UNIT - 5 Spur & helical gears

Introduction, spur gears, standard proportions of gear systems, stresses in gear tooth, Lewis equation and form factor, design for strength, dynamic load and wear load. Helical Gears: definitions, formative number of teeth, design based on strength, dynamic and wear loads.

06 Hrs

UNIT – 6 Bevel and worm gears

Bevel Gears: terminology, formative number of teeth, design based on strength, dynamic and wear loads. Worm Gears: terminology, design based on strength, dynamic, wear loads and efficiency of worm gear drives. **06 Hrs**

UNIT – 7 Sliding and rolling contact bearings

Introduction, principle of hydro dynamic lubrication, assumptions in hydrodynamic lubrication, bearing characteristic number and modulus, Sommerfeld number, coefficient of friction, power loss, heat Generated and heat dissipated, design of journal bearings. Rolling contact bearings: types of bearings, static equivalent load, dynamic load rating, bearing life, selection of ball and roller bearings.

06 Hrs

UNIT - 8: Belts, and rope drives

Introduction, power transmitted, ratio of belt tensions, centrifugal tension, condition for transmission of maximum power, design of flat belts. V-belts: ratio of belt tensions, selection of V-belts.
Rope drives: advantages, classification and designation of rope drives, selection of rope drives.

7 Hrs

DESIGN DATA HAND BOOKS:

1. **Design Data Hand Book** by K. Mahadevan and K.Balaveera Reddy, CBS Publication.
2. **Design Data Hand Book** – K. Lingaiah, McGraw Hill, 2nd Ed. 2003.
3. **P.S.G.Design Data Hand Book**- PSG College of Tech Coimbature

TEXT BOOKS:

1. **A text book of Machine Design:** R.S. Khurmi and J.K. Gupta, S. Chand & co.

2. **Design of Machine Elements:** V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007.

REFERENCE BOOKS:

1. **Machine Design**: Robert L. Norton, Pearson Education Asia, 2001.

2. **Mechanical Engineering Design:** Joseph E Shigley and Charles R. Mischke. McGraw Hill International edition, 6th Edition 2003.

3. **Machine Design:** Hall, Holowenko, and Laughlin (Schaum's Outlines series) Adapted by S. K. Somani, Tata McGraw Hill Publishing Company Ltd.

4. Maleev & Hartman's Machine Design, Grover O.P., CBS Publishers.
5. Design of Machine Elements: M. F. Spotts, T. E. Shoup, L. E. Hornberger, adopted by S. R. Jayram and C. V. Venkatesh, Pearson Education, 2006.

6. Machine design-II: J.B.K. Das, Sapna book house, Bangalore.

AUTOMOTIVE ELECTRICAL AND ELECTRONIC SYSTEMS

Sub Code: 10AU64 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART-A

UNIT-1 Storage Battery:

Principle of lead acid cells, plates and their characteristics containers and separators, electrolyte and their preparation, voltmeter, effect of temperature on electrolyte, its specific gravity, capacity and efficiency, methods of charging from D.C. mains, defects and remedies of batteries, care of idle and new batteries. Recent development in batteries

6 Hrs

UNIT-2 Generator/ Alternator:

Principle of generation of direct current, generator details, shunt, dynamos, armature reaction, action of three brush generator and battery in parallel, setting of third brush, voltage and current regulators, cutout - construction, working and adjustment. Construction of A.C. systems.

6 Hrs

UNIT-3 Starter Motor & Drives:

Battery motor starting system, condition at starting, behaviour of starter during starting series motor and its characteristics, consideration affecting size of motor, types of drives, starting circuit.

6Hrs

UNIT-4 Ignition systems:

Ignition fundamentals, Types of solid state ignition systems, components, construction And operating parameters high energy ignition distributors, Electronic spark timing
And control. **6 Hrs**

PART-B

UNIT-5 Wiring and Lighting system:

Earth return and insulated systems, 6volts and 12 volts system, fusing of circuits, low and high voltage automobile cables, diagram of typical wiring system. Principle of automobile illumination, head lamp mounting and construction, sealed beam auxiliary lightings, horn, windscreen-wipers, signaling devices, electrical fuel pump, fuel, oil and temperature gauge(Dash board instruments)

6Hrs

UNIT-6 Heating and Air conditioning:

Conventional heating and ventilation, Air conditioning theory and systems, seat heaters.

6 Hrs

UNIT-7 Engine management Systems:

Combined ignition and fuel management systems. Exhaust emission control, Digital control techniques – Dwell angle calculation, Ignition timing calculation and Injection duration calculation. Complete vehicle control systems, Artificial intelligence and engine management. Hybrid vehicles and fuel cells.

8Hrs

UNIT-8 Chassis Electrical systems:

Antilock brakes (ABS), Active suspension, Traction control, Electronic control of automatic transmission, other chassis electrical systems, Central locking, Air bags and seat belt tensioners.

8 Hrs

TEXT BOOKS:

1. Tom Denton, “Automobile Electrical and Electronic systems” SAE publication, 2000.
2. P.M. Kohli, ‘Automotive Electrical Equipment”, Tata McGraw Hill, New Delhi.

REFERENCE BOOKS:

1. Heinz Heisler, Advanced Engine Technology. SAE Publications, 1995.
2. Ulrich Adler, " Automotive Electronic Systems", Robert Bosch, GMBH, 1995
3 Bosch Technical Instruction Booklets
4. A.P. Young & Griffiths, "Automobile Electrical Equipment" , ELBS & Newnes Butterworths, London
5. W. Judge, "Modern Electrical Equipment
6. Electrical Equipment for Automobiles by Parker and smith S.

HEAT AND MASS TRANSFER

Sub Code: 10AU65 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART-A

Unit 1: Introductory concepts and definitions:-

Modes of heat transfer: Basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity; convective heat transfer coefficient; radiation heat transfer ; combined heat transfer mechanism.Boundry conditions of 1^{st} , 2^{nd} and $3rd$ Kind Conduction: Derivation of general three dimensional conduction equation in Cartesian coordinate, special cases, discussion on 3-D conduction in cylindrical and spherical coordinate systems. (No derivation). One dimensional conduction equations in rectangular, cylindrical and spherical coordinates for plane and composite walls. Overall heat transfer coefficient. Thermal contact resistance boundary conditions of 1^{st}, 2^{nd} and 3^{rd} kind. Numerical problems and Mathematical formulation. **07 Hrs**

Unit 2: Variable thermal conductivity:

Derivation for heat flow and temperature distribution in plane wall. Critical thickness of insulation without heat generation, Thermal resistance concept. Its importance, Heat transfer in extended surfaces of uniform cross-section without heat generation, Long fin, and short fin with insulated tip and without insulated tip and fin connected between two heat sources. Fin efficiency and effectiveness. Numerical problems.

06 Hrs

Unit 3: One-dimensional transient conduction:

Conduction in solids with negligible internal temperature gradient (Lumped system analysis), Use of Transient temperature charts (Heisler's charts) for transient conduction in slab, long cylinder and sphere; use of transient temperature charts for transient conduction in semi-infinite solids. Numerical Problems

06 Hrs

Unit 4: Concepts and basic relations in boundary layers:

Flow over a body velocity boundary layer; critical Reynolds number; general expressions for drag coefficient and drag force; thermal boundary layer; general expression for local heat transfer coefficient; Average heat transfer coefficient; Nusselt number. Flow inside a duct- velocity boundary layer, hydrodynamic entrance length and hydro dynamically developed flow; flow through tubes (internal flow)(discussion only). Numericals based on empirical relation given in data handbook

Free or Natural Convection:

Application of dimensional analysis for free convection- physical significance of Grashoff number; use of correlations free convection from or to vertical, horizontal and inclined flat plates, vertical and horizontal cylinders and spheres, Numerical problems. **07 Hrs**

PART-B

Unit 5: Forced Convections:

Applications of dimensional analysis for forced convection. Physical significance of Reynolds, Prandtl, Nusselt and Stanton numbers. Use of various correlations for hydro dynamically and thermally developed flows inside a duct use of correlations for flow over a flat plate, over a cylinder and sphere. Numerical problems. **06 Hrs**

Unit 6: Heat Exchangers:

Classification of heat exchangers; overall heat transfer coefficient, fouling and fouling factor; LMTD, Effectiveness-NTU methods of analysis of heat exchangers. Numerical problems.

06 Hrs

Unit 7: **Condensation and Boiling:**

Types of condensation (discussion only) Nusselt's theory for laminar condensation on a vertical flat surface; use of correlations for condensation on vertical flat surfaces, horizontal tube and horizontal tube banks; Reynolds number for condensate flow; regimes of pool boiling pool boiling correlations. Numerical problems. **07 Hrs**

Unit 8: Radiation heat transfer:

Thermal radiation; definitions of various terms used in radiation heat transfer; Stefan-Boltzman law, Kirchoff's law, Planck's law and Wein's displacement law. Radiation heat exchange between two parallel infinite black surfaces, between two parallel infinite gray surfaces; effect of radiation shield; intensity of radiation and solid angle; Lambert's law; radiation heat exchange between two finite surfaces-configuration factor or view factor. Numerical problems.

07 Hrs

TEXT BOOKS

1. **Heat transfer,** by P.K. Nag, Tata Mc Graw Hill 2002.
2**. Heat transfer-A basic approach,** by Ozisik, Tata Mc Graw Hill 2002

REFERENCE BOOKS:

1. **Heat transfer, a practical approach,** Yunus A- Cengel Tata Mc Graw Hill
2. **Principles of heat transfer** by Kreith Thomas Learning 2001

3. **Fundamentals of heat and mass transfer** by Frenk P. Incropera and David P. Dewitt, John Wiley and son's.

4. **Heat & Mass transfer,** by Tirumaleshwar, Pearson education 2006

AUTOMOBILE ENGG. LAB -II

Sub Code: 10AUL67 **IA Marks: 25**
Hrs/Week: 03 **Exam Hrs: 03**
Total Lecture Hrs: 42 **Exam Marks: 50**

1. Writing technical specifications and description of all types of chassis and transmission components of automobiles, including body and interiors (two wheeler, four wheeler and heavy vehicle – one each)
2. Trouble shooting charts for major parts like clutch, gear box, differential, brakes, and wheels with tyres, steering system and suspension.
3. Testing and servicing of electrical components like battery, starting system, ignition system, central locking system, lighting system, and alternator. Experiments on microprocessors related to automobiles
4. Dismantle and assemble of major systems (clutch system, Gear boxes, Propeller shaft, Differential, Front and Rear axles, brake system, steering system and suspension system) and identifying remedies (like backlash adjustment, brakes adjustment, bleeding of brakes) for the possible problems based on trouble shooting charts.
5. Draw sketch of seating arrangements, seats for commercial vehicle and study the comfort levels provided for driver and passengers.
6. Draw sketches of different mechanisms of door, seat adjustments mechanisms.

Scheme of examination

One Question from Chapter 1, 2, 5 & 6	10 marks
TWO Questions from Chapter 3 & 4	30 Marks
Viva-Voce	10 Marks

ENGINE TESTING LAB

Sub Code: 10AUL68 **IA Marks: 25**
Hrs/Week: 03 **Exam Hrs: 03**
Total Lecture Hrs: 42 **Exam Marks: 50**

1. Testing of Single Cylinder, Twin Cylinder and multi cylinder SI / CI engines for performance, calculate BP, Thermal, volumetric efficiencies, and BSFC with emission testing.

2. Study one engine performance by changing parameters like valve timing, ignition timing, carburetor nozzle jet.

3. Conduct Morse test for finding FP, IP, Indicated thermal efficiency and Mechanical efficiency.

4. Study of engine performance using alternate fuels like alcohol blends/ bio diesel / LPG.

5. Performance test on computerized IC engine test rig.

6. Study and testing on MPFI Engine and Variable compression Engine.

7. Tuning of engines. Study and practice on computerized engine analyzer.

8. Exhaust Emission test of Petrol and Diesel engines

Scheme of examination

TWO Questions from Chapter 1 to 8	40 Marks
Viva-Voce	10 Marks

CAD/CAM/CAE

Sub Code: 10AU661 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART-A

UNIT-1 Introduction:
Role of computers in design and manufacturing. Influence of computers in manufacturing environment. Product cycle in conventional and computerized manufacturing environment. Introduction to CAD, Introduction to CAM. Advantages and disadvantages of CAD and CAM.

3 Hrs

UNIY-2 Hardware for CAD:
Basic Hardware structure, Working principles, usage and types of hardware for CAD – Input devices, output devices, memory, CPU, hardcopy and storage devices. **6 Hrs**

UNIT-3 Computer graphics:
Software configuration of a graphic system, function of graphics package, construction of geometry, wire frame and solid modeling, Geometry transformation – two dimensional and three dimensional transformation, translation, scaling, reflection, rotation, CAD/CAM integration. Desirable modeling facilities. Introduction to exchange of modeling data – Basic features of IGES, STEP, DXF, and DMIS

7Hrs

UNIT-4 Introduction to Finite element analysis:
Introduction, basic concepts, discretization, element types, nodes and degrees of freedom mesh generation, constraints, loads, preprocessing, and application to static analysis.

