SYLLABUS
FOR B.E.AUTOMOBILE ENGINEERING
III & IV SEMESTER
2011-2012
Department of Automobile Engineering

Scheme of syllabus for 3rd Sem B.E. Auto

<table>
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<tr>
<th>Sl.No</th>
<th>Subject Code</th>
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Scheme of syllabus for 4th Sem B.E. Auto
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- Metrology and Measurements lab is an audit subject for diploma students.
UNIT I

Fundamental Concepts & Definitions: Thermodynamics; 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 processes; Thermodynamic equilibrium; definition, mechanical equilibrium; dithermic wall, thermal equilibrium, chemical equilibrium-Zeroth law of thermodynamics, Temperature; concepts, scales, measurement. Internal fixed points.

Work & Heat: Mechanics, definition of work and its limitations. Thermo dynamic 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 pv diagrams. Shaft work; Electrical work. Other types of work. Heat; definition, units and sign convention.

UNIT II

First Law of Thermodynamics: Joule’s experiments, 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 at constant pressure.

Second Law of Thermodynamics: Significance of Second law. Kelvin. Planck statement of the Second law of Thermodynamic; PMM I and PMM II. Clausius's statement of Second law of Thermodynamic; Equivalence of the two statements; Reversible and irreversible processes; factors that make a process irreversible, reversible heat engines, Carnot cycle, Carnot principles.

UNIT III

Entropy: Clausius's inequality; statement, proof, application to a reversible cycle. QR/T as independent of the path. 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.

Pure substances: Entropy, T-S diagram, P-T and P-V diagrams, triple point and critical points. Sub cooled liquid, saturated liquid, mixture of saturated liquid and vapor, saturated vapor and superheated vapor states of a pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness factor (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.

UNIT IV


Cycle Analysis: Otto, Diesel, Dual, and Brayton cycles, comparison of air standard, fuel air and actual cycles.

Text books
2. "Thermodynamics an engineering approach", by Yunus A. Cenegal

Reference Books:

QUESTION PAPER PATTERN FOR SEE

1. Total of 8 Questions with 2 from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than 4 sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

UAU303C : PRODUCTION TECHNOLOGY

4 Credits (4-0-0)

UNIT I

Patterns: Definition, functions, Materials used for pattern, various pattern allowances . Classification of patterns .

Sand Moulding: Types of base sand, requirement of base sand. Types of sand moulds, Moulding sand mixture ingredients (base sand, binder & additives) for different sand mixtures. Method used for sand moulding.

Cores: Definition, Need, Types.. Concept of Gating & Risering. Principle involved. and types. Fettling and cleaning of castings.. Casting defects &their causes.

UNIT II
moulding Process: Classification, Green sand, Core sand, Dry sand, and applications. Casting processes, Gravity die-casting, Pressure die-casting, applications.

Special manufacturing techniques: Metal Forming procedures, Application, rolling procedure, application Powder metallurgy procedure and application. Hydro forming, extrusion.

UNIT III

13hours


Principles of soldering & brazing: Different Types of Soldering & Brazing Methods.

Plastic welding techniques.

UNIT IV

13hours

Theory of Metal Cutting: Single point cutting tool nomenclature, geometry, orthogonal and oblique cutting, mechanism of chip formation, types of chips, Merchants analysis, Ernst-Merchant's solution, shear angle relationship, problems of Merchant's analysis, tools life criteria, Taylor's tool life equation, problems on tool evaluation. Machining processes and applications.

Cutting tool materials: Desired properties, types of cutting tool materials - HSS carbides coated carbides, ceramics cutting fluids, desired properties, types and selection. Machinability, factors affecting machinability.

Total: 52 hours

Text Books:

Reference Books:
QUESTION PAPER PATTERN FOR SEE

1. Total of 8 Questions with 2 from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than 4 sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

UAU304C: MECHANICS OF MATERIALS
4 Credits (4-0-0)

UNIT I
13hours


Stress in composite section: Volumetric strain, expression for volumetric strain, elastic constants, simple shear stress, shear strain, temperature stresses (including compound bars).

UNIT II
13hours
**Compound stresses**: Introduction, plane stress, stresses on inclined sections, principal stresses and maximum shear stresses, Mohr's circle for plane stress.

**Thick and thin cylinders**: Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume), Thick cylinders subjected to internal and external pressures (Lame's equation), (compound cylinders not included)

**UNIT III**

13 hours

**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, uniform distributed load (UDL) and couple for different types of beams.

**Bending and shear stresses in beams**: Introduction, theory of simple bending, assumptions in simple bending, relationship between bending stresses and 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. Frames and over hanging beams

**UNIT IV**

13 hours

**Deflection of beams**: Introduction, differential equation for deflection, equations for deflections, slope and moments, double integration method for cantilever and simply supported beams for point load, UDL, UVL and couple, Macaulay's method.

**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. Introduction to 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.

Total: 52 hours

**Text Books:**


**Reference Books:**


**QUESTION PAPER PATTERN:**

1. Total of 8 Questions with 2 from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than 4 sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

**UAU305C: KINEMATICS OF MACHINES**

4 Credits (4-0-0)

**UNIT I**

13 hrs
Introduction: Definitions: Link or element, kinematics 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.
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 mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph, Ackerman steering gear mechanism.

UNIT II
13hrs
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.

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

UNIT III
13hrs
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)

Spur gears: Gear terminology, law of gearing, Characteristics of involute action, Path of contact, Arc of contact, Contact ratio, Interference in involute gears, Methods of avoiding interference, Back lash, Comparison of involute and cycloidal teeth.

UNIT IV
13 Hours
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-faced follower, Disc cam with oscillating roller follower, Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.

Total: 52hours

Text Books:


Reference books:


QUESTION PAPER PATTERN:

1. Total of 8 Questions with 2 from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than 4 sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

UAU306C: MATERIAL SCIENCE & METALLURGY
3 Credits (3-0-0)

UNIT I

Structure of crystalline solids: Fundamental concepts of unit cell space lattice, Bravais space lattices, unit cells for cubic structure & HCP, crystallographic planes and directions, Miller indices, computation of the unit cell indices, calculations of radius, Coordination Number and Atomic Packing Factor for different cubic structures. Crystal imperfections-point, line, surface & volume defects. Diffusion: Diffusion Mechanism, Fick’s laws of diffusion.


UNIT II


UNIT III

10 Hours

Heat treatment of steel: Annealing, and its types, normalizing, hardening, tempering, martempering, austempering, surface hardening like case hardening, carburizing, cyaniding, nitriding Induction hardening, hardenability, Jominy end-quench test, Age hardening of Al & Cu alloys.

UNIT IV

10 Hours


Total: 40 hours

Reference Books:
6. Engineering material science by C.N.Richards

QUESTION PAPER PATTERN:

1. Total of 8 Questions with 2 from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than 4 sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

UAU307L: COMPUTER AIDED MACHINE DRAWING

1.5 Credits (0-0-3)

1. Review of graphic interface of the software
   Review of basic sketching commands and navigational commands. Standard sheet templates, and creating new templates, different line types and their applications

2. Section of solids: sections of square pyramids, hexagonal prism, cones and cylinders.
3. Orthographic views: Conventions used in machine drawings. Sectional planes, 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). Dimensioning and annotations.


5. Fasteners: Hexagonal head bolt, nut and washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw.

6. Keys & Joints: Parallel key, Taper key, Feather key, Gibhead key and Woodruff key, cotter joint (socket and spigot), knuckle joint (pin joint) for two rods.


Assembly Drawings (Part drawings should be given)

1) Plummer block (Pedestal Bearing)
2) Screw jack (Bottle type)
3) Petrol Engine piston
4) I.C. Engine connecting rod

Laboratory Assessment:

1. This subject is to be evaluated for 100 marks (50 CIE and 50 SEE).
2. Allocation of 50 marks for CIE
   - Performance and preparation of drawings:
     10 sheets manually drawn shall be submitted and each sheet shall be evaluated for 3 marks.
   - One practical test for 20 marks. (5 mark for conversion from isometric to orthographic, 15 marks assembly and printing).
3. The SEE practical is conducted for 50 marks of three hours duration. The distribution of marks as 30% from orthographic view, 70% for part modeling, assembling and creating 2D views from assembly using CAD Software. No viva voce.
4. Question paper shall have two parts, questions for first part shall be asked from conversion of isometric to orthographic views and second part shall be asked from assembly.
5. Student should answer two questions choosing one question from each part. At least one question shall be asked from first 3 assemblies.
Part A

a. Tensile, and compression tests of metallic and non metallic specimens using a Universal Testing Machine
b. Shear test of metallic and non metallic specimens using a Universal Testing Machine
c. Torsion tests
d. Bending Test on metallic and nonmetallic specimens.
e. Izode and Charpy tests on M.S. Specimen.
f. Brinell, Rockwell and Vickers's Hardness test
h. Fatigue Test(demonstration)

Part-B

a) Demonstration of various models and linkage mechanisms
b) Mechanisms [One sheet each minimum of 8 mechanisms]
c) Velocity and acceleration diagrams [two sheets containing minimum of 4 problems in each sheet]
d) Problems in cam (one sheet containing four problems)

Laboratory Assessment :

1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
2. Allocation of 50 marks for CIE
   - Performance and journal write-up :
     Marks for each experiment = 30 marks/No. of proposed experiments.
   - One practical test for 20 marks. (5 write-up, 10 conduction, calculation, results etc., 5 viva-voce).
3. Allocation of 50 marks for SEE

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UAU309L: MACHINE SHOP

1.5 Credits (0-0-3)

1. Introduction to lathe, milling machine, shaping machine, slotting machine and grinding machine (construction and working, operations)
3. Cutting of gear teeth using milling machine
5. Demonstration of surface grinding

Laboratory Assessment:

1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
2. Allocation of 50 marks for CIE
   a. Performance and journal write-up:
      Marks for each experiment = 30 marks/No. of proposed experiments.
   b. One practical test for 20 marks. (5 write-up, 10 conduction, calculation, results etc., 5 viva-voce).
3. Allocation of 50 marks for SEE

   Lathe work : 30 Marks
   Shaping or Milling : 10 Marks
   Viva-Voce : 10 Marks
UNIT I

Properties of Fluids: Introduction, properties of fluids, Classification of fluids, thermodynamic properties of fluids
Fluid Statics: Fluid pressure at a point, Pascal’s law, pressure variation in a static fluid, absolute, gauge, atmospheric and vacuum pressures, simple manometers, differential manometers, total pressure and center of pressure, vertical plane surface submerged in liquid, horizontal plane surface submerged in liquid, inclined plane surface submerged in liquid, curved surface submerged in liquid. Buoyancy, center of buoyancy, metacenter and metacentric height, conditions of equilibrium of floating and submerged bodies.

