

5AE1 : HEAT TRANSFER IN IC ENGINE

3L+1T

MM: 100

Unit 1.

Introduction of heat transfer:

Temperature, heat and thermal equilibrium, basic definition and law of heat transfer, modes of heat transfer, steady and unsteady heat transfer, and significance of heat transfer.

Conduction Heat Transfer: Fourier equation, general heat conduction equation: Cartesian co-ordinate, cylinder co-ordinate, spherical co-ordination, conduction through plane wall, composite wall cylindrical, multi cylindrical wall, spheres. Critical thickness of insulation, heat transfer from extended surface, steady state flow of heat along a rod, governing differential equations and their solution, heat dissipation from infinite long fin, insulated tip, fin performance.

Unit 2.

Convection: Stroke energy equation, hydrodynamic and thermal boundary layers: laminar boundary layer equation; forced convection appropriate non dimensional members, flow over flat plate, similarity solution. Von-karman's method, effect of Prandtl number. laminar flow through circular pipe.

Natural Convection: Dimensional analysis Grashoff number, boundary layers in external flow (flow over a flat plate only), boundary layer equations and their solutions. Heat transfer Correlation.

Unit 3.

Radiation: Salient features and characteristics of radiations, absorptive, reflectivity and transmissivity, spectral and spatial energy distribution, wavelength distribution of black body radiation, planck's law. Total emission power. Stefan Boltzman law, Wien's displacement law, kirchoff's law, intensity of radiation & Lambert's cosine law.

Unit 4

Heat transfer in IC engine: Water and air cooling of engines, combustion systems and variation of gas temperatures, heat transfer coefficients, calculations of heat rejection to coolant. Heat transfer, temperature distribution and thermal stress in piston, piston ring, cylinder liner. Heat transfer through cylinder head, fins and valves, Effect of various operating parameter on engine heat transfer.

Unit 5.

Heat exchangers used in IC engine : Principles of different type of Heat exchanger. Type of radiators, inter cooler and after cooler. EGR cooling and EGR coolers. Engine coolant and their properties.

5AE2 AUTOMOTIVE ELECTRICAL AND ELECTRONICS

3L

MM:100

Unit 1

Storage Batteries:

Principles, construction and operation of lead acid battery, battery capacity, efficiency, rating and performance. Determination of battery size. Electrolyte, Battery tests, Battery charging equipment and methods. Battery faults.

Unit 2

Starter and charging system: Starting system requirements, sizing of starter motor and selection, characteristics of starter motor, type of starting, motor drive mechanisms, starter switch, starter system fault. DC Generator & AC alternators. Magneto. Armature reaction, cut out relay, voltage and current regulator system for generator and alternators.

Unit 3

Auxiliary systems: Types of lamps used in automobile, head light, tail light, fog lights, brake light, side indicator, parking and other indicating lights. Principle of automotive illumination, dash board lights, indicators and meters, speedometers, electric horn, wind shield wiper, heaters & defrosters, electric horn and relay devices, Different types of gauges and indicators. Electrical fuel pump.

Unit 4

Ignition system: Working of coil ignition system and its components, spark advance mechanisms, limitations of coil ignition systems. Advantages of electronic ignition systems, types of solid state ignition systems and their principle of operation. Contact less electronic ignition system, electronic spark timing and its control.

Unit 5

Automotive sensors: Description and working of different engine and vehicle sensors such as speed sensor, tyre pressure sensor, oxygen sensors, fuel level sensor etc.

5AE3 : COMPUTER GRAPHICS & DESIGN

3L+1T

MM:100

Unit-1

Computer hardware and software_: Introduction – An overview of CAD – computer fundamentals – classification of computers – Data communication – configuration of computer system for design – Design work stations – Interactive display device – Input device – Output device – Computer software

Unit –2

Computer Drafting :Graphical input techniques - Transformation in graphics – Drafting through high level languages – Fundamentals of 2D drafting – 3D drawings.

Unit –3

Modeling of Curve, Surface and Solid: introduction – 3D geometry – Surface types – Conventions – attributes – Geometry – Example of surface modeling – Solid modeling.

Unit-4

Graphic standards: Introduction – Standards for graphics programming – Graphic standards – Product data exchange specification – Other data exchange formats.