5 Hrs

UNIT-5 NC, CNC, DNC Technologies:
NC, CNC, DNC, modes, NC elements, advantages and limitations of NC, CNC. Functions of computer in DNC **5 Hrs**

PART B

UNIT-6 CNC tooling:
Turning tool geometry, milling tooling system, tool presetting, ATC, work holding.

4 Hrs

UNIT-7 CAM Programming: Overview of different CNC machining centers, CNC turning centers, high speed machine tools **3 Hrs**

UNIT-8 CNC Programming: Part program fundamentals-steps involved in development of a part program. Manual part programming, milling, turning, turning center programming.

10 Hrs

UNIT-9 Introduction to Robotics: Introduction, robot configuration, robot motion, programming of robots, end effectors work cell, control and interlock, robot sensor, robot applications.

9 Hrs.

TEXT BOOKS:

1. CAD/CAM Principles and Application by P.N. Rao, Tata McGraw Hill.
2. CAD/CAM by Groover, Tata McGraw Hill.

REFERENCE BOOKS:

1. Introduction to the Design and Analysis of Algorithms – S.E. Goodman, S.T. Headetmiemi, McGraw Hill Book Company – 1988.
2. Principles of Interactive Computer Graphics by Newman and Sproull, Tata McGraw Hill, 1995.
3. NC Machine Programming and Software Design – Chno-Hwachang, Michel. A. Melkanoff, Prentice Hall, 1989.
4. Numerical control and CAM, Pressman RS and Williams JE, John Wiley.
5. Computer Graphics by Steven Harrington, McGraw Hill Book Co.
6. CAD-CAM by Chris McMahon & Jimmie Browne – Pearson education Asia 2001.
7. CAD/CAM – Ibrahim Zeid, Tat McGraw Hill, 1999.
8. Computer Aided Manufacturing by P.N. Rao, N.K. Tewari and T.K. Kundra Tata McGraw Hill 1999.
9. Introduction to FEM, T Chandra patta Ashok D Bebgundu.

AUTOMOTIVE AIR CONDITIONING

Sub Code: 10AU662 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART-A

UNIT-1 Air conditioning Fundamentals:
Basic air conditioning system,- Air conditioning principles, Air-conditioning types, temperature and pressure fundamentals, types of compressors and refrigerants. **4Hrs**

UNIT-2 Air Conditioning Systems
Classification, layouts, central *I* unitary air conditioning systems, components like compressors, evaporators, condensers, expansion devices, fan blowers, heating systems, Automotive heaters, Types, Heater Systems, Air conditioning protection, Engine protection.
11Hrs

UNIT-3 Load Analysis
Outside& inside design consideration, factors forming the load on refrigeration & air conditioning systems, cooling & heating load calculations, load calculations for automobiles, effect of air conditioning load on engine performance. **11Hrs**

PART- B

UNIT-4 Air Distribution Systems.
Distribution duct system, sizing, supply *I* return ducts, type of grills, diffusers, ventilation, air noise level, layout of duct systems for automobiles and their impact on load calculations.
8 Hrs

UNIT-5 Air Routing & Temperature Control
Objectives, evaporator air flow, through the re-circulating unit, automatic temperature control, duct system, controlling flow, vacuum reserve, testing the air control of air handling systems
6Hrs

UNIT-6 Air conditioning service:
Air conditioner maintenance & service- causes of air conditioner failure, leak testing guide, discharging the system, Evacuating the system, charging the system, servicing heater system, removing & replacing components, trouble shooting of air conditioning system, compressor service, methods of dehydration, charging & testing. **8Hrs**

UNIT-7 Air Conditioning Control
Common control such *as* thermostats, humidistat, control dampers, pressure cut outs, relays
4Hrs

Text *Books:*

1. Mark Schnubel, “Automotive Heating & Air Conditioning", Thomson Delmar Learning, 3rd edition, NY.
2. William H. Crouse & Donald L. Anglin, "Automotive Air Conditioning. McGrawHill, Inc., 1990.
3. ASHRAE Handbook-1985 Fundamentals

Reference *Books:*

1. Boyace H. Dwiggins, ”Automotive Air – conditioning”
2. SamSugarman, “HVAC Fundamentals. Fairmont Press, ISBN0-88173-489-6.
3. Paul Weisler, "Automotive Air Conditioning, Reston PublishingCo.Inc.1990.
4. Paul Lung, "Automotive Air Conditioning, C.B, S. Publisher & Distributor, Delhi.
5. MacDonald K. L “ Automotive Air Conditioning “, TheodoreAudel series, 1978

COMPOSITE MATERIALS

Sub Code: 10AU663 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART -A

UNIT-1: Introduction to composite Materials

Definition, classification and characteristics of composite materials – fibrous composites, laminated composites, particulate composites. Properties and types of Reinforcement and Matrix materials.

6 Hrs.

UNIT-2: Fibre reinforced plastic processing

Lay up and curing, fabricating process – open and closed mould process – hand lay up techniques – structural laminate bag molding, production procedures for bag molding – filament winding, pultrusion, pulforming, thermo – forming, injection, injection molding, liquid molding, blow molding.

10Hrs

UNIT-3: Fabrication of Composites

Cutting, machining, drilling, mechanical fasteners and adhesive bonding, joining, computer aided design and manufacturing, tooling, fabrication equipment. **8Hrs**

PART B

UNIT-4: Application of composites

Automobile, Aircrafts, missiles, Space hardware, Electrical and electronics, marine, recreational and Sports equipment, future potential of composites. **2Hrs**

UNIT-5: Metal Matrix Composites

Reinforcement materials, types, characteristics and selection base metals selection – Need for production MMC's and its application **10 Hrs**

UNIT-6: Fabrication Process for MMC's

Powder metallurgy technique, liquid metallurgy technique and secondary processing, special fabrication techniques **8 Hrs.**

UNIT-7: Study Properties of MMC's

Physical Mechanical, wear, machinability and other properties. Effect of size, shape and distribution of particulate on properties **6 Hrs.**

UNIT-8: Introduction to shape memory alloys **2 Hrs.**

TEXT BOOKS:

1. Composite Science and Engineering by K.K.Chawla Springer Verlag
2. Introduction to composite materials by Hull and Clyne , Cambridge University Press , 2nd edition , 1990

REFERENCE BOOKS:

1. Meing Schwaitz, "Composite materials hand book", 1984, McGraw Hill Book Company.
2. Robert M. Jones, "Mechanics of Composite Materials", McGraw Hill Kogakusha Ltd.
3. Forming Metal hand book, 9th edition, ASM handbook, V15. 1988, P327- 338.
4. Mechanics of composites by Artar Kaw, CRC Press. 2002.
5. Composite Materials by S.C. Sharma Narosa publishing house, New Delhi 2000
6. Principles of Composite Material mechanics by Ronald .F. Gibron,
7. Mc Graw Hill International, 1994

MODELING AND FEA

Sub Code: 10AU664 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART - A

Unit 1: Introduction

Equilibrium equations in elasticity subjected to body force, traction forces, stress strain relations for plane stress and plane strain, Boundary conditions, Initial conditions, Euler's Lagrange's equations of bar, beams, Principal of a minimum potential energy, principle of virtual work, Rayleigh-Ritz method, Galerkins method., Guass elimination Numerical integration.

07 Hrs

Unit 2: Basic Procedure

General description of Finite Element Method, Engineering applications of finite element method, Discretization process; types of elements 1D, 2D and 3D elements, size of the elements, location of nodes, node numbering scheme, half Bandwidth, Stiffness matrix of bar element by direct method, Properties of stiffness matrix, Preprocessing, post processing.

07 Hrs

Unit 3: Interpolation Models:

Introduction, Polynomial form of interpolation functions- linear, quadratic and cubic, Simplex, Complex, Multiplex elements, Selection of the order of the interpolation polynomial, Convergence requirements, 2D Pascal triangle, Linear interpolation polynomials in terms of global coordinates of bar, triangular (2D simplex) elements, Linear interpolation polynomials in terms of local coordinates of bar, triangular (2D simplex) elements, CST element. **06 Hrs**

Unit 4: Higher Order and Isoparametric Elements:

Lagrangian interpolation, Higher order one dimensional elements- quadratic, Cubic element and their shape functions, properties of shape functions, Truss element, Shape functions of 2D quadratic triangular element in natural coordinates , 2D quadrilateral element shape functions – linear, quadratic, Biquadric rectangular element(Nodded quad lateral element), Shape function of beam element, Hermite shape function of beam element. **06 Hrs**

PART – B

Unit 5: Derivation of element stiffness Matrices and load Vectors:

Direct method for bar element under axial loading, trusses, beam element with concentrated and distributed loads, B matrices, Jacobian, Jacobian of 2D triangular element,, quad lateral , Consistent load vector, Numerical integration. **07 Hrs**

Unit 6: Heat Transfer Problems:

Steady state heat transfer, 1d heat conduction governing equation, boundary conditions, one dimensional element, Functional approach for heat conduction, Galerkin approach for heat conduction, hat flux boundary condition, 1D heat transfer in thin fins. **06 Hrs**

Unit 7: Applications I:

Solution of bars, stepped bars, plane trusses by direct stiffness method. Solution for displacements, reactions and stresses by using elimination approach, penalty approach.

06 Hrs

Unit 8: Applications II:

Solution of beam problems, heat transfer 1D problems with conduction and convection.

07 Hrs

Text Books:

1. Introduction to Finite Elements in Engineering, Chandrupatla T. R. and Belegundu A. D., 2nd Edition, PHI, 2000

2. The Finite Element Method in Engineering, Rao S. S., 4th Edition, B. S. Publications, Elsevier, 2006.

Reference Books:

1. Textbook of Finite Element Analysis, P. Seshu, PHI, 2004.

2. Finite Element Method, J. N. Reddy, McGraw Hill International Edition.

3. Finite Element Analysis, C. S. Krishnamurthy, Tata McGraw Hill Publishing Co. Ltd, New Delhi, 1995.

4. **The FEM its basics and fundamentals:** O.C.Zienkiewicz, Elsevier, 6e.

5. **Finite Element Methods,** by Daryl. L. Logon, Thomson Learning 3rd edition, 2001.

STATISTICAL QUALITY CONTROL AND RELIABILITY

Sub Code: 10AU665 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART –A

Unit 1: Introduction

Basic concepts of Quality, Meaning and definition of quality, Quality control, objectives of quality control, Quality Characteristics, Quality costs, Quality of Design, Quality of conformance, Concepts in quality management, quality planning, quality measurement, trouble shooting, diagnostic techniques, System approach to quality management. **6 Hrs**

Unit 2: Basic Statistical Concepts

Concept of variation and its types, Variables and Attributes, Frequency distribution and its graphical representation (Frequency Polygon, Histogram, and Ogive), Central tendency and Measures of dispersion (Mean, Median, Mode, Range, and Standard deviation), Numerical Problems **06 Hrs**

Unit 3: Probability and Probability Distributions: Theory of Probability, Types of Probability distributions: Hyper geometric, Bi-nominal, Poisson and Normal distributions, Numerical Problems **06 Hrs**

Unit 4: Control Charts for Variables

Theory and definition of control chart, Control charts for X - Bar and R charts, Type I and Type II errors, Numerical Problems **08 Hrs**

PART – B

Unit 5: Process Capability

Methods of calculating process capability**,** Natural Tolerance limits, Numerical problems **05 Hrs**

Unit 6: Control Charts for Attributes: Control charts for defects and defectives - p, np,c, and u charts and their applications, Numerical problems **07 Hrs**

Unit 7: Acceptance Sampling

Basis concepts, Sampling by attributes, single, double and multiple sampling plans, use of sampling table, Sequential sampling plan, construction and use of Operating Characteristic curves, Numerical problems **07 Hrs**

Unit 8: Failure statistics and Reliability

Failure density, Failure rate, Mean failure rate, Mean time to failure, Mean time between failure, maintainability, Availability, Concepts and meaning of reliability, Reliability prediction, Bath tub curve, component and system reliability, redundancy and its uses, interaction between reliabil1ty and maintenance, Numerical problems **07 Hrs**

Text Books:

1. **Statistical Quality Control,** E. L. Grant and R.S. Leavenworth, Tata McGraw- Hill publishing Co. Ltd., New Delhi
2. **Concepts in Reliability Engineering,** L.S. Srinath

Reference Books:

1. **Statistical Quality Control**, R. C. Gupta, Khanna Publishers, Delhi
2. **Statistical Quality Control,** Manohar Mahajan, Dhanpat Rai and Sons, New Delhi
3. **Statistical Process Control and Quality Improvement,** Gerald M. Smith, Pearson Prentice Hall
4. **Statistical Quality Control for Manufacturing Managers,** W S Messina, Wiley and Sons, Inc., New York
5. **Introduction to Statistical Quality Control,** Montgomery Douglas C., John Wiley and Sons, Inc., Hoboken
6. **Quality Planning and Analysis,** Juran, Tata Mc Graw Hill
7. **Principles of Quality Control,** Jerry Banks, Wiley & Sons, Inc. New York.
8. **Introduction to Reliability and Quality,** Thomson.R
9. **Reliability Engineering,** E. Balaguruswamy, Tata Mc Graw Hill

OPERATIONS RESEARCH

Sub Code: 10AU71 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART –A

Unit 1: Introduction:

Linear programming, Definition, scope of Operations Research (O.R) approach and limitations of OR Models, Characteristics and phases of OR Mathematical formulation of L.P. Problems. Graphical solution methods. **06 Hrs**

Unit 2: Linear Programming Problems:

The simplex method - slack, surplus and artificial variables. Concept of duality, two phase method, dual simplex method, degeneracy, and procedure for resolving degenerate cases.