UNIT II

Fluid Kinematics: Types of fluid flow, flow net, continuity equation, continuity equation in three dimensions (Cartesian co-ordinate system only), velocity and acceleration, velocity potential function and stream function.
Dimensional Analysis: Introduction, derived quantities, dimensions of physical quantities, dimensional homogeneity, Buckingham’s- π theorem, Raleigh’s method, dimensionless numbers, similitude, types of similitude.

UNIT III

Fluid Dynamics: Introduction, equations of motion, Euler’s equation of motion, Bernoulli’s equation from Euler’s equation, Bernoulli’s equation for real fluids.
Flow through pipes: Frictional loss in pipe flow, Darcy-Equation for loss of head due to friction in pipes, Chezy’s equation for loss of head due to friction in pipes, hydraulic gradient and total energy line.
Laminar flow and viscous effects: Reynolds’s number, critical Reynolds’s number, Laminar flow through circular pipe-Hagen poiseulle’s equation, Laminar flow between parallel and stationary plates.

*UNIT IV

Turbines: Classification, reaction, impulse turbine, outward and inward flow turbines, efficiency and power calculation.
Pumps:
a. Reciprocating pumps- work done, single acting and double acting, coefficient of discharge, percentage of slip, effect of acceleration, air vessels.
b. Centrifugal pumps, advantages of centrifugal pumps over reciprocating pumps, working of centrifugal pump, work done by the impeller, losses and efficiency, multistage pumps.
c. Gear pumps

Total: 52 hours

References:
UNIT I

**Wheels and tyres:** Types of wheels, construction, wheel dimensions, structure and function, desirable tyre properties types, materials, manufacture, designation, factors affecting tyre life, rotation and trouble shooting. Heat dissipation

**Front axle:** Types of front axle, stub axle, materials, loads and stresses, drive line, transaxle; construction working of drive shaft, types of drive shaft

**Rear Axle:** Types of drive, Torque reaction, driving thrust, construction of rear axle supporting -fully floating, semi floating, three quarter floating arrangements, trouble shooting. Numerical problems.

UNIT II

**Steering systems:** Factors affecting wheel alignment, wheel balancing steering mechanisms, correct steering angle, cornering force, self-righting torque, under steer and over steer, steering linkages, different types of steering gears, steering ratio, turning radius, steering adjustment, steering columns, power steering; hydraulic and electronic, advanced steering systems, trouble shooting of steering systems. Numerical problems.,.. EPAS

**Suspension:** Objects, basic considerations, types of suspension springs; construction, rigid axle suspension, operation, materials of leaf springs, coil springs, torsion bar, rubber springs, helper springs, air suspension, shock absorbers, independent suspension; front and rear, stabilizer bars, Active suspension systems, trouble shooting. Numerical problems. Suspension systems for commercial vehicles

UNIT III

**Brakes:** Function, stopping distance, MFDD brake efficiency, weight transfer, determination of braking torque, classification of brakes, types, construction, operation of braking systems-mechanical, hydraulic, disc, drum. Details of hydraulic systems: Master and wheel cylinder, diagonal split systems, bleeding of brakes, factors affecting brake fluid, pressure differential valve, proportioning valve, metering valve, brake adjustment. Brake compensation, parking brakes, hill holders, servo brakes, power brakes. Vacuum servo brakes, air brakes, vacuum -boosted hydraulic brakes. Layouts, auxiliary braking systems. (retarders, exhaust brake, jake brakes)

UNIT IV
Frames: Types of frames, materials, different loads on frame, cross members, channel sections, sub frames, passenger car frames, X member type frame, truck frames, box section type frame, testing of frames, bending and torsion test, body construction and repairs, frame alignment and frame defects

Vehicle layouts: Types of automobiles, different automobile layouts; front wheel drive, rear wheel drive, four wheel drive, rear engine layout. Load distribution

Rearrange units, regulatory requirements to be added.

TEXT BOOKS:
1. Automotive Chassis – P.M. Heldt, Chilton & Co.

REFERENCE BOOKS:
1. Automotive chassis and body – P.L. Kohli, TMH
3. Introduction to automobile engineering – N.R. Khatawate, Khanna pub. New Delhi

UAU404C: MACHINE DESIGN – I

4 Credits (4-0-0)

UNIT I

Introduction: Classification of design, design procedure, standardization, preferred numbers. Selection of materials, manufacturing consideration in design.

Stresses in elementary machine parts: Definitions derived from stress - strain diagram, loads, stress, strain, stress strain diagrams. Factors of safety, Combined stresses, Eccentric loading, Theories of failure stress concentration and stress concentration factor, variable stresses, endurance limit, fatigue stress concentration factor, notch sensitivity, impact loading, design criteria.

UNIT II

Shafts: Introduction, material used for shafting, stresses in shafts, design of shafts, shafts subjected to twisting moment, bending moment. Combined bending and twisting moment, axial load in addition to bending and torsion, fluctuating loads, Design of shaft on the basic of rigidity ASME and ISI codes for design of transmission shafting.

UNIT III

13 Hours

Threaded fasteners and power screws: Uses of screw threads, design of screw threads, threaded fasteners, effect of initial tension, effect of applied loads; bolt stress, bolt spacing, effect of dynamic loads, bolts subjected to shear and eccentric loading, bolts subjected to shear eccentric loading, power screws; efficiency of screw threads, differential screws stress in power screws.

UNIT IV

Riveted joints: Types of joints, design stresses, design of typical joints, boiler joint, tank, and structural joints.
Welded joints: Types of joint design stresses, design of typical joints, eccentrically loaded welded joints

Total: 52 hours

Text books:
1. Theory and problems of Machine Design by Hall (Schaum's 'Outline)
2. Design of Machine Members by Vallance and Doughtie

References:

QUESTION PAPER PATTERN:
1. Total of 8 Questions with 2 from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than 4 sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

UAU405C: THEORY OF AUTOMOTIVE ENGINES
4 Credits (4-0-0)

UNIT I

13 Hours

Introduction: Historical development of Automobiles. Types of power plant, principle of engine operation. Classification of engines; V-Engines, stratified charge engines, variable compression ratio engine.
Fuel air cycles: Uses of fuel air cycle, variation of specific heats, dissociation, comparison of PV diagram of air standard cycle and fuel air cycle for SI engine, thermal efficiency and fuel consumption, effect of variables.
Two stroke and four stroke engines: Principles of engine operation (SI and CI), scavenging -systems, theoretical processes, parameters,
relative merits and demerits, valve and port timing diagrams

UNIT II

Liquid Fuels: Properties and tests: Specific Gravity, viscosity, flash and fire points, calorific value, rating of fuels,
Petrol fuel: Octane no., chemical energy of fuels, reaction equation, volatility properties of A/F mixture, combustion temp, combustion charts

UNIT III

Diesel Fuels: Properties and rating of fuels: Cetane no, chemical energy of fuels, reaction equation, properties of A/F mixture, combustion temp, combustion charts. Vapor pressure, cloud and pour point, annealing point, diesel index, carbon residue.
Combustion in CI Engines: Stages of combustion, air fuel ratio in CI engines, delay period, variables affecting delay period, diesel knock, methods of controlling diesel knock, CI combustion chambers, open & divided. Induction swirl, turbulent combustion chambers, types, M-combustion chamber.

UNIT IV


Total: 52hours

Text books :
1. I.C. Engines By Mathur & Sharma, Dhanpat Rai & Sons, New Delhi, 1994

Reference books:
2. I.C. Engines by Lichty
4. Combustion fundamentals by Roger A Strehlow

QUESTION PAPER PATTERN:
1. Total of 8 Questions with 2 from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than 4 sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

UAU406C: METROLOGY AND MEASUREMENTS

3 Credits (3-0-0)
UNIT I

10 Hours

**Standards of measurement:** Definition and Objectives of metrology, Standards of length - International prototype meter, Imperial standard yard, Wave length standard, subdivision of standards, line gauges and end standard, comparison, transfer from line standard to end standard, calibration of end bars (Numerical), Slip gauges, Wringing phenomena, Indian Standards (M81, M-112), Numerical problems on building of slip System of limits, Fits, Tolerances and gauging: Definition of tolerance, Specification in assembly, Principle of inter changeability 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 (IS 919 -1963), geometrical tolerance, positional - tolerances, hole basis system, shaft basis of 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

UNIT II

10 Hours

**Comparators and Angular measurement:** Introduction to comparator, characteristics, classification of comparators, mechanical comparators - Johnson Mikrokator, Sigma Comparators, dial indicator, Optical Comparators -principles, Zeiss ultra optimeter, Electric and Electronic Comparators -principles, L VDT, Pneumatic Comparators, back pressure gauges, Solex Comparators. Angular measurements, Bevel Protractor, Sine Principle and. use of Sine bars, Sine center, use of angle gauges, (numericals on building of angles) Clinometers Interferometer and Screw thread gear measurement: Interferometer Principle of interferometry, autocollimator. Optical flats. Terminology of screw threads, measurement of major diameter, minor diameter pitch, angle and effective diameter of screw threads by 2-wire and 3-wire methods, Best size wire. Toolmakers microscope, gear terminology, use of gear tooth Vernier caliper and gear tooth micrometer

UNIT III

10 hours

**Measurements and Measurement systems:** Definition, Significance of measurement, generalized measurement system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, system response-times delay. Errors in Measurements, Classification of Errors. Transducers, Transfer efficiency, Primary and Secondary transducers, electrical, Mechanical, electronic transducers, advantages of each type transducers.