07 Hrs

Unit 3: Transportation Problem:

Formulation of transportation model, Basic feasible solution using different methods, Optimality Methods, Unbalanced transportation problem, Degeneracy in transportation problems, Applications of Transportation problems. **07Hrs**

Unit 4:

Assignment Problem: Formulation, unbalanced assignment problem, traveling problem.

06 Hrs

PART –B

Unit 5: Sequencing:

Johnson's algorithm, n - jobs to 2 machines, n jobs 3machines, n jobs n machines without passing sequence. 2 jobs n machines with passing. Graphical solutions **06 Hrs**

Unit 6: Game Theory:

Formulation of games, two person-Zero sum game, games with and without saddle point, Graphical solution (2x n, m x 2 game), dominance property. **06 Hrs**

Unit 7: Queuing Theory:

Queuing system and their characteristics. The M/M/1 Queuing system, Steady state performance analyzing of M/M/ 1 and M/M/C queuing model. **06 Hrs**

Unit 8: PERT-CPM Techniques:

Network construction, determining critical path, floats, scheduling by network, project duration, variance under probabilistic models, prediction of date of completion, crashing of simple networks.

8 Hrs

Text Books:

1. Taha H. A. - Operations Research and Introduction, Macmillan edition
2. Operations Research: Principles and practice: Ravindran, Phillips & Solberg, Wiley India ltd, 2nd Edition 2007.

Reference Books:

1. AM Natarajan, P.Balasubramani , ATamilaravari "Operation research" Pearson 2005

2. Hiller and Lieberman, Introduction to operation research. Mc Grew Hill. 5th edition 2001.
3. S. D. Sharma – Operations Research Kedarnath Ramnath & Co 2002.

VEHICLE BODY ENGINEERING AND SAFETY

Sub Code: 10AU72 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART-A

UNIT-1 Introduction:

Classification of coachwork type: styling forms, coach and bus body style, layout of cars, buses and coach with different seating and loading capacity, commercial vehicle types, Vans and Pick ups. Terms used in body building construction, Angle of approach, Angle of departure, Ground clearance, Cross bearers, Floor longitudes, posts, seat rail, waist rail, cant rail, Roof stick, Roof longitude, Rub rail, skirt rail, truss panel, wheel arch structure, wheel arch, post diagonals, gussets

8Hrs

UNIT-2 Vehicle Body Materials:

Aluminium alloys, Steel, alloy steels, plastics, Metal matrix composites, structural timbers - properties, glass reinforced plastics and high strength composites, thermoplastics, ABS and styrenes, load bearing plastics, semi rigid PUR foams and sandwich panel construction. Paints adhesives and their properties, corrosion and their prevention.

6 Hrs

UNIT-3 Aerodynamics:

Basics, Vehicle drag and types, Various types of forces and moments, effects of forces and moments, various body optimization techniques for minimum drag, Principle of wind tunnel technology, flow visualization techniques, tests with scale models, aerodynamic study for heavy vehicles

7Hrs

UNIT-4 Load distribution:

Type of body structures, Vehicle body stress analysis, vehicle weight distribution, Calculation of loading for static loading, symmetrical, longitudinal loads, side loads, stress analysis of bus body structure under bending and torsion. **6Hrs**

PART-B

UNIT-5 Interior Ergonomics:

Introduction, Seating dimensions, Interior ergonomics, ergonomics system design, seat comfort, suspension seats, split frame seating, back passion reducers, dash board instruments, electronic displays, commercial vehicle cabin ergonomics, mechanical package layout, goods vehicle layout. Visibility, regulations, drivers visibility, methods of improving visibility, Window winding and seat adjustment mechanisms.

6Hrs

UNIT-6 Vehicle Stability:

Introduction, Longitudinal, lateral stability, vehicle on a curvilinear path, critical speed for toppling and skidding. Effect of operating factors on lateral stability, steering geometry and stabilization of steerable wheels, mass distribution and engine location on stability.

7 Hrs

UNIT-7 Noise and vibration:

Noise characteristics, Sources of noise, noise level measurement techniques, Body structural vibrations, chassis bearing vibration, designing against fatigue, methods of noise suppression.

6 Hrs

UNIT_8 Safety:

Impact protection basics, Physics of impact between deformable bodies, Design for crash worthiness, occupant and cargo restraint, passive restraint systems, side impact analysis, bumper system, energy absorbent foams, laws of mechanisms applied to safety. **6Hrs**

TEXT BOOKS:

1. Sydney F page, "Body Engineering"' Chapman & Hall Ltd, London, 1956
2. "Giles J Pawlowski", Vehicle body engineering Business books limited, 1989
3. John Fenton, "Vehicle body layout and analysis", Mechanical Engg. Publication ltd, London.

REFERENCE BOOKS:

1. Hand book on vehicle body design – SAE publication
2. Automotive chassis by P.M. Heldt, Chilton & Co, 1970
3. Vehicle Safety 2002, Cornwell press, Townbridge, UK, ISBN 1356 -1448.
4. Redesign of bus bodies – part I & part II – CIRT pune (Report), 1983
5. Ed W.H. Hucho, Aerodynamics of Road Vehicles, 4th Edition, Butter worth's 1987
6. Scibor-Rylski A.J, Road Vehicle Aerodynamics, Pentech press, London 2nd Edition 1984
7. Rae W.H & Pope A, Low Speed Wind Tunnel Testing Wiley & Sons, USA 1984 out of print
8. Noel W. Murray, "when it comes to the Crunch: The Mechanics of the Car Collisions" (Body work maintenance and repair) by Paul and Browne

MECHANICAL VIBRATIONS AND VEHICLE DYNAMICS

Sub Code: 10AU73 **IA Marks: 25**
Hrs/Week: 04 **Exam Hrs: 03**
Total Lecture Hrs: 52 **Exam Marks: 100**

PART -A

UNIT_1 Introduction:

Types of vibration, Simple harmonic motion and definition of some terms of vibration, Vector method and complex form of representing harmonic motions, addition of simple harmonic motions.

5 Hrs

UNIT-2 Undamped free vibration:

Introduction, Newton's second law of motion method, D'Alembert's principle, Energy method, Rayleigh's method, Single degree of freedom systems, Natural frequency of free vibration, equivalent stiffness of springs, effect of spring mass. 8 Hrs

UNIT-3 Damped free vibration:

Single degree of freedom systems, types of damping, concept of critical damping and its importance, study of viscous damped systems - under damping, critical damping and over damping, logarithmic decrement, structural and coulomb damping. 6 Hrs

UNIT-4 Forced vibration:

Single degree of freedom systems, steady state solution with viscous damping due to harmonic force, concept of frequency response, reciprocating an rotating unbalance, vibration isolation and transmissibility, energy dissipated by damping, equivalent viscous damping, Structural damping, sharpness of resonance, base excitation. 7Hrs

PART- B

UNIT-5 Vibration measuring instruments and Whirling of shafts:

Vibrometer, Accelerometer and frequency measuring instruments, whirling of shafts with and without air damping, discussion of speeds above and below critical speeds. 6Hrs

UNIT-6 Two degree of freedom systems:

Introduction, principle and normal modes of vibration, co-ordinate coupling, generalized and principal co-ordinates, orthogonality principle, Lagrange's equation, semi-definite systems, forced vibrations, harmonic excitation. Applications: Vehicle suspension, Dynamic vibration absorber, dynamics of reciprocating engines. 6 Hrs

UNIT-7 Vehicle vibration and human comfort:

Vehicle vibration with single degree of freedom - free vibration, forced vibration - vibration due to road roughness, vibration due to engine unbalance, transmissibility of engine mounting, vibration with two degrees of freedom - free vibration - compensated suspension system, forced vibration - vibration due to road roughness, vibration absorber.

6 Hrs

UNIT-8 Multi degree of freedom systems:

Introduction, influence coefficients, Maxwell's reciprocal theorem, orthogonality principle, Dunker ley's equation, determination of natural frequencies using matrix iteration method, Holzer's method for systems with free, fixed free and fixed ends, stodola method, Rayleigh's method for beam vibration

8 Hrs

Text Books:

1. Mechanical Vibrations, G. K. Grover and S. P. Nigam, Nemchand and Brothers, Roorkee
2. **Mechanical Vibrations:** V.P. Singh, Dhanpat Rai and Sons, New Delhi
3. **Theory and Problems of Mechanical Vibrations**, William W. Seto, McGraw Hill International Book Co., Singapore (Schaum's outline series)

References:

1. **Vibration, Theory and Applications**, William I Thomson, Prentice Hall
2. **Mechanical Vibration**, Church, A. W., John Wiley and Sons, USA
3. **Automobile Mechanics** (Through Problems), N. K. Giri, Khanna Publishers, Delhi
4. **Mechanical Vibration Analysis**, P. Srinivasan, TMH
5. **Vibration and Noise for Engineers**, Kewal Pujara and R.S. Pujara, Dhanpat Rai and Sons, Delhi
6. **Mechanical Vibrations:** S. S. Rao, Pearson Education Inc.,
7. **Mechanical Vibrations,** S. Graham Kelly, Schaum's Outline Series, Tata McGraw Hill Publishing Co. Ltd., New Delhi
8. **Theory and Practice of Mechanical vibrations,** J. S. Rao and K. Gupta, New Age International Publications, New Delhi
9. **Elements of Vibrations Analysis**: Leonard Meirovitch, Tata McGraw Hill, New Delhi
10. **Vibrations**, Tse F. S., Morse I. E. and Hinkle T., CBS Publishers and Distributors, Delhi
11. Mechanical vibrations, Den Hertog, McGraw Hill

AUTOMOTIVE AIR POLLUTION AND CONTROL

Sub Code: 10AU74 **IA Marks: 25**
Hrs/Week: 04 **Exam Hrs: 03**
Total Lecture Hrs: 52 **Exam Marks: 100**

PART-A

UNIT-1 Laws and regulations:

Historical background, regulatory test procedure (European cycles), Exhaust gas pollutants (European rail road limits), particulate pollutants, European statutory values, inspection of vehicle in circulation (influence of actual traffic conditions and influence of vehicle maintenance)

4 hrs

UNIT-2 Mechanism of pollutant formation in Engines

INTRODUCTION:

NITROGEN OXIDES, formation of nitrogen oxides, kinetics of NO formation, formation of NO_2, NO formation in spark ignition engines, NOx formation, in compression ignition engines

CORBONMONOXIDE

UNBURNED HYDROCARBON EMISSIONS

Back ground, flame quenching and oxidation fundamentals, HC emissions from spark ignition engines, HC emission mechanisms in diesel engines

PARTICULATE EMISSIONS

Spark ignition engine particulates, characteristics of diesel particulates, soot formation fundamentals, soot oxidation.

Crankcase emissions, piston ring blow by, evaporative emissions **10 hrs**

UNIT-3 Pollution control techniques:

Pollution control measures inside SI Engines & lean burn strategies, measures in engines to control Diesel Emissions

Pollution control in SI & CI Engines, Design changes, optimization of operating factors and Exhaust gas recirculation, fuel additives to reduce smoke & particulates

Road draught crankcase ventilation system, positive crankcase ventilation system, fuel evaporation control

8 hrs

UNIT-4 Influence of Fuel Properties

Effect of petrol, Diesel Fuel, Alternative Fuels and lubricants on emissions **5 hrs**

PART -B

UNIT-5 Post combustion Treatments

Available options, physical conditions & exhaust gas compositions before treatment, Catalytic mechanism, Thermal Reactions, Installation of catalyst in exhaust lines, catalyst poisoning, catalyst light-off, NO_x treatment in Diesel Engines, particulate traps, Diesel Trap oxidizer.

8 hrs

UNIT-6 Effect of air pollution

Effect of air pollution on Human Health, Effect of air pollution on animals, Effect of air pollution on plants

4 hrs

UNIT-7 Sampling procedures

Combustion gas sampling: continuous combustion, combustion in a cylinder

Particulate sampling: soot particles in a cylinder, soot in exhaust tube, Sampling Methods- sedimentations, and filtration, and impinge methods- electrostatic precipitation thermal precipitation, centrifugal methods

Determination of mass concentration, analytical methods- volumetric-gravimetric-calorimetric methods etc.