**Intermediate modifying and terminating devices:** Mechanical systems, inherent problems, Electrical intermediate modifying devices, input circuitry, ballast, ballast circuit, electronic amplifiers and telemetry. Terminating devices, Mechanical, Cathode Ray Oscilloscope, Oscillographs, X-Y Plotters.

UNIT IV

10 hours

**Measurement of Force and Torque, pressure:** Principle, analytical balance, platform balance, proving ring, Torque measurement, Prony brake, hydraulic dynamometer. Pressure Measurements, Principle, use of elastic members, Bridgeman gauge, Pirani Gauge.

**Temperature and strain measurement:** Resistance thermometers, thermocouple, law of thermocouple, materials used for construction, pyrometer, Optical Pyrometer. Strain Measurements, Strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement

Total: 40 hours
Text books:

Reference Books:
2. "Mechanical measurements" by R.K. Jain

QUESTION PAPER PATTERN:
1. Total of 8 Questions with 2 from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than 4 sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

UAU407L: FOUNDRY AND FORGING LABORATORY
1 Credit (0-0-2)

Part-A
1. Testing of Molding sand and Core sand
   Preparation of sand specimens and conduction of the following tests:
   b. Permeability test
   c. Core hardness & Mould hardness tests.
   d. Grain fineness number test (Sieve Analysis test)
   e. Clay content test.
   f. Moisture content test.

Part-B
2. Foundry Practice
   a. Use of foundry tools and other equipments.
   b. Preparation of moulds using two molding boxes using patterns or without patterns. (Split pattern, Match plate pattern and Core boxes).
   c. Preparation of one casting (Aluminum or cast iron-Demonstration only)

Part-C
3. Forging Operations
   a. Preparing minimum three forged models involving upsetting, drawing and bending operations.
   b. Out of these three models, at least one model is to be prepared by using Power Hammer.

Part – D
Industrial visit (report to be submitted)

Laboratory Assessment :
1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
2. Allocation of 50 marks for CIE
   a. Performance and journal write-up:
      Marks for each experiment = 30 marks/No. of proposed experiments.
   b. One practical test for 20 marks. (5 write-up, 10 conduction, calculation, results etc.,5(viva-voce).
3. Allocation of 50 marks for SEE

Part-A : 20 Marks
Part-B or Part-C : 20 Marks
Viva-Voce : 10 Marks

UAU408L I.C.ENGINE AND FUELS LABORATORY.
1.5 Credits (0-0-3)

Part-A
Fuels Lab :
1. Determination of Flash point and Fire point of lubricating oil using Abel Pensky and Pensky Martins Apparatus.
2. Study the determination of Calorific value of solid, liquid and gaseous fuels.
3. Determination of Viscosity of a lubricating oil using Redwoods, Saybolts and Viscometers
4. Valve, Timing opening diagram of an I.C. engine (4 stroke/2 stroke)

Part-B
Test on IC Engines :
   (a) Four stroke Diesel Engine
(b) Four stroke petrol Engine.
(c) Multi cylinder Diesel/Petrol Engine, (Morse test)
(d) Two stroke Petrol Engine

Performance study against malfunctioning
Design of experimentation, emission tests.

**Laboratory Assessment :**

1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
2. Allocation of 50 marks for CIE Performance and journal write-up:
   Marks for each experiment = 30 marks/No. of proposed experiments.
   One practical test for 20 marks. (5 write-up, 10 conduction, calculation, results etc., 5 viva-
   voce).
3. Allocation of 50 marks for SEE

   Part-A : 10 Marks
   Part-B : 30 Marks
   Viva-Voce : 10 Marks

**UAU409L: MECHANICAL MEASUREMENTS, METROLOGY**
1 Credit (0-0-2)

**Part-A :**
MECHANICAL MEASUREMENTS.
1. Calibration of Pressure Gauge
2. Calibration of Thermocouple.
3. Calibration of LVDT
4. Determination of modulus of elasticity of a mild steel specimen using strain gauges.

**Part-B :**
METROLOGY.
5. Measurements using Optical Projector / Toolmaker Microscope.
6. Measurements of angle using Sine Center / Sine bar / bevel protractor
7. Measurements of alignment using Autocollimator / roller set
8. Measurements of Screw thread Parameters using two wire or three-wire method.

**Laboratory Assessment:**

1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
2. Allocation of 50 marks for CIE
   a. Performance and journal write-up:
      Marks for each experiment = 30 marks/No. of proposed experiments.
   b. One practical test for 20 marks. (5 write-up, 10 conduction, calculation, results etc., 5 viva-voce).
3. Allocation of 50 marks for SEE

| Part-A | : 20 Marks |
| Part-B | : 20 Marks |
| Viva-Voce | : 10 Marks |
**Scheme of syllabus for 5th Sem B.E. Auto**

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Credits</th>
<th>Hours/ Week</th>
<th>Examination Marks</th>
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<td>Heat Transfer</td>
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<td>Industrial organization and management (HSS)</td>
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**Total**

|         | 25 | 22 | 0      | 07 | 450 | 450 | 900 |

*Automobile Engineering lab - I is an audit subject for diploma students.*

V Sem
### Department Elective – I

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<td>Automotive Engine Auxiliary Systems</td>
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<td>2</td>
<td>UAU 552E</td>
<td>Embedded System in Automotive Vehicles</td>
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<tr>
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<td>UAU 553E</td>
<td>Statistical Quality Control</td>
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### Department Elective – II

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<td>UAU 510E</td>
<td>Alternate Energy Systems for Automobile and Pollution Control</td>
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<tr>
<td>2</td>
<td>UAU 511E</td>
<td>Manufacturing of Automotive Components</td>
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<td>Tribology</td>
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### Scheme of syllabus for 6th Sem B.E. Auto

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Total
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<td>Total Quality Management</td>
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<td>3</td>
<td>UAU653E</td>
<td>Product design and development</td>
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### Department Elective - IV

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<td>2</td>
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<td>Computational Fluid Dynamics</td>
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<td>3</td>
<td>UAU663E</td>
<td>CNC Machines</td>
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</table>
UNIT I

Introduction 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 coefficient; combined heat transfer mechanism

Conduction: Basic Equations, general form of one dimensional heat conduction equation in rectangular, cylindrical and spherical coordinates. Discussion (no derivation) on three dimensional conduction in rectangular, cylindrical and spherical coordinate systems. Boundary conditions of first, second and third kinds; Illustrative problems on mathematical formulation of conduction problems

One-dimensional Steady state conduction: Steady state conduction in a slab, in a cylinder and in a sphere without and with heat generation; overall heat transfer coefficient for a composite medium; thermal contact resistance; critical thickness of insulation; Steady state conduction in fins of uniform cross section long fin, fin with insulated tip and fin with convection at the tip; fin efficiency; conduction in solids with variable thermal conductivity

UNIT II

One-dimensional Transient conduction: Conduction in solids with negligible internal temperature gradients (Lumped system analysis); Use of Transient Temperature charts (Jeisler's Charts) for transient conduction in slab, long cylinder and sphere; Use of transient temperature charts for transient conduction in semi infinite solids

Concepts and Basic Relations in Boundary Layers: Flow over a body - Velocity boundary layer; Laminar and Turbulent layers, 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 tubes and a ducts

UNIT III

Forced Convection: Application of dimensional analysis for forced convection problems. Physical significance of Reynolds, Prandtl, Nusselt and Stanton numbers. Use of various correlations for hydrodynamically and thermally developed flows; use of correlations for flow over a flat plate, over a cylinder and across a tube bundle

Free or Natural convection: Application of dimensional analysis for free convection-physical significance of Grashoff number; Use of correlations for free convection from or to vertical, horizontal and inclined flat plates, vertical and horizontal cylinders.

UNIT IV

Heat Exchangers: Classification of heat exchangers; overall heat transfer coefficient, fouling and fouling factor; LMTD and NTU methods of analysis of heat exchangers

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; properties of view factors; determination of view factors - view factor algebra; Hottel's cross string formula; Network method for radiation heat exchange in an enclosure.
10 Hours

Total: 40 hours

Textbooks:
1) **Heat Transfer** by P.K. Nag Tata Mc Graw Hill 2002

Reference books:
1) **Heat transfer** a practical approaches by Yunus A Cengel Tata Mc Graw Hill 2002.
2) **Principles of Heat Transfer** by Kreith Thomas learning 200 1.
5) **Heat transfer**: Jojo Jaico Book house 2003

QUESTION PAPER PATTERN:

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2. Each Question should not have more than 4 sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit

UAU512C: MACHINE DESIGN – II

4 CREDITS (4-0-0)

UNIT - 1

CURVED BEAMS: Stresses in curved beams of standard cross sections used in crane hook, punching presses & clamps, closed rings and links. 5 Hours

CYLINDERS & CYLINDER HEADS: Review of Lame’s Equations; compound cylinders, stresses due to different types of fits, cylinder heads, flats. 5 Hours

UNIT - 2

SPRINGS: Types of springs - stresses in Helical coil springs of circular and non-circular cross sections. Tension and compression springs, springs under fluctuating loads, Leaf Springs: Stresses in leaf springs. Equalized stresses, – Energy stored in springs, Torsion, Belleville and Rubber springs. 8 Hours

SPUR & HELICAL GEARS: Spur Gears: Definitions, 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.
UNIT - 3

BEVEL AND WORM GEARS: Bevel Gears: Definitions, formative number of teeth, Design based on strength, dynamic and wears loads. Worm Gears: Definitions, Design based on strength, dynamic, wear loads and efficiency of worm gear drives.

CLUTCHES & BRAKES: Design of Clutches: Single plate, multi plate and cone clutches. Design of Brakes: single block and simple band brakes

UNIT - 4


BELTS ROPES AND CHAINS: Flat belts: Length & cross section, Selection of V-belts, wire ropes and chains for different applications.

DESIGN DATA HAND BOOKS:
2. Design Data Hand Book - K. Mahadevan and K. Balaveera Reddy CBS Publication

TEXT BOOKS:

REFERENCE BOOKS:

UAU503C: DYNAMICS OF MACHINERY

4 Credits (4-0-0)

UNIT - 1

7 Hours

UNIT - 2
6 Hours

BALANCING OF ROTATING MASSES: Static and dynamic balancing, Balancing of single rotating mass by balancing masses in same plane and in different planes. Balancing of several rotating masses by balancing masses in same plane and in different planes.  
7 Hours

UNIT - 3
BALANCING OF RECIPROCATING MASSES: Inertia effect of crank and connecting rod, single cylinder engine, balancing in multi cylinder-inline engine (primary & Secondary forces), V-type engine; Radial engine – Direct and reverse crank method.  
7 Hours

GOVERNORS: Types of governors; force analysis of Porter and Hartnell governors. Controlling force, stability, sensitiveness, isochronism, effort and power  
6 Hours

UNIT - 4
GYROSCOPE: Vectorial representation of angular motion, Gyroscopic couple. Effect of gyroscopic couple on ship, plane disc, aeroplane, stability of two wheelers and four wheelers.  
7 Hours

ANALYSIS OF CAMS: Analysis of Tangent cam with roller follower and Circular arc cam operating flat faced and roller followers, Undercutting in Cams.  
6 Hours

TEXT BOOKS:
REFERENCE BOOKS:

UAU504C : INDUSTRIAL ORGANIZATION AND MANAGEMENT (HSS)
3 Credit ( 3-0-0 )

UNIT - 1
MANAGEMENT: Introduction - Meaning - nature and characteristics of Management, Scope and functional areas of management - Management as an art or science, art or profession Management & Administration - Roles of Management, Levels of Management, Development of Management Thought - early management approaches - Modern management approaches.

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. 5 Hours

UNIT - 2

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) 5 Hours

UNIT - 3
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; Barriers to entrepreneurship. 5 Hours
SMALL SCALE INDUSTRY: Definition; Characteristics; Need and rationale: Objectives; Scope; role of SSI in Economic Development. Advantages of SSI Steps to start an SSI – Government policy towards SSI; Different Policies of S.S.I.; Government Support for S.S.I. during 5 year plans, Impact of Liberalization, Privatisation, Globalization on S.S.I., Effect of WTO/GATT, Supporting Agencies of Government for S.S.I., Meaning; Nature of Support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry (Definition only)

UNIT- 4

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

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.

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

REFERENCE BOOKS:
2. Entrepreneurship Development - S S Khanka - S Chand & Co
CARBURETION: Carburetor principle, Properties of air-petrol mixtures, Mixture requirements for steady state and transient operation, Mixture formation studies of volatile fuels, design of elementary carburetor, Chokes, Automatic chokes, Effects of altitude on carburetion, Carburetor for 2-stroke and 4-stroke engines, carburetor systems for emission control.

GASOLINE INJECTION: Petrol Injection; advantages, disadvantages, Lucas petrol injection system, mechanical, Pneumatic and Electronic Fuel Injection Systems, types.

UNIT - 2

DIESEL FUEL INJECTION: Cleaning systems, transfer pumps, injection 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, 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. CRDI injection, latest injection systems

UNIT - 3

MANIFOLDS AND MIXTURE DISTRIBUTION: Intake system components: Air filter, Intake manifold with mixture distribution, Discharge coefficient, Pressure drop, Exhaust system components: Exhaust manifold and exhaust pipe, Spark arresters, Waste heat recovery, Exhaust mufflers, Type of mufflers, exhaust manifold expansion.


UNIT - 4

LUBRICATION SYSTEM: Lubricants, lubricating systems - types, 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, crankcase ventilation - types.

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.

TEXT BOOKS:

REFERENCES BOOKS:

**UAU552E: NON - TRADITIONAL MACHINING**

4 CREDITS(4-0-0)

**UNIT - 1**

**INTRODUCTION:** History, Classification, comparison between conventional and Non-conventional machining process selection.  
7 Hours

**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 abrasive 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.  
6 Hours

**UNIT - 2**

**ABRASIVE JET MACHINING (AJM):** Introduction, Equipment, Variables in AJM: Carrier Gas, Type of abrasive, size of abrasive grain, velocity of the abrasive jet, mean number. 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  
7 Hours

**ELECTROCHEMICAL MACHINING (ECM):** Introduction, study of ECM machine, elements of ECM process: Cathode tool, Anode work piece,  
6 Hours

**UNIT - 3**

**NC, CNC, DNC TECHNOLOGIES:** NC, CNC, DNC, modes, NC elements, advantages and limitations of NC, CNC. Functions of computer in DNC  
7 Hours

**CNC TOOLING:** Turning tool geometry, milling tooling system, tool presetting, ATC, work holding.  
6 Hours

**UNIT - 4**

**CNC PROGRAMMING:** Overview of different CNC machining centers, CNC turning centers, high speed machine tools. Part program fundamentals-steps involved in development of a part program. Manual part programming, milling, turning, turning center programming.
INTRODUCTION TO ROBOTICS: Introduction, robot configuration, robot motion, programming of robots, end effectors work cell, control and interlock, robot applications.

TEXT BOOKS:
2. CAD/CAM - by Groover, Tata McGraw Hill.

REFERENCE BOOKS:

UAU553E: STATISTICAL QUALITY CONTROL
4CREDITS(4-0-0)

UNIT - 1
INTRODUCTION: The Meaning of Quality and Quality Improvement; Brief History of Quality ethodology; Statistical Methods for Quality Control and Improvement; Total Quality Management (quality philosophy, links between quality and productivity, quality costs, legal aspects of quality implementing, quality improvement).

MODELLING PROCESS QUALITY: Mean, Median, Mode, Standard deviation, Calculating area, The Deming funnel experiment, Normal distribution tables, Finding the Z score, Central limit theorem.

UNIT - 2
METHODS AND PHILOSOPHY OF STATISTICAL PROCESS CONTROL: Chance and assignable causes, Statistical Basis of the Control Charts (basic principles, choices of control limits, significance of control limits, sample size and sampling frequency, rational subgroups, analysis of pattern on control charts, warning limits, Average Run Length-ARL)  

CONTROL CHARTS FOR VARIABLES: Control Charts for X-Bar and R-Charts, Type I and Type II errors, the probability of Type II error. Simple Numerical Problems  

UNIT - 3  

Control Charts For Attributes: Binomial distribution, Poisson distribution (from the point of view of Quality control) Control Chart for Fraction Nonconforming, Control Chart for number Nonconforming, Control Charts for Nonconformities or Defects, Control Chart for Number of non conformities per unit. Numerical problems  

UNIT - 4  
LOT-BY-LOT ACCEPTANCE SAMPLING FOR ATTRIBUTES: The acceptance sampling problem, single sampling plan for attributes, Double, Multiple, and Sequential sampling, AOQL, LTPD, OC curves, Military Standard 105E, the Dodge-Romig sampling plans. Numerical problems  

CUMULATIVE-SUM (CUSUM) & EXPONENTIALLY WEIGHTED MOVING AVERAGE (EWMA) CONTROL CHARTS: CUSUM Control Chart (basic principles of the chart for monitoring the process mean); EWMA control chart (EWMA control chart for monitoring process mean), design of an EWMA control chart.  

TEXT BOOKS:  

REFERENCE BOOKS:  
UAU507L AUTOMOBIE ENGINEERING LAB-I
1.5 CREDITS (0-0-3)

1. Study of hand tools- sketching, materials used and their applications
2. Technical specifications of all types of automobile engines
3. Trouble shooting charts of all engine components
4. Note the specifications of given engines and component standard dimensions. Dismantle, inspect, clean and assemble of engine components of SI and CI engines (two and four stroke) of any commercial vehicles. Note procedure of dismantling and assembly; identify the major components, noting their functions and materials used. Measurement & comparison of major components dimension with standard specifications. Inspection for wear and tear, crack and brake down, identify the service requirements of engines such as decarbonoizing, degresing, spark plug cleaning and adjusting, fuel injector cleaning etc.
5. Compression and vacuum test on diesel and petrol and diesel engines.
6. Study (Dismantling and assembly): Carburetors, fuel injection pumps, fuel filters, fuel pumps, turbochargers, cooling systems and components, lubrication system and components. Identify the location of above components in a vehicle and note their functions

Laboratory Assessment:

1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
2. Allocation of 50 marks for CIE
   - Performance and journal write-up:
     Marks for each experiment = 30 marks/No. of proposed experiments.
   - One practical test for 20 marks. (5 write-up, 10 conduction, calculation, results etc., 5 viva-voce).
3. Allocation of 50 marks for SEE

UAU518L DYNAMICS AND HEAT TRANSFER LAB
1.5 CREDITS (0-0-3)

Part - A
1. Balancing of rotating masses
2. Governors
3. Gyroscope

Part - B
4. Determination of thermal conductivity of a metal rod.
5. Determination of overall heat transfer coefficient of a composite wall
6. Determination of effectiveness on a metallic fin
7. Determination of heat transfer coefficient in a free convection on a vertical tube
8. Determination of heat transfer coefficient in a forced convection flow through a pipe
9. Determination of Stefan Boltzman constant
10. Determination LMDT and effectiveness in a parallel flow and counter flow heat exchangers

Laboratory Assessment:
1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
2. Allocation of 50 marks for CIE
   - Performance and journal write-up:
     Marks for each experiment = 30 marks/No. of proposed experiments.
   - One practical test for 20 marks. (5 write-up, 10 conduction, calculation, results etc., 5 viva-voce).
3. Allocation of 50 marks for SEE
   - Part-A : 20 Marks
   - Part-B : 20 Marks
   - Viva-Voce : 10 Marks

UAU509L : AUTOMOBILE ENGINEERING LAB II
1.5 CREDITS(0-0-3)
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, 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, 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.

Laboratory Assessment:
1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
2. Allocation of 50 marks for CIE
   - Performance and journal write-up:
Marks for each experiment = 30 marks/No. of proposed experiments.

- One practical test for 20 marks. (5 write-up, 10 conduction, calculation, results etc., 5 viva-voce).

3. Allocation of 50 marks for SEE

3. Allocation of 50 marks for SEE

UAU611C: AUTOMOTIVE ENGINE COMPONENT DESIGN

4 credits (4-0-0)

UNIT - 1

Engine selection criteria: Road, wind and gradient resistance, starting torque, load-speed characteristics, Expectancy curves and performance curves.