4 hrs

UNIT-8 Instrumentation for pollution measurements

NDIR analyzers, Gas chromatograph, Thermal conductivity and flame ionization

detectors, Analyzers for NO_x, Orsat apparatus, Smoke measurement, comparison method, obscuration method, ringelmann chart, Continuous filter type smoke meter, Bosch smoke meter, Hart ridge smoke meter **9 hrs**

TEXT BOOKS:

1. Automobiles and pollution - Paul degobert (SAE)
2. Internal combustion engine fundamentals – john B. Heywood

REFERANCE BOOKS;

1. Air pollution – M.N. Rao, and H. V. Rao
2. Internal combustion engines: V. Ganesan
3. Crouse William, Automotive Emission Control, Gregg Division /McGraw-Hill. 1980
4. Ernest, S., Starkman, Combustion Generated Air Pollutions, Plenum Press, 1980.
5. George, Springer and Donald J.Patterson, Engine emissions, Pollutant Formation and Measurement, Plenum press, 1972.
6. Obert, E.F., Internal Combustion Engines and Air Pollution, Intext Educational Publishers, 1980.

SERVICE AND RECONDITIONING LAB

Sub Code: 10AUL77 **IA Marks: 25**

Hrs/Week: 03 **Exam Hrs: 03**

Total Lecture Hrs: 42 **Exam Marks: 50**

1. Inspection of vehicles and preparation of test charts.
2. Tuning of Engines: Check for ignition timing, valve tappet clearance, Radiator flushing and check for leaks ete.,

3. Study and practice on

Connecting rod alignment
Cylinder reboring machine
Valve refacing machine
Nozzle grinding machine
Brake drum skimming machine

4. Servicing of components like FIP, Carburetor, Fuel pump, Exhaust pipes and Silencer, Lubricating system, Air compressor, shock absorber, Calibration of FIP.
5. Study and practice of wheel alignment (Mechanical and computerized) and wheel balancing
6. Testing of Two wheeled vehicles on chassis dynamometer
7. Study of tyre retreading and vulcanizing
8. Study and practice on body repairs – tinkering and painting
9. Head light focusing test and visibility test

Scheme of Examination:

One Question from Chapter 1 & 2	10 marks
TWO Questions from Chapter 3 to 9	30 Marks
Viva-Voce	10 Marks

NOTE:
Students have to compulsorily visit at least Five Automobile related Industries of which One must be any one Automoble manufacturing Plant. Students have to submit a report on their Industrial Visit.

CAD/CAM/CAE LAB

Sub Code: 10AUL78 **IA Marks: 25**

Hrs/Week: 03 **Exam Hrs: 03**

Total Lecture Hrs: 42 **Exam Marks: 50**

Part-A

I. FINATE ELEMENT ANALYSIS (Ansys/ Nastran/ Patran etc.)

Study of FEA packages, Modeling, Static and Dynamic analysis

1) STATIC ANALYSIS

a) Bars subjected to axial loads for Constant cross section, Tapered cross section and stepped bars

b) Trusses – Simple trusses

c) Beams – Cantilever and Simply supported beams subjected to point load, UDL, UVL and moments

d) Analysis of Rectangular Plates (with and with out holes) subjected to axial and bending loads.

e) Thermal analysis – 2D problems (thermal and heat transfer) with conduction and convection boundary conditions

f) Fluid flow analysis – simple 2D problems

Verification of Results of conventional problems

2) DYNAMIC ANALYSIS

a) Harmonic analysis of bars and beams

b) Natural frequency and modal analysis (Eigen values and Eigen vectors)of beams

Part-B

II SIMULATION AND PART PROGRAMMING (simple exercises)

a) Simulation of Turning and Milling operations (Master cam/ Solid cam/ Edge cam etc.)

b) CNC part programming - Turning and Milling operations (G and M codes)

Scheme of Examination

One question from Part-A (25 marks), One question from Part-B (15 marks) and viva-Voce (10 marks)

VEHICLE TRANSPORT MANAGEMENT

Sub Code: 10AU751 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART - A

UNIT-1 **Introduction:** Historical background, the growth of a network, trams, trolley buses, buses, private cars, subsidies. Motor vehicle act 1988. 6 Hrs

UNIT-2 **The Infrastructure:**

Road, Highway network, traffic control, Bus priorities, pedestrianization, out town shopping centers, Bus-stops, shelters, Bus stations-drive through type, head on type, facilities for passengers, bus garages, requirement, layout of premises, size, function, ,location, design, equipment, use of machinery, garage organization, large scale overhaul conveyance of staff, requirement of facilities at depot., legal provisions for depot. Layouts.

Maintenance - preventive, breakdown, overhauling - major, minor, repair schedules & workshop, facilities, documentation, analysis & corrective maintenance schedules 7 Hrs

UNIT-3 Organization and Management:

Forms of ownership, municipal undertaking, company undertaking, traffic, secretarial and engineering deportments, management, principle of transport, - internal organization-centralized control, de-centralized control, staff administration: industrial relation, administration, recruitment and training, drivers and conductors duties, training of drivers and conductors, factors affecting punctuality, welfare, health and safety.

7 Hrs

UNIT-4 Route planning:

Source of traffic, town planning, turning points, stopping places, shelters, survey of route, preliminary schedule test runs, elimination of hazards, factors affecting frequency, direction of traffic flow, community of interest, estimating, traffic volume, probable weekday travelers, passengers during various periods of the day, estimated number of passengers, estimated traffic, possibility of single verses double deck and frequency

Timing, Bus working and Schedules: Time table layout, uses of flat graph method of presentation, preparation of vehicle and crew schedule preparation of the duty roster, co-operation with employers, use of the vehicle running numbering determination of vehicle efficiency checking efficiency of crew, duty arrangements

7 Hrs.

PART –B

UNIT-5 Fare collections & Fare structure:

Need, Principles of collection, tickets, the way bill, stage by stage, bell punch system, bellgraphic system, reduced ticket stocks will brew system, mechanical ticket machines, T.I.M and straight machines, Vero meter, one-man operation, two stream boarding, pre paid tickets, lenson parason coach tickets exchanges, the fare box, electronic ticket machines, box system personal and common stock flat fare platform control.Fare structure: Basis of fares, historical background, effects of competition and control, calculating average zone system, concession fares, straight and tapered scale elastic and inelastic demand co-ordination of fares concessions fares changes for workman, standard layout of fare table, anomalies double booking inter availability through booking and summation, private hire charges.

6 Hrs

UNIT-6 Operating cost and types of vehicles:

Classification of costs, average speed, running costs, supplementary costs, depreciation obsolescence, life of vehicles, sinking fund, factor affecting cost per vehicles mile incidence of wages and overheads, 100 seats miles basis, average seating capacity, vehicles size and spread overs, types of vehicle economic considerations authorization of trolley, bus services, statuary procedure taxes and hire car.

7 Hrs

UNIT-7 Public relations divisions:

Dissemination of information, maintaining goodwill- handling complaints, traffic advisory committees- local contractors co-operation with the press news and articles- facilities for visitors- forms of publicity - importance of quality - inter departmental liaison advertisements, sings, notice and directions general appearance of premises, specialized publicity. Prevention of accidents: Emphasis of safe driving, annual awards, bonus encouragement, vehicle design, platform layout, location of stops, scheduled speed, route hazards, records, elimination of accident prone drivers. 6 Hrs

UNIT-8 Vehicle design:

Buses & coaches, types & capacities, basic features, entrances & exits, comfort & capacity, steps & staircases, miscellaneous arrangements & fitments, articulated buses, standardization. The future: a projection from the past, future demand, environmental and social issues, the energy situation, new technology, hybrid,

battery/trolley bus, other types of hybrid, lead acid battery bus, advanced battery bus

6 Hrs.

Text books:

1. Bus operation - L.D.Kitchen, Iliffe & Sons , London
2. Bus & coach operation - Rex W. Faulks, Butterworth Version Of 1987, London

Reference books:

1. Compendium of transport terms - Cirt,Pune
2. M.V. Act 1988 - Central Law Agency, Allahabad
3. The elements of transportation - R.J. Eaton
4. Goods vehicle operation - C.S. Dubbar
5. Road transport law - L.D. Kitchen
6. Automobile engineering-G B S Narang, Khanna Publications
7. Automobile engineering-H B Keshwani
8. Automobile engineering-R B Gupta, satyaprakashan, New Delhi

TWO AND THREE WHEELED VEHICLES

Sub Code: 10AU752 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART - A

UNIT 1:**The Power Unit**:

Types of engines for two wheelers, advantages and disadvantages of two stroke and four stroke engines, engine components, constructional details, materials, symmetrical and unsymmetrical port timing diagrams, valve actuating mechanisms, valve timing diagrams. Rotary valve engine, Advantages and disadvantages of diesel engines for two wheelers, power plant for electric bikes, exhaust systems.

8Hrs

UNIT 2:**Fuel, Lubrication and Cooling system**:

Layout of fuel supply system, fuel tank construction, carburetor types, construction, working and adjustments. Types of cooling systems, advantages of air cooling system. Lubrication types, Lubrication of parts, grades of lubricating oils 6Hrs

UNIT 3:**Transmission system**:

Primary drive and Clutch:Motor cycle power train, Primary drives, Types of primary drives, Chain drive, Gear drive, Construction and operation of motorcycle clutches, Clutch release mechanism.

Gear boxes and Transmision: Introduction to motorcycle transmission, Sprockets and chain, Gears and Dogs in motor cycle transmission, Gear and Gear ratios, Sliding gear transmissions, Shifting fork mechanisms, Constant mesh transmissions, lubrication,

inal drive: Introduction to motorcycle final drives, Fundamentals of chain drive, Chain lubrication and lubricators, Shaft drives, Drive shaft couplings, Final drive gear case,

6Hrs

UNIT 4**:Frames and suspension**:

Types and constructional details of frames, advantages and limitations, frame materials, frame stresses, frame building problems, frame components, Front and Rear suspension systems, shock absorber construction and working, Panel meters and controls on handle bar, body manufacture and painting.

6Hrs

PART -B

UNIT 5: **Brakes and Wheels**:

Front and rear braking systems, disc and drum brakes, merits and demerits. Types of wheels, loads on wheels, construction and materials for wheels, wheels designation. Tyre designation, inflation, types of tyres, construction details. 6Hrs

UNIT 6:**Electrical system**:

Types of ignition system, their working principles, wiring diagram for Indian vehicles, spark plug construction, indicators and gauges used in two wheelers, lighting systems.

6Hrs

UNIT 7:**Two wheelers and Three wheelers**:

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

Case study of Indian models of three wheelers, Front mounted engine and rear mounted engine types, Auto rickshaws, pick up van, delivery van and trailer, Bijili electric vehicles.

8Hrs

UNIT 8:**Maintenance:**

Importance of maintenance, Decarburizing procedure for engine and silencer, periodic inspection, maintenance schedules, trouble diagnosis charts, safety precautions, Lubrication charts

6 Hrs

TEXT BOOKS:

1. P.E.IRVING, “Motor cycle engines”, Temple Press Book, London, 1992
2. Motor cycles -Michel M Griffin
3. William H. Crouse and Donald L. Anglin, “Motor cycle Mechanics”,

References Books:

1. “The cycle Motor manual”, Temple Press Ltd, 1990
2. Bryaut R. V. “Vespa maintenance and repair series.
3. “Encyclopedia of Motor Cycling 20 volumes”, Marshall Cavendish, New York and London, 1989

NON – TRADITIONAL MACHINING

Sub Code: 10AU753 **IA Marks: 25**
Hrs/Week: 04 **Exam Hrs: 03**
Total Lecture Hrs: 52 **Exam Marks: 100**

PART - A

Unit 1: Introduction:

History, Classification, comparison between conventional and Non-conventional machining process selection. **03 Hrs**

Unit 2: Ultra sonic machine(USM):

Introduction, equipment, tool materials & tool size, abrasive slurry, cutting tool system design:- Effect of parameter: Effect of amplitude and frequency and vibration, Effect of grain diameter, effect of applied static load, effect of slurry, tool & work material, USM process characteristics: Material removal rate, tool wear, Accuracy, surface finish, applications, advantages & Disadvantages of USM.

08 Hrs

Unit 3: Abrasive Jet Machining (AJM):

Introduction, Equipment, Variables in AJM: Carrier Gas, Type of abrasive, size of abrasive grain, velocity of the abrasive jet, mean No. abrasive particles per unit volume of the carrier gas, work material, stand off distance (SOD), nozzle design, shape of cut. Process characteristics-Material removal rate, Nozzle wear, Accuracy & surface finish. Applications, advantages & Disadvantages of AJM. Water Jet Machining **:** Principal, Equipment, Operation, Application, Advantages and limitations of water Jet machinery

09Hrs

Unit 4: Electrochemical machining (ECM):

Introduction , study of ECM machine, elements of ECM process : Cathode tool, Anode work piece, source of DC power, Electrolyte, chemistry of the process, ECM Process characteristics – Material removal rate, Accuracy, surface finish, ECM Tooling: ECM tooling technique & example, Tool & insulation materials, Tool size Electrolyte flow arrangement, Handling of slug, Economics of ECM, Applications such as Electrochemical turning, Electrochemical Grinding, Electrochemical Honing, deburring, Advantages, Limitations. **06 Hrs**

PART – B

Unit 5: Chemical Machining (CHM) :

Introduction, elements of process, chemical blanking process : Preparation of work piece, preparation of masters, masking with photo resists, etching for blanking, accuracy of chemical blanking, applications of chemical blanking, chemical milling (contour machining): process steps –masking, Etching, process characteristics of CHM: ;material removal rate accuracy, surface finish, Hydrogen embrittlement, advantages & application of CHM. **06 Hrs**

Unit 6: Electrical discharge machining (EDM):

introduction, machine, mechanism of metal removal, dielectric fluid, spark generator, EDM tools (electrodes) Electrode feed control, Electrode manufacture, Electrode wear , EDM tool design choice of machining operation electrode material selection, under sizing and length of electrode , machining time. Flushing pressure flushing suction flushing, side flushing, pulsed flushing synchronized with electrode movement, EDM process characteristics: metal removal rate, accuracy surface finish, Heat affected Zone. Machine tool selection, Application EDM accessories / applications, electrical discharge grinding, Traveling wire EDM. **08 Hrs**

Unit 7: Plasma Arc Machining (PAM):

Introduction, equipment non-thermal generation of plasma, selection of gas, Mechanism of metal removal, PAM parameters, process characteristics. Safety precautions, Applications, Advantages and limitations.