6 Hours

Fuels, Carburation, injection: Automobile fuels, desirable properties of automobile fuels, air fuel mixture in S I engine. Air flow, fuel flow, Critical velocity. Injection in C I engines velocity and work of injection. 7 hours

UNIT - 2

DESIGN OF CYLINDER BLOCK, CRANK CASE & CYLINDER HEADS: Cylinder heads, Gaskets, cylinder wear, water jacket, Cylinder liners, valve seats. Crank Case – General form of crank case, oil sumps and cooling features,
flywheel mountings, Engine mountings, Front & Rear mountings. Production of engine blocks 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

7 Hours

DESIGN OF 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

6 Hours

UNIT - 3

DESIGN OF CONNECTING ROD: Length of rod, Cross section, Buckling, Drilled connecting rods, piston pin bearing, offset connecting rods, effects of whipping, bearing materials, lubrication

6 Hours

DESIGN OF CRANK SHAFT: Balance weights, local balance, Crankshaft proportions, oil holes drilled in crank shafts, balancing and torsional vibration analysis, vibration dampers, firing order, bearings, lubrication

6 Hours

UNIT - 4

DESIGN OF FLYWHEEL: Necessity, capacity, Mounting of flywheels, Coefficient of fluctuation of speed, fluctuation of energy, Maximum fluctuation of energy, Energy stored in a flywheel, stresses, construction.

6 Hours

DESIGN OF VALVE AND VALVE MECHANISM: 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 Hours

TEXT BOOKS:
1. High Speed Engines - P.M.Heldt, Oxford & IBH, 1965
3. Automotive mechanics- N.K. Giri

REFERENCE BOOKS:
1. A course in I.C. Engine - Mathur & Sharma, Dhanput 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, 2004
8. Machine design exercises - S.N.Trikha, Khanna publications, Delhi
9. **Machine design** - Sharma & Agarwal, S K Kataria & Sons, Delhi

**Scheme:**
1) 2 questions each 20 marks has to be set Unit –I
2) A question of 80 marks on design and drawing has to be set covering the units 2,3 & 4.

**UAU602C: ALTERNATIVE FUELS AND POLLUTION CONTROL**

**3 Credits (3-0-0)**

**UNIT I**

10Hours

**Introduction:** Historical background, Euro norms

**Effect of air pollution:** Effect of air pollution on human heath, animals and plants, global warming, climate change.

**Mechanism of pollutant formation:** Evaporative losses both tank and carburetor, crank case blow-by and tail pipe exhaust. Unburnt hydrocarbon emissions, carbon monoxide, oxides of nitrogen, particulate emissions, smog formation in SI and CI engines. Diesel smoke; mechanism of smoke formation, causes and controlling methods.

**Pollution control methods:** Fuel vapour emission control, charcoal canister, positive crank case ventilation systems, Design modifications, lean burn strategies, faster warm-up, heated air system, exhaust gas recirculation; different methods, fuel additives, electronic control of air fuel ratio.

**Pollution study of alternate fuels**

**UNIT II**

10Hours

**Post combustion treatment:** Available options, physical conditions and exhaust gas composition before treatment, catalytic mechanism, thermal reactions, installation of catalyst in exhaust lines, two-way and three way converters, air injection system, NOx treatment in diesel engines, particulate traps, diesel trap oxidizer.

**Influence of fuel properties on emission:** Influence of fuel properties like density, olefin and aromatic content, volatility, octane number, additives, viscosity, distillation interval, cetane number, sulphur content on emissions.

**Instrumentation for pollution measurement:** NDIR analyzers, gas chromatograph, Orsat apparatus, flame ionization detectors, chemiluminescence, smoke measurement; comparison and obscuration method, Hartridge and Bosch smoke meter.

**UNIT III**

10Hours

**Alternative energy resources:** Types of energy sources, batteries and fuel cells, need for energy sources, availability, merits and demerits of solar energy, wind energy, ocean energy.

Properties of alcohols, performance of IC engines using ethanol and methanol blends, production and properties of natural gas and LPG. Advantages and disadvantages of using natural gas and LPG as a fuel in IC engine, comparison with respect to conventional fuel. CNG rearrangement

**UNIT IV**

10Hours

**Hydrogen energy:** Properties, storage, transportation, combustion, emission and performance characteristics of hydrogen engine, engine modifications required.
**Biomass energy:** Properties, composition, application of biogas for IC engines, modifications required, vegetable oils, types, properties, biodiesel esterification, performance in engines.

**TEXT BOOKS:**
1. I.C. Engines By Mathur & Sharma, Dhanpat Rai & Sons, New Delhi, 1994

**REFERENCE BOOKS:**
5. Fuels & Combustion by Smith & Stinson,
6. I.C. Engines by Lichte

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**UAU613C: AUTOMOTIVE ELECTRICAL AND ELECTRONIC SYSTEMS**

3 CREDITS (3-0-0)

**UNIT – 1**

10Hours

*STORAGE BATTERY:* principle of lead acid cells, plates and their characteristics containers and separators, electrolyte and their preparation, effect of temperature on electrolyte, its specific gravity, capacity and efficiency, methods of charging from D.C. mains, defects and remedies of batteries, s. Working principles of Alkaline, Nickel-Cadmium, Lithium batteries.

05

**GENERATOR / ALTERNATOR:** Principle of generation of direct current, generator constructional details, Construction of alternator, rectification, voltage regulation, testing of alternator, Fault diagnosis of alternator generating system.

05

**STRENGTHEN**

**UNIT – 2**

10Hours

**STARTER MOTOR & DRIVES:** Battery motor starting system, condition at starting, construction, types of starter motor connections (series and shunt motor) and its characteristics, , types of drives (Bendix, positively engaging and disengaging, sliding armature type). dc motors, and drives

**IGNITION SYSTEM:** Ignition fundamentals, Types of ignition systems, components, construction and operation, ignition timing, spark advance mechanism and control. Advance ignition systems like Electronic, distributor less ignition system, C.D.I, D.I ignition systems.

**UNIT – 3**

10Hours
LIGHTING and ELECTRICAL ACCESSORIES: Principle of automobile illumination, head lamp mounting and construction, sealed beam auxiliary lightings and recent developments (L.E.D), horn, windscreens-wipers, signaling devices, electrical fuel pump, fuel, oil and temperature gauge(Dash board instruments)

HEATING AND AIR CONDITIONING: Conventional heating and ventilation, Air conditioning theory and systems, seat heaters. Wire harnessing

UNIT – 4

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.

CHASSIS ELECTRICAL SYSTEMS: Antilock brake systems (ABS), Active suspension, Traction control, Electronic control of automatic transmission, other chassis electrical systems, Central locking, Air bags and seat belt tensioners, Electronic brake distribution (EBD).

TEXT BOOKS:

REFERENCE BOOKS:
3. Bosch Technical Instruction Booklets
4. Automobile Electrical Equipment - A.P. Young & Griffiths,
5. Modern Electrical Equipment - W. Judge,
INTRODUCTION: Definition of various economic terms such as economic goods, utility, value, price, wealth, wants capital, rent and profit, Laws of returns.


WAGES: Nominal and real wages, Factors affecting real wages, theory of wages, Difference in wages, methods of wage payment.

UNIT - 2

MONEY AND EXCHANGE: Theory of exchange, Barter, stock exchange, Speculation money qualities of a good money, function of a money, classification of money, value of money, index number, appreciation and depreciation of money value, Gresham’s Law and its limitations.

TAXATION AND INSURANCE: Principle of taxation, characteristics of a good taxation system, kinds of taxes, and their merits and demerits, Vehicle Insurance, Loss Assessment.

INTEREST AND DEPRECIATION: Introduction, theory of interest, interest rate, interest from lender’s and borrower’s view point, simple and compound interest. Nominal and effective interest rates, interest formulae
Annual compounding, Annual payments and continuous compounding annual payment, simple numerical problems. Need for depreciation causes of depreciation life and salvage value methods of depreciation, simple numerical problems.

UNIT - 3

COSTS: Standard costs estimated cost, First cost, Fixed cost, Variable costs, Incremental cost, Differential cost, Sunk and marginal cost, Breakeven and minimum cost analysis, simple numerical problems.

COST ACCOUNTING: Introduction, objectives of cost accounting, elements of cost material cost, labour cost, and expenses, allocation of overheads by different methods, simple numerical problems.

UNIT - 4

BASIS FOR COMPARISON OF ALTERNATIVES, present worth methods, capital recovery methods, and rate of return method, simple numerical problems.

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.

4 Hours

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 Hours

UNIT - 2

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, DMIS.

6 Hours

INTRODUCTION TO ROBOTICS: Introduction, robot configuration, robot motion, programming of robots, end effectors work cell, control and interlock, robot sensor, robot applications.

4 Hours

UNIT - 3
NC, CNC, DNC TECHNOLOGIES: NC, CNC, DNC, modes, NC elements, advantages and limitations of NC, CNC. Functions of computer in DNC 4Hours

CNC TOOLING: Turning tool geometry, milling tooling system, tool presetting, ATC, work holding. 3Hours

CAM PROGRAMMING: Overview of different CNC machining centers, CNC turning centers, high speed machine tools. 3 Hours

UNIT - 4
CNC PROGRAMMING: Part program fundamentals-steps involved in development of a part program. Manual part programming, milling, turning, turning center programming. 5 Hours

INTRODUCTION TO FINITE ELEMENT ANALYSIS: Introduction, basic concepts, discretization, element types, nodes and degrees of freedom mesh generation, constraints, loads, preprocessing, application to static analysis. 5 Hours

TEXT BOOKS:
2. CAD/CAM - by Groover, Tata McGraw Hill.

REFERENCE BOOKS:
9. Introduction to FEM - T Chandra patta Ashok D Bebgundu.

UAU652E : TOTAL QUALITY MANAGEMENT
3 Credits (3-0-0)
UNIT - 1


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

UNIT - 2

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

BUILDING AND SUSTAINING TOTAL QUALITY ORGANIZATIONS: Making the commitment to TQ, Organizational culture and Total Quality, Change management, sustaining the quality organization.

UNIT - 3

TOOLS AND TECHNIQUES IN TQM: 7 basic tools of quality control, Kaizen, Re-engineering, 6 sigma, Benchmarking, Definition, Process of benchmarking, 5S, Yoke.