05 Hrs

Unit 8: Laser Beam Machining (LBM):

Introduction, equipment of LBM mechanism of metal removal, LBM parameters, Process characteristics, Applications, Advantages & limitations.

Electron Beam Machining (EBM): Principles, equipment, operations, applications, advantages and limitation of EBM. **07 Hrs**

Text Books:

1. **Modern machining process,** by PANDEY AND SHAN, TATA McGraw Hill 2000
2. New technology by BHATTACHARAYA 2000

Reference Books:

1. **Production Technology,** by HMT TATA McGraw Hill. 2001
2. Modern Machining Process by ADITYA. 2002
3. **Non-Conventional Machining** by P.K.Mishra, The Institution of Engineers (India) Test book series, Narosa Publishing House – 2005.
4. Metals Handbook: Machining(Hardcover) volume 16
   by Joseph R. Davis (Editor), American Society of Metals (ASM)

COMPUTER INTEGRATED MANUFACTURING

Sub Code: 10AU754 **IA Marks: 25**
Hrs/Week: 04 **Exam Hrs: 03**
Total Lecture Hrs: 52 **Exam Marks: 100**

PART - A

Unit 1: Computer Integrated Manufacturing Systems :

Introduction, Automation definition, Types of automation, CIM, processing in manufacturing, Production concepts, Mathematical Models-Manufacturing lead time, production rate, components of operation time, capacity, Utilization and availability, Work-in-process, WIP ratio, TIP ratio, Problems using mathematical model equations.

08 Hrs

Unit 2: High Volume Production System:

Introduction Automated flow line-symbols, objectives, Work part transport-continuous, Intermittent, synchronous, Pallet fixtures, Transfer Mechanism-Linear-Walking beam, roller chain drive, Rotary-rack and pinion, Rachet & Pawl, Geneva wheel, Buffer storage, control functions-sequence, safety, Quality, Automation for machining operation. **06 Hrs**

Unit 3: Analysis of Automated Flow line & Line Balancing :

General terminology and analysis, Analysis of Transfer Line with Out storage-upper bound approach, lower bound approach and problems, Analysis of Transfer lines with storage buffer, Effect of storage, buffer capacity with example problem, Partial automation-with numerical problem example, flow lines with more than two stage, Manual Assembly lines line balancing problem.

06 Hrs

Unit 4: Minimum rational work element:

work station process time, Cycle time, precedence constraints. Precedence diagram, balance delay methods of line balancing-largest candidate rule, Kilbridge and Westers method, Ranked positional weight method, Numerical problems covering above methods and computerized line balancing.

06 Hrs

PART - B

Unit 5: Automated Assembly Systems:

Design for automated assembly systems, types of automated assembly system, Parts feeding devices-elements of parts delivery system-hopper, part feeder, Selectors, feed back, escapement and placement analysis of Multistation Assembly machine analysis of single station assembly.

Automated Guided Vehicle System:

Introduction, Vehicle guidance and routing, System management, Quantitative analysis of AGV's with numerical problems and application. **08 Hrs**

Unit 6: Computerized Manufacturing Planning system :

Introduction, Computer Aided process planning, Retrieval types of process planning , Generative type of process planning, Material requirement planning, Fundamental concepts of MRP inputs to MRP, Capacity planning. **06 Hrs**

Unit 7: CNC Machining Centers:

Introduction to CNC, elements of CNC, CNC machining centers, part programming, fundamental steps involved in development of part programming for milling and turning

06 Hrs

Unit 8: Robotics:

Introduction to Robot configuration, Robot motion, programming of Robots end effectors, Robot sensors and Robot applications. **06 Hrs**

Text Books:

1. **Automation, Production system & Computer Integrated manufacturing,** M. P. Grover" Person India, 2007 2nd edition.
2. **Principles of Computer Integrated Manufacturing,** S. Kant Vajpayee, Prentice Hall India.

Reference Books:

1. **Computer Integrated Manufacturing,** J.A.Rehg & Henry.W. Kraebber.
2. **CAD/CAM by Zeid,** Tata McGraw Hill.

TOTAL QUALITY MANAGEMENT

Sub Code: 10AU755 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART –A

Unit 1: Overview of TQM:

Introduction-Definition, Basic Approach, And Contribution of Gurus – TQM framework, Historical Review, Benefits of TQM, TQM organization. **05 Hrs**

Unit 2: Leadership, Customer Satisfaction and Employee Involvement:

Characteristics of quality leaders, Customers satisfaction, Customer perception of quality, Feedback, Using customers complaints, Employee involvement - Introduction, Teams, Cross functional teams, Quality circles, Suggestion system, Benefits of employee involvement.

07 Hrs

Unit 3: Human Resource Practices:

Scope of Human Resources Management, leading practices, designing high performance work systems-work and job design, Recruitment and career development, Training and education, Compensation and recognition, Health, safety and employee well-being, performance appraisal.

08 Hrs

Unit 4: Building and sustaining Total Quality Organizations:

Making the commitment to TQ, Organizational culture and Total Quality, Change management, sustaining the quality organization. **06 Hrs**

PART –B

Unit 5: Tools and techniques in TQM:

7 basic tools of quality control, Kaizen, Re-engineering, 6 sigma, Benchmarking, Definition, Process of benchmarking, 5S, Yoke. **08 Hrs**

Unit 6: Quality management systems:

Quality management systems, ISO-9000 series of standards, Overview of ISO-14000, Overview of TS 16959. **06 Hrs**

Unit 7: Product Acceptance Control:

Product acceptance control through IS 2500 part 1 and part 2. **06 Hrs**

Unit 8: Quality Function Deployment and Failure Modes Effects Analysis:

Introduction to QFD and QFD process, Quality by design, Rationale for implementation of quality by design, FMEA, Design FMEA and process FMEA. **06 Hrs**

Text Books:

1. Total Quality Management: Dale H. Besterfield, Publisher - Pearson Education India, ISBN: 8129702606, Edition 03/e Paperback (Special Indian Edition)
2. The management and control of Quality: James R. Evans and William M.Lindsay, ISBN: 981-243-552-0 , Publisher - Thomson South-Western, Edition –6

Reference Books:

1. Total Quality Management for Engineers: M. Zairi, ISBN: 1855730243, Publisher: Woodhead Publishing.

2. 100 Methods for Total Quality Management: Gopal K. Kanji and Mike Asher , ISBN: 0803977476, Publisher: Sage Publications, Inc.; Edition – 1

NON DESTRUCTIVE TESTING

Sub Code: 10AU761 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

Part – A

UNIT-1 Introduction to ND testing:

Selection of ND methods, visual inspection, leaks testing, liquid penetration inspection, its advantages and limitations. **(06 Hrs)**

UNIT-2 Magnetic particle inspection:

Methods of generating magnetic field, types of magnetic particles and suspension liquids – steps in inspection – application and limitation. **(08 Hrs)**

UNIT-3 Eddy current inspection:

Principles, operation variables, procedure, inspection coils, and detectable discounts by the method.

(08 Hrs)

UNIT-4 Microwave inspection:

Microwave holography, applications and limitations. **(06 Hrs)**

Part – B

UNIT-5

Ultrasonic inspection: Basic equipment characteristics of ultrasonic waves, variables inspection.

(04 Hrs))

UNIT-6

inspection methods pulse echo A, B, C scans transmission, resonance techniques transducer elements, couplets, search units, contact types and immersion types inspection standard-standard reference blocks, inspection of products like casting, extrusions, rolled product, weld set.

(08 Hrs)

UNIT-7

Radiography inspection: Principles, radiation source-Rays and gamma rays-rays tubes, radio graphic films, scenes and filters, image intensifiers, techniques charts, industrial radiography, image quality, radiography sensitivity, Peneramotors, electron, neural radiology, application of ICT. Thermal inspection principles, equipment inspection methods applications. **(08 Hrs)**

UNIT-8

Optical Holography: Basics of Holography, recording and reconstruction-info metric techniques of inspection, procedures of inspection, typical applications. Acoustical Holography: systems and techniques applications. Indian Standard for NDT. **(08 Hrs)**

REFERENCE BOOKS:

1. McGonnagle JJ “Non Destructive testing” – Garden and reach New York

2. Non destructive Evolution and quality control” volume 17 of metals hand book 9 edition Asia internal 1989

3. Davis H.E Troxel G.E Wiskovil C.T the Testing instruction of Engineering materials Mc graw hill.

ENGINEERING ECONOMICS AND AUTOMOTIVE COST ESTIMATION

Sub Code: 10AU762 **IA Marks: 25**
Hrs/Week: 04 **Exam Hrs: 03**
Total Lecture Hrs: 52 **Exam Marks: 100**

PART-A

UNIT-1 Introduction:

Definition of various economic terms such as economic goods, utility, value, price, wealth, Attributes of wealth and its classification, wants and their characteristics, Classification of wants, standard of living, rent and profit, Factors of Production: Land, Lab our, Capital, Organization.

Demand and Supply: Law of diminishing utility, marginal and total utility, Demand, Demand Schedule, Law of demand, Elasticity of demand, Factors governing the elasticity of demand, Law of substitution and its application, Supply, Law of supply, supply schedule, elasticity of supply, theory of value, equilibrium price, Laws of returns.

Wages: Nominal and real wages, Factors affecting real wages, Wages, efficiency and standard of living, theory of wages, difference in wages, methods of wage payment 8 **Hrs**

UNIT-2 Money and Exchange:

Definition and function of money, Qualities of a good money, classification of money, value of money, index numbers, appreciation and depreciation of money, Gresham's Law and its limitations. Theory of exchange, barter, stock exchange, Speculation

Taxation and Insurance:

Principle of taxation, characteristics of a good taxation system, kinds of taxes and their merits and demerits, Vehicle Insurance and loss Assessment 6**Hrs**

UNIT-3 Interest:

Introduction, theory of interest, interest rate, interest rate from lender's and borrower's view point, simple and compound interest, Cash Flow Diagram, Interest formulas (discrete compounding, discrete payments), Nominal and effective interest rates, Numerical problems. 6**Hrs**

UNIT-4 Depreciation:

Need for depreciation, Causes of depreciation, Life and salvage value, Methods of calculating depreciation and their merits and demerits, Numerical problems. 6**Hrs**

PART-B

UNIT-5 Costs and Cost Accounting:

Standard cost, estimated cost, First cost, Fixed cost, Variable cost, Incremental cost, Differential cost, Sunk and marginal cost, Breakeven and minimum cost analysis. Objectives of cost accounting, elements of cost: material cost, labor cost, and expenses, allocation of over heads by different methods, Numerical problems.

8**Hrs**

UNIT-6 Basis for Comparison of alternatives:

Present worth, equivalent annual worth, future worth, rate of return, payback period, capitalized cost comparison, and capital recovery with return methods, Numerical problems.

Replacement analysis: Basic reasons for replacement, present asset and its replacement, consideration leading to replacement, installation and removal cost, Numerical problems. 6**Hrs**

UNIT-7 Book Keeping and accounts:

Introduction, Necessity of book keeping, single entry and double entry system, Classification of assets, Journal, Ledger, Trial balance, Final accounts, trading, profit and loss account, Balance sheet, Numerical problems. 4**Hrs**

UNIT-8 Cost Estimation:

Introduction, importance, objectives and functions of estimating, principle factors in estimating, Functions and qualities of an estimator, estimating procedure. Estimation of material cost and manufacturing cost of simple automotive components, Estimation of cost of overhauling and servicing of automotive components - cylinder, valves, valve seats, crankshaft, FIP, Brake drum, body building, different types of repairs, Numerical problems. 8**Hrs**

TEXT BOOKS:

1. **Engineering Economics**, Tara Chand, Nem Chand and Brothers, Roorkee
2. **Engineering Economy**, Thuesen, G. J. and Fabrycky, W. J., Prentice Hall of India Pvt. Ltd.
3. **Mechanical Estimating and Costing**, T. R. Banga and S. C. Sharma, Khanna Publishers, Delhi

REFERENCE BOOKS:

1. **Industrial Organization and Engineering Economics**, T. R. Banga and S. C. Sharma, Khanna Publishers, New Delhi
2. **Mechanical Estimating and Costing**, D. Kannappan et al., Tata McGraw Hill Publishing Company Ltd., New Delhi
3. **A Text Book of Mechanical Estimating and Costing**, O. P. Khanna, Dhanpat Rai Publications Pvt. Ltd., New Delhi
4. **Industrial Engineering and Management**, O. P. Khanna, Dhanpat Rai and Sons, New Delhi
5. **Financial Management**, I. M. Pandey, Vikas Publishing House Pvt. Ltd., New Delhi
6. **Engineering Economics,** James L. Riggs, David D. Bedworth and Sabah U. Randhawa, Tata McGraw-Hill Publishing Co. Ltd., New Delhi
7. **Engineering Economy,** Paul DeGarmo, Macmillan International Inc., New York

ADVANCED I.C.ENGINES

Sub Code: 10AU763 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART-A

UNIT-1 Combustion in Spark Ignition Engines

Thermodynamic analysis of SI engine Combustion: Burned and unburned mixture states. Analysis of cylinder pressure data, Combustion process characterization, Flame structure and speed; flame structure, laminar burning speeds, flame propagation relations, Cyclic variations in combustion, partial burning and misfire: definitions, causes of cycle – by – cycle and cylinder to cylinder variations, partial burning, misfire and engine stability. Spark Ignition: Ignition fundamentals, conventional ignition systems, alternative ignition systems, alternative ignition approaches, Abnormal Combustion: knock and surface ignition, knock fundamentals, fuel factors. **13 Hrs**

UNIT-2 Combustion in Compression Ignition Engines

Types of diesel combustion systems: Direct injection systems, indirect injection systems, comparison of different combustion systems, Analysis cylinder pressure data; combustion efficiency, DI engines, IDI engines, Fuel spray behaviour: Fuel injection, overall spray structure, atomization, spray penetration, droplet size distribution and spray evaporation, Ignition delay: definitions and discussion, fuel ignition quality, auto ignition fundamentals, physical properties affecting delay, effect of fuel properties.

13 Hrs

PART-B

UNIT-3 Equilibrium charts:

Charts for burnt mixture, charts for unburned Mixture, transmission from unburned to burnt mixture, non-equilibrium Problems covering the above. **4 Hrs**

UNIT-4 Modern Developments in I.C.Engines:

Lean burn engines, ceramic and adiabatic engines, Multi-valving, Tuned manifolding, camless valve gearing, variable valve timing, Turbo and supercharging – Waste gating, EGR, Part-load charge stratification in GDI systems. Sports vehicle engines, Stirling engines, MPFI engines – operation and performanance. **10Hrs**

UNIT-5 Special types of Engines;

Introduction to working of startified charged engines, Wankel engine, variable compression engine, Surface ignition engines, free piston engines, Current engines and future trends (e.g. Convergence of SI and CI engine technology, Control developments, fuel quality), Effect of air cleaners and silencers on engine performance. **8Hrs**

UNIT-6 Gas Turbine combustion:

Simple brayton cycle, working of a gas turbine, modification of the simple cycle, intercooling reheat and regeneration, determination of efficiency and power output, numerical problems.

4 Hrs

TEXT BOOKS:

1. Internal Combustion Engines Fundamentals - John B. Heywood, McGraw Hill International Edition,
2. A course in I.C. Engines - Mathur & Sharma, Dhanpat Rai & sons, New Delhi,1994

REFERENCE BOOKS:

1. I.C.Engines by Taylor, MIT Press England 1989

2. I.C.Engines By Lichty., McGraw Hill

3. Fuels & Combustion By Smith & Stinson., McGrawHill

4. Motor Vehicle Engines by M.Khovakh., Mir Publishers

5. I.C. Engines by V.Ganesan, Tata Mc Graw Hill,1994

ENGINEERING SYSTEM DESIGN

Sub Code: 10AU764 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART – A

Unit1: Introduction:

What is designing, Man as a designer: Design by evolution, inadequacies of traditional design method: System approach of engineering problems: Need models: design history of large scale existing system.

Morphology of Design: The three phases of design projects, the structure of design process, decision making and iteration. **08 Hrs**

Unit2: Identification And Analysis Of Need:

Preliminary need statement, analysis of need, specifications, and standards of performance and constrains. **06 Hrs**

Unit3: Origination Of Design Concept:

Process of idealization, mental fixity, and some design methods like morphological analysis, AIDA, brain storming etc. **06 Hrs**

Unit4: Preliminary Design:

Mathematical modeling for functional design: concept of sensitivity, compatibility and stability analysis. **06 Hrs**

Part – B

Unit5: Evaluation Of Alternatives And Design Decisions:

Physical realizability, DESIGN TREE: Quality of design, Concept of utility, multi criteria decisions, decisions under uncertainty and risk (Numerical) **08 Hrs**

Unit6: Reliability Considerations in Design:

Bath tub curve, exponential reliability function, system reliability concept. (Numerical) **07 Hrs**

Unit7: Economics and Optimization in Engineering design:

Economics in Engineering Design, Fixed and variable costs, break-even analysis. (Numerical)

Optimization: Introduction to LPP. **06 Hrs**

Unit8: Man-Machine Interaction:

Designing for use and maintenance, Man-Machine Cycle, Design of displays and controls. Factors influencing displays and controls. **05 Hrs**

TEXTBOOKS:

1. An introduction to engineering design method, by V. Gupta and P. Murthy, Tata McGraw Hill. 2000
2. Introduction of Engineering Design by T. Woodson, McGraw Hil1.2001

REFERENCE BOOKS:

1. Design & Planning of Engineering systems by D.D. Meredith, K.W. Wong, R.W. Woodhead & K.K. Worthman. 2000
2. Introduction to Design by M.A. Asimov-Prentice Hall. 1996
3. Design Methods - Seeds of Human Futures-Wiley Inter Science. 1970.

ROBOTICS

Sub Code: 10AU765 **IA Marks: 25**
Hrs/Week: 04 **Exam Hrs: 03**
Total Lecture Hrs: 52 **Exam Marks: 100**

PART - A

Unit 1: Introduction and Mathematical Representation of Robots

History of Robots, Types of Robots, Notation, Position and Orientation of a Rigid Body, Some Properties of Rotation Matrices, Successive Rotations, Euler Angles For fixed frames X-Y-Z and moving frame ZYZ. Transformation between coordinate system, Homogeneous coordinates, Properties of ${}^{A}_{B}T$, Types of Joints: Rotary,Prismatic joint, Cylindrical joint, Spherical joint, Representation of Links using Denvit-Hartenberg Parameters: Link parameters for intermediate, first and last links, Link transformation matrices, Transformation matrices of 3R manipulator, PUMA560 manipulator, SCARA manipulator

07 Hrs

Unit 2: Kinematics of Serial Manipulators

Direct kinematics of 2R, 3R, RRP, RPR manipulator, puma560 manipulator, SCARA manipulator, Stanford arm, Inverse kinematics of 2R, 3R manipulator, puma560 manipulator.

06 Hrs

Unit 3: Velocity and Statics of Manipulators

Differential relationships, jacobian, Differential motions of a frame (translation and rotation), Linear and angular velocity of a rigid body, Linear and angular velocities of links in serial manipulators, 2R, 3R manipulators, Jacobian of serial manipulator, Velocity ellipse of 2R manipulator, Singularities of 2R maipulators, Statics of serial manipulators, Static force and torque analysis of 3R manipulator, Singularity in force domain. **7 Hrs**

Unit 4: Dynamics of Manipulators

Kinetic energy, Potential energy, Equation of motion using Lagrangian, Equation of motions of one and two degree freedom spring mass damper systems using Lagrangian formulation, Inertia of a link, Recursive formulation of Dynamics using Newton Euler equation, Equation of motion of 2R manipulator using Lagrangian, Newton-Euler formulation

06 Hrs

PART - B

Unit 5: Trajectory planning

Joint space schemes, cubic trajectory, Joint space schemes with via points, Cubic trajectory with a via point, Third order polynomial trajectory planning, Linear segments with parabolic blends, Cartesian space schemes, Cartesian straight line and circular motion planning

07Hrs

Unit 6: Control

Feedback control of a single link manipulator- first order, second order system, PID control, PID control of multi link manipulator, Force control of manipulator, force control of single mass,Partitioning a task for force and position control- lever, peg in hole Hybrid force and position controller

08 Hrs

Unit 7: Actuators

Types, Characteristics of actuating system: weight, power-to-weightration, operating pressure, stiffness vs. compliance, Use of reduction gears, comparision of hydraulic, electric, pneumatic, actuators, Hydraulic

actuators, proportional feedback control, Electric motors: DC motors, Reversible AC motors, Brushles DC motors, Stepper motors- structure and principle of operation, stepper motor speed-torque characteristics

06 Hrs

Unit 8: Sensors

Sensor characteristics, Position sensors- potentiometers, Encoders, LVDT, Resolvers, Displacement sensor, Velocity sensor- encoders, tachometers, Acceleration sensors, Force and Pressure sensors – piezoelectric, force sensing resistor, Torque sensors, Touch and tactile sensor, Proximity sensors-magnetic, optical , ultrasonic, inductive, capacitive, eddy-current proximity sensors.

05 Hrs

Text Books:

1.Fundamental Concepts and analysis, Ghosal A., Robotics, Oxford,2006

2. Introduction to Robotics Analysis, Systems, Applications, Niku, S. B., Pearso Education, 2008

Reference Books:

1. Introduction to Robotics: Mechanica and Control, Craig, J. J., 2nd Edition, Addison-Welsey, 1989.

2.Fundamentals of Robotics, Analysis and Control, Schilling R. J., PHI, 2006

Scheme of Examination:-Theory subjects

In general, One question to be set from each chapter. Students have to answer any FIVE full questions out of EIGHT questions, choosing at least TWO questions from Part A and TWO questions from Part B.

EARTHMOVING EQUIPMENTS & TRACTORS

Sub Code: 10AU81 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART - A

UNIT-1 EQUIPMENTS AND OPERATION:
Different types of earth moving equipments and their applications. Dozers, Loaders, Shovels, Excavators, Scrapers, Motor graders, Rollers, Compactors, Tractors and Attachments.

9 hrs

UNIT-2 ENGINE
All systems of engine and special features like Automatic injection timer, turbochargers, after coolers etc

4 hrs

UNIT-3 UNDER CARRIAGE AND SUSPENSION
Tyre and tracked vehicles , advantages and disadvantages, under carriage components like , tracks, roller frames, drive sprockets, track rollers, track chains and track shoes. SUSPENSION: rubber spring suspension and air spring suspension **6 hrs**

UNIT-4 TRANSMISSIONS AND FINAL DRIVES:
Basic types of transmissions, auxiliary transmission ,compound transmission, twin triple countershaft transmissions and planetary transmission, constructional and workingprinciples, hydroshift automatic transmission and retarders. FINAL DRIVES: types ofreductions like, single reduction, double reduction final drives and planetary final drives,PTO shaft

6 Hrs

PART-B

UNIT-5 HYDRAULICS
Basic components of hydraulic systems like pumps (types of pumps), control valves like flow control valves, directional control valves and pressure control valves, hydraulic motors and hydraulic cylinders. Depth & draft control systems. **7 hrs**

UNIT-6 STEERING AND BRAKES
Power steering types like, linkage type power steering , semi integral power steering & integral power steering. STEERING OF TRACKED VEHICLES: Skid steering , articulated steering, clutch /brake steering system, controlled differential steering systemand planetary steering system. BRAKES: Types of brakes like, disc brake, engine brakes etc

6 hrs

UNIT-7 EARTH MOVING EQUIPMENTS MAINTENANCE & SAFETY: Types of maintenance schedules purpose and advantages, organization set ups, documentation. Safety methods for earth moving equipments. **6 hrs**

UNIT-8 METHODS OF SELECTION OF EQUIPMENTS
1) Selection of machines
2) Basic rules of equipments including the nature of operation
3) Selection based on type of soil
4) Selection based on haul distance
5) Selection based on weather condition

CALCULATION OF OPERATING CAPACITY
1) Methods of calculating operating capacity
2) Calculation of productivity of a bull dozer **8 hrs**

TEXT BOOKS:
1. Diesel equipment- volume I and II by Erich J.schulz
2. Construction equipment and its management By S.C. Sharma

REFERENCE BOOKS:
1.Farm machinery and mechanism by Donald R. hunt and L. W.garner
2.Theory of ground vehicles by J.Y.Wong john wiley and sons
3.Moving the earth by Herbert Nicholas
4.On and with the earth by Jagman Singh, W.Newman and Co. culkatta

AUTOTRONICS

Sub Code: 10AU82 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART-A

UNIT 1 Introduction to Mechatronic system

Definition of Mechatronics, Objective, Evolution of Mechatronics, An overview of Mechatronics systems, Measurement &Control systems their elements & functions. Need of Mechatronics in Industries , Advantages & disadvantages of Mechatronics, Microprocessor based controllers, Working principle of Engine management system.

08 hours

UNIT 2 Transducers and sensors

Definition and classification of Transducers. Definition and classification of sensors. Working Principle and applications of Light sensors, Proximity sensors and Hall effect sensors.