UNIT - 4

PRODUCT ACCEPTANCE CONTROL: Product acceptance control through IS 2500 part 1 and part 2.

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.

TEXT BOOKS:
PRODUCT DESIGN AND DEVELOPMENT

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<th>Subject Code</th>
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**UNIT I**

**Introduction:** Characteristics of successful product development, Design and development of products, duration and cost of product development, the challenges of product development. **02 Hour**

**Development Processes and Organizations:** A generic development process, concept development: the front-end process, adopting the generic product development process, the AMF development process, product development organizations, the AMF organization. **03 Hour**

**Product Planning:** The product planning process, identify opportunities. Evaluate and prioritize projects, allocate resources and plan timing, complete pre project planning, reflect all the results and the process. **03 Hour**
Identifying Customer Needs: Gather raw data from customers, interpret raw data in terms of customer needs, organize the needs into a hierarchy, establish the relative importance of the needs and reflect on the results and the process.

02 Hour

UNIT II
Product Specifications: What are specifications, when are specifications established, establishing target specifications, setting the final specifications.

04 Hour

Concept Generation: The activity of concept generation clarify the problem, search externally, search internally, explore systematically, reflect on the results and the process.

03 Hour

Concept Selection: Overview of methodology, concept screening, and concept scoring.

03 Hour

UNIT III
Concept Testing: Define the purpose of concept test, choose a survey population, choose a survey format, communicate the concept, measure customer response, interpret the result, reflect on the results and the process.

05 Hour

Product Architecture: What is product architecture, implications of the architecture, establishing the architecture, variety and supply chain considerations, platform planning, related system level design issues.

05 Hour

UNIT IV
INDUSTRIAL DESIGN: Assessing the need for industrial design, the impact of industrial design, industrial design process, managing the industrial design process, assessing the quality of industrial design.

03 Hour

Design for Manufacturing: Definition, estimation of manufacturing cost, reducing the cost of components, assembly, supporting production, impact of DFM on other factors.

03 Hour

Prototyping: Prototyping basics, principles of prototyping, technologies, planning for prototypes.

02 Hour

Product Development Economics: Elements of economic analysis, base case financial mode, Sensitive analysis, project trade-offs, influence of qualitative factors on project success, qualitative analysis.

02 Hour
Managing Projects: Understanding and representing task, baseline project planning, accelerating projects, project execution, postmortem project evaluation.

TEXT BOOK:

REFERENCE BOOKS:
  c. Geoffery Boothroyd, Peter Dewhurst and Winston Knight, “Product Design for Manufacture and Assembly”, 2002
2. Analysis – FEA (Preprocessor, solver, post processor)
   a) Exercise involving simple structures.
   b) Validation of result with analytical solution.
3. Introduction to CNC programming (G codes & M codes) a) Turning b) Milling Simple Exercises (2 – 4 Nos.) using CNC Simulator.

1. Maintenance/service charts for different parts of chassis, suspension and transmission.
2. Study of Head light beam testing for two & four wheeler.
3. Braking distance test for four wheeler.
4. Study of tyre retreading, tubeless tyre puncture repairs, painting of vehicles.
5. Sketch the layout of a service station and bus depot mentioning the various equipments required including the space needed.
6. Study and practice on Computerized wheel balancing machine, computerized wheel alignment machine, Computerized Engine analyzer.
7. Study of two wheeler performance on two wheeler chassis dynamometer.
8. Study of electrical components like battery, alternator, regulator on electrical test bench
9. Study and demo of wind tunnel testing i) testing for pressure distribution ii) testing for lift, yaw, drag

Basaveshwar Engineering College, Bagalkot
Department of Automobile Engineering

Scheme for VII to VIII semesters
&
Syllabus of VII to VIII semesters

<table>
<thead>
<tr>
<th>Scheme of syllabus for 7th Sem B.E. Auto</th>
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**Department Electives - IX**
**List of Elective Subjects for VIII**

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<td>Numerical Methods for Automobile Applications</td>
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<td>2</td>
<td>UAU852E</td>
<td>Hybrid vehicles</td>
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<td>3</td>
<td>UAU853E</td>
<td>Robotics</td>
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<td>4</td>
<td>UAU854E</td>
<td>FEM</td>
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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

Vehicle Body Materials:
Properties, manufacturing methods and suitability for vehicle body construction - Aluminium alloys, Steel, alloy steels, plastics and composite materials, semi rigid PUR foams and sandwich panel construction.

Paints and adhesives

UNIT-2

Aerodynamics:
Basics, Various types of forces and moments, effects of forces and moments, various body optimization techniques for minimum drag, Study of wind tunnels, flow visualization techniques, tests with scale models, aerodynamic study for heavy vehicles

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.

UNIT-3

Interior Ergonomics:
Introduction, Seating dimensions, Interior ergonomics, seat comfort, Driver seat design, , 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 mechanisms.

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.

UNIT-4

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.

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.

TEXT BOOKS:
REFERENCES:
1. Hand book on vehicle body design – SAE publication
2. Automotive chassis by P.M. Heldt, Chilton & Co, 1970
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

AUTOMOTIVE TRANSMISSION

Sub Code: UAU702C
Hrs/Week: 03
Total Lecture Hrs: 40
CIE Marks: 50
Exam Hrs: 03
Exam Marks: 100

UNIT-1

Power Required for Propulsion
 Resistances ; wind, gradient, rolling to Motion of the Automobile, Traction, tractive effort, road performance curves; acceleration, gradability, drawbar pull, Numerical problems. 3 hrs

Clutch
 Need of clutch in an automobile, requirements, materials, different types of clutches; wet and dry friction clutches; principle of friction clutches, Single plate, multi-plate, diaphragm, cone,
centrifugal clutch, Method of actuation; electromagnetic, hydraulic, vacuum, adjustment, Clutch trouble shooting diagnosis, Numerical problems 7 hrs

UNIT-2

**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. 4 hrs

**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. Differentials, propeller shafts, universal joints 6 hrs

UNIT-3

**Gear box**
Functions of transmissions, Necessity of gear box, types of transmission; manual and automatic transmission, Sliding-mesh gear box, Constant-mesh gear box, synchromesh gear box, transfer box, transaxle, selector mechanism, types, lubrication, trouble shooting diagnosis, Calculation of gear ratios for vehicles, Performance characteristics in different gears, Desirable ratios of 3speed & 4speed gear boxes, numerical problems 6 hrs

**Epicyclic Transmission**
Principle of operation, types of planetary transmission, Calculation of gear ratio in different speeds, Wilson planetary transmission, Over drives, control of the over drive, Numerical problems 4 hrs

UNIT-4

**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, advantages and limitations, typical hydrostatic drives, hydrostatic shunt drives. Continuous variable transmission 6 hrs

**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. 4 hrs

**TEXT BOOKS:**

**REFERAENCE BOOKS:**
4. G.B.S.Narang “Automobile Engineering”, Khanna publication, New Delhi
7. P.M. Heldt,”Torque converters”, Oxford & IBH, 1975
ADVANCED I.C. ENGINES

Sub Code: UAU817C
CIE Marks: 50
Hrs/Week: 04
Exam Hrs: 03
Total Lecture Hrs: 52
Exam Marks: 100

UNIT-1

Combustion in Spark Ignition Engines

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

UNIT-3

Equilibrium charts:
Charts for burnt mixture, charts for unburned Mixture, transmission from unburned to burnt mixture, non-equilibrium Problems covering the above.

UNIT-4

Modern Developments in I.C.Engines:

13 Hrs

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.

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.

13 Hrs

TEXT BOOKS:
COMPOSITE MATERIALS

Sub Code: UAU731E
Hrs/Week: 03
Total Lecture Hrs: 40

CIE Marks: 50
Exam Hrs: 03
Exam Marks: 100

UNIT - 1

INTRODUCTION TO COMPOSITE MATERIALS: Definition, classification and characteristics of composite materials – fibrous composites(CFRP and GFRP), laminated composites, particulate composites. Properties and types of Reinforcement and Matrix materials.

3 Hours


7Hours

UNIT - 2

FABRICATION OF COMPOSITES: Fabrication methodology, processing and applications of Cutting, machining, drilling, mechanical fasteners and adhesive bonding

8 Hours

Testing of Composites

2Hours

UNIT - 3

METAL MATRIX COMPOSITES: Reinforcement materials, types, characteristics and selection. Base metals selection – Need for production of MMC’s and its application

10 Hours

UNIT - 4
FABRICATION PROCESS FOR MMC’S: Powder metallurgy technique, liquid metallurgy technique and secondary processing, special fabrication techniques. Applications of MMC’s

08 Hours

APPLICATION OF COMPOSITES: Automobile, Aircrafts, missiles, Space hardware, Electrical and electronics, marine, recreational and Sports equipment, future potential of composites.