06 hours

UNIT 3 Electrical Actuation Systems

Actuator and actuator system. Classifications of actuator system with examples. Mechanical switches. Concept of bouncing, Methods of preventing bouncing of mechanical switches. Solenoids, Relays , Solid state switches - Diodes, Thyristors, Triacs, Transistors, Darlington pair. Electrical actuator, Principle, Construction and working of AC,DC motors, Stepper motors, Permanent magnet motors, servomotors, servo systems and control. **06 hours**

UNIT 4 *Signal Conditioning*

Introduction to Signal conditioning, Operational amplifiers, Protection, filtering –Wheatstone bridge , Digital signals , Multiplexer. Data acquisition, Introduction to Digital signal processing, Pulse modulation.

06 hours

PART-B

UNIT 5 Introduction to Microprocessors

Basic concepts, evolution of microprocessors, organization of microcomputers, microprocessor programming, Boolean algebra , Logic gates and Gate networks, Digital number system, Binary and Decimal number systems, memory representation of positive and negative integers , Maximum and minimum integers , Conversion of real numbers , Floating point notation, Representation of floating point numbers , Accuracy and range in floating point representation , Overflow and underflow , addition of floating point numbers , Character representation. **08 hours**

UNIT 6 Organization & Programming a Microprocessor

Organization of Intel 8085 microprocessor , Instruction set of the 8085, programming the 8085, Assembly language programming , programming examples **07 hours**

UNIT 7 Microprocessor Timings & Interfacing memory & I/O devices

Microprocessor Timings Timing & Control unit, Timings of Intel 8085.

Interfacing memory & I/O devices : Address space partitioning , memory interfacing

06 hours

UNIT 8 : Applications of Mechatronics

A temperature monitoring system, Automotive applications **05 hours**

TEXT BOOKS:

1. "*Mechatronics* " – by W. Bolton, Longman Pearson publications ., 2nd Ed , 2007, Third Edition.

2. "Microprocessor Architecture, Programming – by R.S.Gaonkar, Wiley Eastern and Applications" with 8085/8085A

3. Mecharonics by Prof. H.D.Ramachandra , M/S Sudha publications, Bangalore

REFERENCE BOOKS:

1. *"Mechatronics" principles, concepts and applications* – by Nitaigour & Premchand Mahalik, TATA McGraw Hill - 2003

2. " Introduction to Microprocessors" – by Adithya P.Mathur., TMH Publication , III edition , 2000.

3. "Fundamentals of Microprocessors and Microcomputers"– by B.Ram., Dhanpat Rai Pub.,1999.

TRIBOLOGY

Sub Code: 10AU831 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART-A

Unit –1 Introduction to Tribilogy:
Properties of oils and equation of flow: Viscosity, Newton's of viscosity, Hagen-Poiseuille Law, Flow between parallel stationary planes, viscosity measuring apparatus. Lubrication principles, classification of lubricants. **06 Hrs**

Unit-2 Hydrodynamics Lubrication:
Friction forces and power loss in lightly loaded bearing, Petroff's law, Tower's experiments, idealized full journal bearings. **06 Hrs**

Unit-3
Mechanism of pressure development in an oil film, Reynold's investigations, Reynold's equation in two dimensions. Partial journal bearings, end leakages in journal bearing, numerical problems..
07 Hrs

Unit- 4
Slider / Pad bearing with a fixed and pivoted shoe: Pressure distribution, Load carrying capacity, coefficient of friction, frictional resistance in a pivoted shoe bearing, influence of end leakage, numerical examples.
07 Hrs

PART-B

Unit-5 Oil flow and thermal equilibrium of journal bearing:
Oil flow through bearings, self-contained journal bearings, bearings lubricated under pressure, thermal equilibrium of journal bearings. **06 Hrs**

Unit 6 Hydrostatic Lubrication
Introduction to hydrostatic lubrication, hydrostatic step bearings, load carrying capacity and oil flow through the hydrostatic step bearing. **06 Hrs**

Unit-7 Bearing Materials
Commonly used bearings materials, properties of typical bearing materials. **Wear:** Classification of wear, wear of polymers, wear of ceramic materials, wear measurements, effect of speed, temperature and pressure.
07 Hrs

Unit -8 Behavior of tribological components
Selection, friction, Wear of ceramic materials, wear measurements, effects of speed, temperature and pressure. **Tribological measures**: Material selection, improved design, surface engineering
07 Hrs

TEXT BOOKS:

1. Basu S K., Sengupta A N., Ahuja B. B.,Fundamentals of Tribiology, PHI 2006
2. Mujumdar B. C., Introduction to Tribiology bearings, Wheelers and company pvt. Ltd 2001.

REFERENEC BOOKS:

1. Fuller, D., Theory and Practice of Lubrication for Engineers, New York company 1998
2. Moore, Principles and applications of Tribiology, Pergamaon press 1998
3. Srivastava S., Tribiology in industries, S Chand and Company limited, Delhi 2002
4. Redzimovskay E I., Lubrication of bearings – theoretical principles and design, Oxford press company 2000

SIMULATION OF IC ENGINE PROCESSES

Sub Code: 10AU832 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART-A

UNIT-1 INTRODUCTION

Principle of computer modeling and simulation, Monte Carlo simulation, Nature of computer modeling and simulation. Limitations of simulation, areas of application.6 Hrs

UNIT-2 SYSTEM AND ENVIRONMENT

components of a system-discrete and continuous systems. Models of a system-a variety of modeling approaches. 4 Hrs

UNIT-3 DESIGN AND EVALUATION OF SIMULATION EXPERIMENTS

Variance reduction techniques. Antithetic variables. Variables verification and validation of simulation models. 6 Hrs

UNIT-4 DESIGN AND EVALUATION OF SIMULATION EXPERIMENTS

Variance reduction techniques. Antithetic variables. Variables verification and validation of simulation models. 6 Hrs

UNIT-5 COMBUSTION PROCESS – GENERAL

Heat of reaction – Adiabatic flame temperature – Temperature change due to fuel vaporization 4Hrs

PART-B

UNIT-6 COMBUSTION AND HEAT TRANSFER IN ENGINES

Combustion in diesel engines – Heat transfer in engines – Heat Transfer correlations.

4 hrs

UNIT-7 C.I. AND S.I. ENGINE SIMULATION

Simulation of Otto cycles under full load and part load and supercharged conditions. Progressive combustion, Exhaust and intake process analysis. 12hrs

UNIT-8 TWO STROKE ENGINE SIMULATION

Engine and porting geometry, gas flow, Scavenging.- 8 Hrs

UNIT-9 SIMULATIONEXERCISES:

Simulation exercises using computers- MATLAB SimuLink, ProE / ICEM, CFD Analysis, FE Analysis and Validation of models. 8Hrs

TextBooks:

1. V.Ganesan," ComputerSimulation of Spark Ignition Engine Processes", Universities Press,1995.
2. V.Ganesan, Computer Simulation of Spark Ignition Engine Processes, Universities Press, 2002.

3.NARS1NGH DEO, “System Simulation with digital Computer", prentice Hall Of India,1979 ..
4. J.I.Ramos,. “Internal Combustion Engine Modeling" Hemisphere Publishing Corporation, 1989

ReferenceBooks:

1. Ashley S. Campbell, Thermodynamic Analysis of Combustion Engines, John Wiley and Sons, 1980.

2. J.N.Mattavi and C. A. Amann,. Combustion Modeling in Reciprocating Engines", Plenum Press,1980.
3. Horlockan and lWlnterbone,” The Thermodynamics and Gas Dynam1cs of Internal Combustion Engines, Vol.I & II ", Clarendon Press, 1986.
4. Gordon P. Blair, The Basic Design of two-Stroke engines, SAE Publications, 1990.

HYDRAULICS AND PNEUMATICS

Sub Code: 10AU833 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART – A

UNIT 1: Introduction to Hydraulic Power:

Pascal's law and problems on Pascal's Law, continuity equations, introduction to conversion of UNITs. Structure of Hydraulic Control System. **The Source of Hydraulic Power:** Pumps Pumping theory, pump classification, gear pumps, vane pumps, piston pumps, pump performance, pump selection. Variable displacement pumps. **8 Hrs**

UNIT 2: Hydraulic Actuators and Motors

Linear Hydraulic Actuators [cylinders], Mechanics of Hydraulic Cylinder loading, Hydraulic Rotary Actuators, Gear motors, vane motors, piston motors, Hydraulic motor theoretical torque, power and flow rate, hydraulic motor performance **6 Hrs**

UNIT 3: Control Components in Hydraulic Systems

Directional Control Valves – Symbolic representation, Constructional features, pressure control valves – direct and pilot operated types, flow control valves. **5 Hrs**

UNIT 4: Hydraulic Circuit Design and Analysis

Control of single and Double – acting Hydraulic cylinder, regenerative circuit, pump unloading circuit, Double pump Hydraulic system, Counter Balance Valve application, Hydraulic cylinder sequencing circuits. Locked cylinder using pilot check valve, cylinder synchronizing circuits, speed control of hydraulic cylinder, speed control of hydraulic motors, accumulators and accumulator circuits.

7 Hrs

PART – B

UNIT 5: Maintenance of Hydraulic systems

Hydraulic oils – Desirable properties, general type of fluids, sealing devices, reservoir system, filters and strainers, problem caused by gases in hydraulic fluids, wear of moving parts due to solid particle contamination, temperature control, trouble shooting. **6 Hrs**

UNIT 6: Introduction to Pneumatic control

Choice of working medium, characteristics of compressed air. Structure of Pneumatic control system. **Pneumatic Actuators:** Linear cylinders – Types, conventional type of cylinder working, end position cushioning, seals, mounting arrangements applications. Rod – less cylinders – types, working advantages. Rotary cylinder types construction and application. Design parameters – selection

6 Hrs

UNIT 7: Directional Control valves

Symbolic representation as per ISO 1219 and ISO 5599. Design and constructional aspects, poppet valves, slide valves spool valve, suspended seat type slide valve. **Simple Pneumatic Control:** Direct and indirect actuation pneumatic cylinders, use of memory valve. Flow control valves and speed control of cylinders supply air throttling and exhaust air throttling use of quick exhaust valve. **Signal processing elements:** Use of Logic gates – OR and AND gates pneumatic applications. Practical examples involving the sue of logic gates. Pressure dependent controls types construction –practical applications. Time dependent controls – Principle, construction, practical applications. **7 Hrs**

UNIT 8: Multi-cylinder applications

Coordinated and sequential motion control. Motion and control diagrams – Signal elimination methods. Cascading method – principle. Practical application examples (up to two cylinders) using cascading method (using reversing valves). **Electro-Pneumatic control:** Principles-signal input and out put pilot assisted solenoid control of directional control valves, use of relay and contactors. Control circuitry for simple single cylinder applications. **Compressed air:** Production of compressed air – compressors, preparation of compressed air- Driers, Filters, Regulators, Lubricators, Distribution of compressed air- Piping layout.

7 Hrs

Text Books:

1. Fluid Power with applications: Anthony Esposito, Fifth edition pearson education, Inc. 2000.
2. Pneumatics and Hydraulics: Andrew Parr. Jaico Publishing Co. 2000.

Reference Books:

1. Oil Hydraulic Systems – Principles and Maintenance: S.R. 2002 Majumdar, Tata Mc Graw Hill publishing company Ltd. 2001.
2. Pneumatic systems by S.R.Majumdar, Tata Mc Graw Hill publishing Co., 1995.
3. Industrial Hydraulics: Pippenger, Hicks, McGraw Hill, New York.

ALTERNATIVE ENERGY SOURCES FOR AUTOMOBILES

Sub Code: 10AU834 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART-A

UNIT-1: **Introduction**

Types of energy sources, their availability, need of alternative energy sources, Non-conventional energy sources, Classification of alternative fuels and drive trains. Scenario of conventional auto fuels, oil reserves of the world. Fuel quality aspects related to emissions. Technological up gradation required business driving factors for alternative fuels. Implementation barriers for alternative fuels. Stakeholders of alternative fuels, roadmap for alternative fuels. **7 Hrs**

UNIT-2: Solar energy

Solar energy geometry, solar radiation measurement devices. Solar energy collectors, types of collectors. Direct application of solar energy, solar energy storage system. P.V.effect solar cells and characteristics. Application of solar energy for automobiles.

8 Hrs

UNIT-3: Wind energy

Introduction, principle of wind energy conversion. Types of wind machines, applications of wind energy. Site selection considerations. Advantages and disadvantages of WEC systems.

5 Hrs

UNIT-4: Gaseous alternative fuels.

Hydrogen, properties and production of hydrogen. Storage, Advantages and disadvantages of hydrogen. Hydrogen used in SI and CI engines. Hazards and safety systems for hydrogen, hydrogen combustion. Emission from hydrogen. CNG, LNG, ANG, LPG and LFG.

6 Hrs

PART-B

UNIT-5: Biomass energy

Biogas or Biomethane.History, properties and production of Biogas, classification of biogas plants, biogas storage and dispensing system. Advantages of biogas, hazards and emissions of biogas.Methanol, Ethanol, Butanol, Straight vegetable oil, Biodiesel. **7 Hrs**

UNIT-6: Synthetic Alternative fuels

History, properties and production of hythane and HCNG, storage and dispensing of hythane and HCNG. Advantages, disadvantages, fuel kit, combustion process of HCNG and hythane.Emissions ofhythaneandHCNG.DME,DEE,BTL,GTL,CTL,Syngas,producer gas, P-series, Eco-friendly plastic fuel, wood pyrolysis oil, Magnegas,Tyre pyrolysis oil.

8 Hrs

UNIT-7: Reformulated conventional fuels

Introduction. Production of coal water slurry.properties, as an engine fuel, emissions of CWS. RFG, Emulsified fuels. Hydrogen-enriched gasoline. Future Alternative Fuels, PMF, Ammonia, Liquid-Nitrogen, Boron, Compressed Air, Water. **6 Hrs**

UNIT-8: **Introduction to alternative power trains**

Components of an EV,.EV batteries, chargers, drives, transmission and power devices. Advantages and disadvantages of EVs.Hybrid electric vehicles, what is a hybrid EV? HEV drive train components, advantages of HV. History of dual fuel technology, Applications of DFT. Duel fuel engine operation. Advantages and disadvantages of duel fuel technology.

5 Hrs

TEXT BOOKS

1. S.S.Thipse “Alternative Fuels”. JAICO Publishing House.
2. G.D.Rai “Non-Conventional Energy Sources” Khanna Publishing New Delhi.

REFERENCES

1. Alternative fuels for vehicle book by M.poulton
2. Alternative fuels guide book by R. Bechtold.SAE
3. Alternative energy sources by T.N Veziroglu, McgrawHill
4. A Primer on Hybrid Electric vehicles
5. Automotive Fuels Guide Book- Richard L.Bechtold, SAE Publications, 1997

HYBRID VEHICLES

Sub Code: 10AU841 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART - A

UNIT 1 HYBRID VEHICLES

Performance characteristics of road vehicles, calculation of road load, predicting fuel economy, Grid connected hybrids. **4 Hrs**

UNIT 2 & 3 PROPULSION METHODS

DC motors-series wound, shunt wound. Compound wound and separately excited motors AC motors - induction, synchronous, brushless DC motor, switched reluctance motors.

12 Hrs

UNIT 4 HYBRID ARCHITECTURE

Series configuration- locomotive drives, series parallel switching, load tracking architecture. Pre transmission parallel and combined configurations-Mild hybrid, power assist, dual mode, power split, power split with shift, Continuously Variable transmission (CVT). Wheel motors.

8 Hrs

PART –B

UNIT 5 HYBRID POWER PLANT SPECIFICATIONS

Grade and cruise targets. launching and boosting, braking and energy recuperation, drive cycle implications, engine fraction-engine downsizing and range and performance, usage requirements.

8 Hrs

UNIT 6 SIZING THE DRIVE SYSTEM

Matching electric drive and ICE, sizing the propulsion motor, sizing power electronics

4 Hrs

UNIT 7 ENERGY STORAGE TECHNOLOGY

Battery basics, lead-acid battery, different types of batteries, battery parameters. **6 Hrs**

UNIT 8 FUEL CELLS

Fuel cell characteristics, fuel cell types - alkaline fuel cell, proton exchange membrane, direct methanol fuel cell, phosphoric acid fuel cell, molten carbonate fuel cell, solid oxide fuel cell, hydrogen storage systems, reformers, fuel cell EV, super and ultra capacitors, flywheels.

1**0 Hrs**

TEXTBOOKS:

1. **The Electric Car: Development & Future of Battery, Hybrid & Fuel-Cell Cars -** Dr Mike Westbrook, M H Westbrook, British library Cataloguing in Publication Data, UK, ISBN0 85296 0131.

2. **Electric and Hybrid Vehicles -** Robin Hardy, Iqbal Husain, CRC Press, ISBN 0-8493-1466-6.

3. Propulsion Systems for Hybrid Vehicles - John M. Miller, Institute of Electrical Engineers,London,ISBN0 863413366.

REFERENCEBOOKS:

1. **Energy Technology Analysis Prospects for Hydrogen and Fuel Cells,** International Energy Agency, France.

2. **Hand Book of Electric Motors -** Hamid A Taliyat,Gerald B Kliman, Mercel Dekker Inc., US,ISBN0-8247-4105-6.

CONTROL ENGINEERING

Sub Code: 10AU842 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART-A

Unit 1: Introduction:
Definitions and concept of automatic controls, classification of control system - open and closed loop systems, concepts of feedback, requirements of an ideal control system.

03 Hrs

Unit 2: Mathematical Modeling:
Transfer function, modeling of mechanical systems, electrical systems, elctromechanical systems, thermal systems, hydraulic and pneumatic systems, and Analogous systems: Force voltage, Force current.

09 Hrs

Unit 3: Block Diagrams and Signal Flow Graphs:
Block diagram representation, functional block, block diagram reduction, Signal flow graphs, Mason's gain formula. **07 Hrs**

Unit 4: Transient and Steady State Response Analysis:
Introduction, Standard test inputs, concept of time constant and its importance in speed of response, analysis of first order and second order systems, Transient response specifications, System stability analysis - Routh - Hurwitz Criterion. **07 Hrs**

PART-B

Unit 5: Frequency Response Analysis using Nyquist Plots:
Polar plots, Nyquist Stability Criterion, Stability Analysis, Relative stability concepts, phase and gain margin, M & N circles. **07 Hrs**

Unit 6: Frequency Response Analysis using Bode Plots:
Bode attenuation diagrams, Stability Analysis using Bode plots, and Simplified Bode Diagrams, phase and gain margin. **07 Hrs**

Unit 7: Root locus plots:
Definition of root loci, general rules for constructing root loci, Analysis using root locus plots.

07 Hrs

Unit 8: Control Action and System Compensation:
Types of controllers – Proportional, Integral, Proportional Integral, Proportional Derivative, Proportional Integral Derivative controllers (Basic concept only), Series and feedback compensation, Physical devices for system compensation. **05 Hrs**

Text Books:

1. **Control Engineering**, Uday A. Bakshi and Varsha U. Bakshi, Technical Publications, Pune
2. **Control Engineering**, D. Ganesh Rao and K. Channa Venkatesh, Sanguine Technical Publishers, Bangalore
3. **Feedback and Control Systems**, Joseph J. Distefano, Allen R. Stubberud and Ivan J. Williams, Tata McGraw Hill Publishing Co. Ltd., New Delhi

References:

1. **Modern Control Engineering,** Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., New Delhi
2. **Control Systems Principles and Design,** M. Gopal, Tata McGraw Hill Publishing Co. Ltd., New Delhi
3. **Control Systems Engineering,** I. J. Nagrath and M. Gopal, New Age International publishers, New Delhi
4. **Automatic Control Systems,** Benjamin C. Kuo, Prentice Hall of India Pvt. Ltd., New Delhi
5. **Feedback Control Systems**, Shailaja C. Patil, Satya Prakashan, New Delhi
6. **Control Systems**, A. Anand Kumar, Prentice Hall of India Pvt. Ltd., New Delhi
7. **Control Systems**, Theory and Applications, Smarajit Ghosh, Pearson Education, Delhi
8. **Control Systems**, Rao V. Dukkipati, Narosa Publishing House, New Delhi

NANO TECHNOLOGY

Sub Code: 10AU843 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

Part A

Unit 1: **An overview of Nanoscience & Nanotechnology**

Historical background – nature, scope and content of the subject – multidisciplinary aspects – industrial, economic and societal implications. **5 Hrs**

Unit 2: **Experimental Techniques and Methods**

For investigating and manipulating materials in the nano scale – electron microscope – scanning probe microscope – optical and other microscopes – light scattering – x-ray diffraction. **7 Hrs**

Unit 3: **Fullerenes**

Discovery, synthesis and purification – chemistry of fullerenes in the condensed phase – orientational ordering – pressure effects – conductivity and superconductivity – ferromagnetism – optical properties.

Carbon Nanotubes – synthesis and purification – filling of nanotubes – mechanism of growth – electronic structure – transport properties – mechanical and physical properties applications. 7 **Hrs**

Unit 4: **Self-assembled Monolayers**

Monolayers on gold – growth process – phase transitions – patterning monolayers mixed monolayers – applications.

Gas Phase Clusters – history of cluster science – formation and growth – detection and analysis – type and properties of clusters – bonding in clusters. **7 Hrs**

Part B

Unit 5: **Semiconductor Quantum Dots**

Synthesis – electronic structure of nanocrystals – how quantum dots are studied – correlation of properties with size – uses. **5 Hrs**

Unit 6: **Monolayer-protected Metal Nanoparticles**

Method of preparation –characterization – functionalized metal nanoparticles – applications – superlattices.

Core-shell Nanoparticles – types – characterization – properties – applications.

Nanoshells – types – characterization – properties – applications. **8 Hrs**

Unit 7: **Nanobiology** –

Interaction between biomolecules and nanoparticle surfaces – materials used for synthesis of hybrid nano-bio assemblies – biological applications – nanoprobes for analytical applications – nanobiotechnology – future perspectives.

Nanosensors – what make them possible – nanoscale organization for sensors – characterization – nanosensors based on optical properties – nanosensors based on quantum size effects – electrochemical sensors – sensors based on physical properties – nanobiosensors – sensors of the future.

Nanomedicines – approach to development – nanotechnology in diagnostic and therapeutic applications. **8 Hrs**

Unit 8: **Molecular Nanomachines** –

Covalent and non-covalent approaches – molecular motors and machines – other molecular devices – single molecular devices – practical problems involved.

Nanotribology – studying tribology on the nanoscale – applications. **5 Hrs**

Textbook:

1. NANO: The Essentials – Understanding Nanoscience and Nanotechnology; T Pradeep (Professor, IIT Madras); Tata McGraw-Hill India (2007)

References:

1. Nanotechnology: Richard Booker & Earl Boysen; Wiley (2005).
2. Introduction to Nanoscale Science and Technology [Series: Nanostructure Science andTechnology]: Di Ventra, et al (Ed); Springer (2004)
3. Nanotechnology Demystified: Linda Williams & Wade Adams; McGraw-Hill (2007)
4. Introduction to Nanotechnology: Charles P Poole Jr, Frank J Owens, Wiley India Pvt. Ltd., New Delhi, 2007.

MAINTENANCE ENGINEERING

Sub Code: 10AU844 **IA Marks: 25**

Hrs/Week: 04 **Exam Hrs: 03**

Total Lecture Hrs: 52 **Exam Marks: 100**

PART-A

UNIT -1

Introduction to Maintenance System: Definition, Scope, Objective, functions and Importance of maintenance system, Type of maintenance system, Break down maintenance system. Preventive maintenance, Predictive maintenance, design out maintenance, corrective maintenance, planned maintenance, total productive maintenance, condition monitoring. Problems on selection of methods like preventive or breakdown maintenance,

9 Hrs

UNIT - 2

Economics in Maintenance: Repair, replacement, Repair complexity, Finding out most optimal preventive maintenance frequency. Numerical treatment required, **8 Hrs**

UNIT - 3

Maintenance of Machinery: Causes of machine failure, performance evaluation, complete overhauling of Machines tools. Maintenance planning and scheduling. Repair order control manpower requirement, Maintenance job analysis spare parts control. **6 Hrs**

UNIT - 4

Maintenance Planning: Planning of maintenance junctures manpower allocation, long range planning, short range planning. Planning techniques and procedures. Estimation of maintenance work. Maintenance control.

4 Hrs

PART-B

UNIT-5

Computers in maintenance: Features and benefits of Computer aided maintenance. Application of computers to maintenance work. **6 Hrs**

UNIT- 6

Industrial Safety: Economic importance of accidents, Types of safety organizations, Analysis of accident records, accident investigations, Analysis of accident Safety standards for Mechanical equipment.

7 Hrs

UNIT- 7

Safety standards: Safety standards for Electrical equipment and systems. Chemical hazards, material handling, exhaust systems, welding, Plant house keeping-building, Aisles, passages, floors, tool cribs, washrooms, canteens. **6 Hrs**

UNIT - 8

Industrial Pollution Control: Dust control -Fibre collectors, mechanical dust collectors, wet type collectors, Electro static precipitators, Noise pollution Control - Noise measurement and control. Industrial vibration and its control. **6 Hrs**

TEXT BOOKS:

1Maintenance Engineering and Management - R.C.Mishra and K.Pathak, Prentice Hall of India, 2002
2 Maintenance Engineering Hand book - Morrow.

REFERENCE BOOKS:

1Hand book of Maintenance Management - Frank Herbaty
2Hand book of Industrial Engg & Management - W. Grant Lreson & Eugene L-Grant
3 Industrial Pollution Control Handbook • LUND *A.* Industrial Maintenance - H P Garg
5 Maintenance Engineering Hand book- Lindrey Higgins, Mc Graw Hill, ff^{h} edition, 2003
6 Plant Engineering Hand book – Staniar

SCHEME OF EXAMINATION – THEORY SUBJECTS

In general, One question to be set from each chapter. Students have to answer any FIVE full questions out of EIGHT questions, choosing at least TWO questions from Part A and TWO questions from Part B.