02 Hours

TEXT BOOKS:


REFERENCE BOOKS:


Microprocessors

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>UAU 732E</th>
<th>IA Marks</th>
<th>25</th>
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<td>03</td>
<td>Exam Hrs</td>
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</table>
UNIT - 1

THE 8086 PROCESSORS: Historical background, The microprocessor-based personal computer system, 8086 CPU Architecture, Machine language instructions, Instruction execution timing. 5 Hours

INSTRUCTION SET OF 8086: Assembler instruction format, data transfer and arithmetic, branch type, loop, NOP & HALT, flag manipulation, logical and shift and rotate instructions. Illustration of these instructions with example programs, Directives and operators. 5 Hours

Unit - 2

BYTE AND STRING MANIPULATION: String instructions, REP Prefix, Table translation, Number format conversions, Procedures, Macros, Programming using keyboard and video display. 5 Hours

8086 INTERRUPTS: 8086 Interrupts and interrupt responses, Hardware interrupt applications, Software interrupt applications, Interrupt examples. 5 Hours

UNIT - 3

8086 INTERFACING: Interfacing microprocessor to keyboard (keyboard types, keyboard circuit connections and interfacing, software keyboard interfacing, keyboard interfacing with hardware), Interfacing to alphanumeric displays (interfacing LED displays to microcomputer), Interfacing a microcomputer to a stepper motor. 5 Hours

8086 / 8088 BASED MULTIPROCESSING SYSTEMS: Coprocessor configurations, The 8087 numeric data processor: data types, processor architecture, instruction set and examples. 5 Hours

UNIT - 4

SYSTEM BUS STRUCTURE: Basic 8086 configurations: minimum mode, maximum mode, Bus Interface: peripheral component interconnect (PCI) bus, the parallel printer interface (LPT), The universal serial bus (USB). 5 Hours

80386, 80486 AND PENTIUM PROCESSORS: Introduction to the 80386 microprocessor, Special 80386 registers, Introduction to the 80486 microprocessor, Introduction to the Pentium microprocessor.
5 Hours

TEXTBOOKS:

REFERENCE BOOKS:

UAU 733E: VEHICLE DYNAMICS
3 Credits (3-0-0)

UNIT - 1
UNDAMPED FREE VIBRATION: Introduction, Sinusoidal motion, Single degree of freedom system, Newton’s method, Energy method and D’Alembert’s principle, undamped free vibration - Natural frequency of free vibration, problems. 6 Hours
DAMPED FREE VIBRATION: Single degree of freedom systems, different types of damping, concept of critical damping and its importance, response study of viscous damped systems for cases of under damping and over damping, logarithmic decrement, problems. 4 Hours

UNIT - 2
FORCED VIBRATION: Single degree of freedom systems, steady state solution with viscous damping due to harmonic force solution by complex algebra, vibration isolation - transmissibility ratio, energy dissipated by damping equivalent viscous damping, Structural damping, sharpness of resonance, base excitation, problems. 5 Hours

SYSTEMS WITH TWO DEGREE OF FREEDOM: Introduction, principle modes and normal modes, co-ordinate coupling, generalised and principle co-ordinate, free vibrations in terms of initial conditions, Lagrange’s equation, semi-definite systems, Applications: Vehicle suspension, Dynamic vibration absorber, dynamics of reciprocating engines, problems. 5 Hours

UNIT - 3
NUMERICAL METHODS FOR MULTI DEGREE OF FREEDOM SYSTEMS:
Introduction, influence coefficients, Maxwell’s reciprocal theorem, Dunkerley’s method, orthogonality principle, method of matrix iteration, method of determination of all the natural frequencies using sweeping matrix and orthogonality principle, Holzer’s method for systems with free, fixed free and fixed ends, stodola method, Rayleigh Ritz method for beam vibration

UNIT - 4

VEHICULAR VIBRATION: vibration due to road roughness, vibration due to engine unbalance, reciprocating and rotating unbalance, transmissibility of engine mounting vibration with two degree of freedom, compensated suspension systems forced vibration.

6 Hours

TYRE MECHANICS: Vehicle control – low speed cornering and static steering, steady –state cornering – steering factors, vehicle control parameters (under steer, neutral steer and over steer), roll steer, compliance steer, ride steer, slip angle steer, steady state handling – lateral acceleration gain, characteristic speed, yaw velocity gain, critical speeds

4 Hours

TEXT BOOKS:

REFERENCE BOOKS:
5. Mechanical Vibration Analysis- P.Srinivasan, TMH

OPERATIONS RESEARCH
03Credits (3-0-0)

Subject Code : UAU 741E
IA Marks : 50
No. of Lecture Hrs/ Week : 03
Exam Hours : 03
Total No. of Lecture Hours :40
Exam Marks : 100
1. Introduction: OR methodology, definition of OR, Application of OR to engineering and Managerial problems, Features and Limitation of OR 4 Hrs

2. Linear Programming: definition, mathematical formulation, standard form, solution space, solution – feasible, basic feasible, optimal, infeasible, multiple, optimal, Redundancy, Degeneracy. Graphical and Simplex methods 6 Hours

Unit 2

3. Variants of Simplex algorithm – Artificial basis techniques, Concept of duality, dual simplex method, degeneracy, and procedure for resolving degenerate cases

4. 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. 7 Hrs

Unit 3

5. Assignment problem: Formulation, unbalanced assignment problem, Travelling salesman 3 Hrs

6. 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 5 Hrs

7. Project management using network analysis: Network construction, numbering the events, determination of critical path 2 Hrs

Unit 4

8. PERT- estimation of project duration, variance, CPM and duration, floats, crashing, least cost project scheduling, Flow in networks, determination of shortest route, determination of maximum flow through the networks 6 Hrs

9. Game theory: Formulations of games, Two person – zero sum game, games with and without saddle point, graphical solution (2x n,mx2 game) dominance property 4 Hrs

TEXT BOOKS:


REFERENCE BOOKS:

1. Operation research - AM Natarajan, P.Balasubramani,ATamilaravari Pearson 2005
4. Kanthi swarup – Operations research
HYDRAULICS AND PNEUMATICS

Sub Code: UAU742E
Hrs/Week: 03
Total Lecture Hrs: 40
IA Marks: 50
Exam Hrs: 03
Exam Marks: 100

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.


4 Hrs

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 2:

Control Components in Hydraulic Systems:
Directional Control Valves – Symbolic representation, Constructional features, pressure control valves – direct and pilot operated types, flow control valves.

3 Hrs

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

Unit 3:

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.

4 Hrs

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 4:

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. Signal processing elements: Use of Logic gates – OR and AND gates pneumatic applications. Practical examples involving the sue of logic gates.

5 Hrs

Multi-cylinder applications:
Coordinated and sequential motion control. Motion and control diagrams – Signal elimination methods. (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. Compressed air: Production of compressed air – compressors, preparation of compressed air- Driers, Filters, Regulators, Lubricators, Distribution of compressed air- Piping layout. 5 Hrs

Text Books:

Reference Books:
Simulation of IC Engine Processes

Sub Code: UAU743E
Hrs/Week: 03
Total Lecture Hrs: 40
CIE Marks: 50
Exam Hrs: 03
Exam Marks: 100

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

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

UNIT-2

DESIGN AND EVALUATION OF SIMULATION EXPERIMENTS:
Variance reduction techniques. Antithetic variables. Variables verification and validation of simulation models.
6 Hrs
DESIGN AND EVALUATION OF SIMULATION EXPERIMENTS:
Variance reduction techniques. Antithetic variables. Variables verification and validation of simulation models.
4 Hrs

UNIT-3

COMBUSTION PROCESS – GENERAL
Heat of reaction – Adiabatic flame temperature – Temperature change due to fuel vaporization
5 Hrs

HEAT TRANSFER IN ENGINES
5 hrs

UNIT-4

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.

TWO STROKE ENGINE SIMULATION
Engine and porting geometry, gas flow, Scavenging.-
6 Hrs

SIMULATION EXERCISES:
Simulation exercises using computers - MATLAB SimuLink, Lotus Engine simulation, ProE / ICEM, CFD Analysis, FE Analysis and Validation of models.
4 Hrs

TextBooks:
3. NARSINGH DEO, “System Simulation with digital Computer", prentice Hall Of India,1979 ..

ReferenceBooks:
1. Study and Practice of Line reboring machine
2. Study and Practice of calibration FIP
3. Study and Practice of vertical cylinder reboring machine
4. Study and Practice of reboring small and big end of connecting rod
5. Study and Practice on body repairs tinkering and painting
6. Study and Practice of refacing of given valve
7. Study and Practice of surface grinding machine
8. Study and Practice of crank shaft grinding machine
Introduction:
Historical background, the growth of a network, trams, trolley buses, buses, private cars, subsidies. Motor vehicle act 1988. Maintenance - preventive, breakdown, overhauling - major, minor, repair schedules & workshop, facilities, documentation, analysis & corrective maintenance schedules 4 Hrs

Organization and Management:
Forms of ownership, municipal undertaking, company undertaking, traffic, secretarial and engineering departments, 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. 6 Hrs

UNIT-2

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 5 Hrs

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 5 Hrs.

UNIT-3

Fare collections:
Need, Principles of collection, tickets, the way bill, stage by stage, bell punch system, bell graphic 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. 5 Hrs

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. 5 Hrs

UNIT-4

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. 5 Hrs
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. 5 Hrs

Text books:

Reference books:
1. Compendium of transport terms - Cirt,Pune
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

EARTHMOVING EQUIPMENTS & TRACTORS

Sub Code: UAU802C  
IA Marks: 40

Hrs/Week: 03  
Exam Hrs: 03

Total Lecture Hrs: 40  
Exam Marks: 100

Types of soil

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

10 hrs

UNIT-2
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

4 hrs

TRANSMISSIONS AND FINAL DRIVES: (repeated)
Basic types of transmissions, auxiliary transmission , compound transmission, planetary transmission, constructional and working principles, hydroshift automatic transmission and retarders. FINAL DRIVES: types of reductions like, single reduction, double reduction final drives and planetary final drives, PTO shaft.

6 Hrs

UNIT-3
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.

5 hrs

STEERING AND BRAKES: Power steering types like, linkage type power steering , semi integral power steering & integral power steering. STEERING OF TRACKED VEHICLES: articulated steering, clutch /brake steering system,. BRAKES: Types of brakes like, disc brake, engine brakes etc.

5 hrs

UNIT-4

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 EMEs

Safety aspects and maintenance to be added.

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

UAU 803: ROCKET AND JET PROPULSIVE SYSTEMS
4 CREDITS (4-0-0)

UNIT 1

13 HOURS

UNIT 2
13 HOURS

UNIT 3
13 HOURS

UNIT 4
13 HOURS


CONTROL ENGINEERING
03 Credits (3-0-0)

Subject Code: UAU841E
CIE Marks: 50
No. of Lecture Hrs/ Week: 03
Exam Hours: 03
Total No. of Lecture Hours: 40
Exam Marks: 100

UNIT - 1

INTRODUCTION: Concept of automatic controls, open and closed loop systems, concepts of feedback, requirement of an ideal control system. Types of controllers– Proportional, Integral, Proportional Integral, Proportional Integral Differential controllers. 6 Hours.

MATHEMATICAL MODELS: Transfer function models, models of mechanical systems, models of electrical circuits, DC and AC motors in control systems, models of thermal systems, models of hydraulic systems. Pneumatic system. Analogous systems: Force voltage, Force current (discussions only). 4 Hours.
UNIT - 2

BLOCK DIAGRAMS AND SIGNAL FLOW GRAPHS: Transfer Functions definition, function, blocks representation of system elements, reduction of block diagrams, Signal flow graphs: Mason’s gain formula.  

5 Hours

TRANSIENT AND STEADY STATE RESPONSE ANALYSIS:


5 Hours

UNIT - 3

FREQUENCY RESPONSE ANALYSIS: Polar plots, Nyquist Stability Criterion, Stability Analysis, Relative stability concepts, phase and gain margin, M & N circles  

5 Hours

FREQUENCY RESPONSE ANALYSIS USING BODE PLOTS: Bode attenuation diagrams, Stability Analysis using Bode plots, Simplified Bode Diagrams  

5 Hours

UNIT - 4


5 Hours

CONTROL ACTION AND SYSTEM COMPENSATION: Series and feedback compensation, Physical devices for system compensation  

5 Hours

TEXT BOOKS:

2. Control Systems Principles and Design - M. Gopal, TMH, 2000

REFERENCE BOOKS:

UNIT - 1
AN OVERVIEW OF NANOSCIENCE & NANOTECHNOLOGY – historical background – nature, scope and content of the subject – multidisciplinary aspects – industrial, economic and societal implications.

03 Hours

UNIT - 2

07 Hours

UNIT - 2

10 Hours

UNIT - 3

05 Hours


05 Hours

UNIT - 4

10 Hours

TEXT BOOKS:
1. NANO: The Essentials – Understanding Nanoscience and Nanotechnology; T Pradeep (Professor, IIT Madras); Tata McGraw-Hill India (2007)

REFERENCE BOOKS:

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**Numerical Methods For Automotive Applications**

**UAU851E**

<table>
<thead>
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<th>Hrs/ Week:</th>
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**Unit 1**

**Linear Algebraic Systems**

**Motivation and Objectives/ Gauss-Jordan Elimination/Gaussian Elimination/ Iterative Methods.**

05 Hrs

**Unit 2**

**EigenValues and Eigenvectors**

**Motivation and Objectives/ The characteristics Polynornial/ Power Methods / Jacobi's Method/ Householder Transformation/ QR Method/ Danilevsky's Method/ Polynorninal Roots.**

10 Hrs

**Unit 3**

**Numerical Differentiation and Integration**

Derivative from difference tables - Divided differences Interpolating with a cubic spline - Newton's forward and backward difference formulas.

05 Hrs

**Unit 4**

**CurveFitting**

**Motivation and objectives/ Interpolation/ Newton's Difference Formula/ Cubic Splines/ Least Square/ Two-Dimensional Interpolation.**

05 Hrs

**Root Finding**
Motivation and Objectives/ Bracketing methods/ Contraction Mapping Method/ Se cant Method/ Muller's Method/ Newton's Method/ Polynomial Roots. 05 Hrs

Text Book:


Reference Books:


UAU 852E: Hybrid Vehicles
3 Credits (3-0-0)

UNIT – I
1. Introduction and The history of electric cars up to 1990
   The early days, the first road vehicles, competition for speed and reliability, Electric vehicles compete with steam and gasoline, the golden age, Cost problems for electric dive, the
dark ages (1925-1960), the modern era, the 1960s, 1970s, 1980s. General reference.

06 Hours

2. Propulsion Methods
   DC Motors – Series wound motors, Shunt Wound motors, compound Compound wound motors, separately excited motors. AC Motors – induction motors, Synchronous motors, the brushless DC motors, Switched reluctance motors, motor cooling, transmission system, general reference.
   06 Hours

UNIT – II

3. Control and power electronics
   Electronic energy management, power electronics, power switching devices – the bipolar darlington, the thyristor, the gate turn – off thyristor, (GTO) the MOS controlled thyristor (MCT), the MOSFET, the insulated bipolar transistor (IGBT), Semiconductor cooling, Capacitors, Current Measurements. References. 06 Hours

4. Energy Sources1 – Storage Batteries
   Lead acid, advanced lead acid, Metal foil lead acid, Nickel iron, Nickel zinc, Nickel cadmium, Sodium sulphur, sodium nickel chloride, Lithium iron sulphide, lithium solid polymer, lithium-ion, aluminium-air and zinc-air, Batteries for hybrid vehicles.
   06 Hours

UNIT – III

5. Energy Sources2 – Other Technologies
   The super capacitor, Fuels cells, Solar cells, the flywheel, the hydraulic accumulator, Compressed air storage, thermal energy storage, summary – non battery energy sources.
   06 Hours

6. Charging
   Early systems, charging techniques for lead acid batteries, charging techniques for nickel based batteries, charging techniques for non aqueous batteries, Battery state of charge measurement, battery management, connection methods, battery exchange, infrastructure implications, Recharging/refueling of other power storage devices.
   06 Hours

UNIT – IV

7. Vehicle design and safety
   Effect of battery weight and volume, designing for minimum weight, safety of batteries, safety of alternative energy generating and storage systems, safety of other electrical systems, general design and safety issues, heating and air conditioning, auxiliary power subsystem, braking suspension and wheel systems, rolling resistance.
   06 Hours

8. Battery Electric Cars
   Production electric cars – the general motors EV1, the ford think city, the Nissan Hypermni, the Toyota RAV 4 EV, Prototype and experimental electric cars.
   02 Hours

9. Hybrid Electric Cars
   Hybrid system configuration, All-electric hybrid vehicles, Electromechanical hybrid vehicles, Heat engine electric hybrid vehicles – series hybrids, parallel hybrids, Hybrid concepts, production hybrid cars – the Honda insight, the Toyota prius.
   04 Hours

Text Book

UNIT-1

Unit 1: Introduction and Mathematical Representation of Robots: Classification of Robots, Transformations, 2D and 3D, Homogeneous coordinates, Types of Joints: Rotary, Prismatic joint, Cylindrical joint, Spherical joint, Representation of Links using Denavit-Hartenberg Parameters:

Link parameters for intermediate, first and last links, Link transformation matrices, Transformation matrices of 3R manipulator, PUMA560 manipulator, SCARA manipulator

04 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

Velocity and Statics of Manipulators: Differential relationships, Jacobean, 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.

04 Hrs

UNIT - 3

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

10 Hrs

UNIT - 4

Actuators: Types, Characteristics of actuating system: weight, power-to-weight ratio, operating pressure, stiffness vs. compliance, comparison of hydraulic, electric, pneumatic, actuators, proportional feedback control, Electric motors: DC motors, Reversible AC motors, Brushless DC motors, Stepper motors- structure and principle of operation, stepper motor speed-torque characteristics

06 Hrs

04 Hrs

Text Books:

Reference Books:

UNIT-1

10 Hrs

UNIT-2

10 Hrs

UNIT-3
Shape functions and Nodal load vector, Strain displacement matrix and Jacobian for triangular and rectangular element. Solutions of bars and stepped bars for displacements, reactions and stresses by using penalty approach and elimination approach. Guass-elimination technique.

10 Hrs

UNIT-4
Higher Order Elements: Langrange’s interpolation, Higher order one dimensional elements-Quadratic and cubic element and their shape functions. Shape function of 2-D quadrilateral element-linear, quadric element Iso-parametric, Sub parametric and Super parametric elements.

05 Hrs


05 Hrs

TEXT BOOKS:

**REFERENCE BOOKS:**

1. “**Finite Element Methods for Engineers**” U.S. Dixit, Cengage Learning, 2009
ADVANCED I.C. ENGINES

Sub Code: UAU842E
Hrs/Week: 03
Total Lecture Hrs: 40

UNIT-1
Combustion in Spark Ignition Engines

10 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, Ignition delay: definitions and discussion, fuel ignition quality, auto ignition fundamentals.

10 Hrs

UNIT-3
Modern Developments in I.C.Engines:

10 Hrs

UNIT-4
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.

10 Hrs

TEXT BOOKS:

REFERENCE BOOKS:
7. I.C.Engines By Lichty., McGraw Hill
Project Work – I

Sub Code: UAU 707P
Credits: 08
Hours/Week: 08

CIE Marks: 50
Sem: VII

• Project Batch may consist of maximum of Four Students however under exceptional conditions it may be extended up to 5 students.

• Guide/s may be identified by the students or it may be allotted by the department.

• The students along with the respective guides have to decide the project work and submit the title and synopsis of the project work to the Departmental committee (DC) consisting of 1) HOD or HOD Nominee 2) Project Coordinator and 3) Respective Project Guide/s

• Each student in the batch is directed to maintain the project progress record book to enter the progress of project work during the contact hours with the respective guides.

• The contact hour schedule may be defined by the guides in consent with their batches as per convenience.

• The CIE evaluation is to be conducted for 50marks by the guide by reviewing the progress of the project work, attendance through the record books conducting at least one demo/seminar presentation for the same project work before SEE examination.

• Students have to submit the synopsis in 2 copies containing objectives, methodology, literature review, etc as a project report-I for VII Semester SEE Examination purpose. (one report to the Guide and one report to DC)

• The SEE examinations will be conducted by DC separately for each project batch for 50marks.

• In case of the change of the title/synopsis/project work, may be done in consent with the respective guides before SEE examination and the same should be brought to the notice of DC.

Project-I
Project Work – II

Sub Code: UAU 806P  
CIE Marks: 50  
Credits: 12  
Sem: VIII  
Hours/week: 6+6

- The project work defined in project -I has to be continued for the project work – II.
- The guides have to review the progress of the project work continuously during the contact hours.
- The contact hour schedule may be defined by the guides in consent with their batches as per convenience.
- CIE evaluation has to be done by DC based on the progress of the project work by conducting minimum of two demos/ seminar presentation for 25 marks each.
- The students of the project batches are supposed to submit the final project report earlier to SEE examination with the consent of the guide to the DC.
- The SEE examinations will be conducted by PEC consisting of 1) HOD/His Nominee, 2) Internal Examiner/Project Coordinator, 3) External Examiner separately for each project batch for 50 marks.

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<thead>
<tr>
<th>Examination</th>
<th>CIE-I</th>
<th>CIE-II</th>
<th>SEE</th>
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Project-II

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