Unit -5

Interfacing Drafting and Design Analysis: introduction – Parametric design – Script file – Application of a drawing exchange file – A design and drafting example – Operation in batch mode

5AE6 : THEORY OF MACHINE

3L+1T

MM:100

Unit 1

Kinematics: Element. pairs, mechanisms, four bar chain and its inversions, velocity and acceleration, Klein construction, corolis component, Instantaneous centre method, synthesis of mechanism, panto graph, Scott-Russel, Tchbeicheff straight line, indicator diagram mechanisms.

Unit 2

Brakes: Band, Block and band & block brakes, braking action, braking system of automobiles.

Dynamometers Absorption and transmission type dynamometers, prony, rope and hydraulic dynamometers

Unit 3

Cams: Types of cams, displacement, velocity and acceleration curves for different cam flowers, consideration of pressure angle and wear, analysis of motion of followers for cams with specified contours.

Gyroscope: Principle of gyroscope couple, effect of gyroscopic couple and centrifugal force on vehicle taking a turn, stabilization of sea vessels.

Unit 4

Inertia force analysis: Velocity and acceleration of slider crank and four bar mechanism, inertia force, piston thrust and forces on connecting rod, Turning moment diagram and flywheel

Unit 5

Gears: Law of gearing, terminology, tooth form, standard interchangeable tooth profile, minimum number of teeth on pinion in contact with gear or rack, interference and undercutting, helical and spiral gears.

Gear trains: Simple, compound, reverted and epicyclic gear trains, analytical, tabular, graphical and vector methods for velocity ratio.

5AE5 : AUTOMOTIVE TRANSMISSION

3L

MM:100

Unit-1

Transmission requirements: Requirements of transmission system, general arrangements for power transmission for front engine, rear engine vehicle, four wheel drive vehicle, dead axle and axle less transmission.

Clutch: Single plate, multi plate clutch, centrifugal clutch, electromagnetic clutch, constructional details, torque capacity and clutch friction materials.

Unit- 2

Gear box: Requirements of gear box, sliding mesh gear box, constant mesh gear box, synchromesh gear box, epicyclic gear box, velocity ratio and gear ratio for vehicle, performance characteristics in different speed , overdrive.

Unit- 3

Hydrodynamic drive: Fluid Coupling : principle of operation, constructional details, torque capacity and performance curve.

Torque converter : principle of operation, constructional details, torque capacity and performance curve. Multistage torque converter, converter fluid.

Unit- 4

Hydrostatic drive: Various types of hydrostatic system, working principle of hydrostatic system, advantage and limitations, Jenny hydrostatic drive, comparison of hydrostatic and hydrodynamic drive.

Electric drive: Principle of electric drive, Early ward Leonard control system, Modify Leonard control system, advantage of electric drive, limitation of electric drive.

Unit- 5

Automatic Transmission: Need for automatic Transmission, Chevrolet turbo glide transmission system, torque flite, Automatic transmission fluid, effect of automatic transmission on vehicle performance and fuel economy.

5AE 4 : ADVANCED IC ENGINE – I

3L+1T

MM:100

Unit-1

Fundamentals: Cycle Analysis: Operating cycles of S.I. and C.I. engines and Gas turbines-Comparison of Air standard cycle-Fuel air cycle and actual cycles. Combustion of Fuels: Combustion stoichiometry of petrol, diesel, alcohol and hydrogen fuels-Chemical energy and heating values-Chemical equilibrium at maximum temperature. Combustion in premixed and diffusion flames-Combustion process in IC engines.

Unit-2

SI Engine Combustion: Mixture preparation, Flammability limits of various fuels, Ignition, cool flames, Flame speed and area of flame front, stages of combustion, ignition delay, flame propagation, flame quenching. Cycle-to-cycle variations. Abnormal combustion-knocking, surface ignition, knock control, knocks sensing. Effect of various design and operating variables on gasoline combustion. Study of different combustion chamber designs. Air motion-turbulence, swirl squish and tumble. Multipoint fuel injection in gasoline engines.

Unit-3

CI Engine Combustion: Mixture preparation-fuel sprays characteristics-droplet size, penetration and atomization. Droplet and spray combustion theory-stages of combustion-delay period-peak pressure-Heat release-Gas temperature-Diesel knock, combustion chamber design. Effect of different design and operating variable on CI combustion. Cold starting.

Unit-4

Supercharging & Turbo charging: Objective, superchargers, supercharging principles for SI and CI engines, turbochargers and turbo charging methods, arrangement of exhaust manifold for turbocharged engines, charge cooling methods, Effect of turbo charging on engine performance. Trends in downsizing of engines.

Unit-5

Performance Testing of Engines: Basic engine testing, Methods of measurement of BHP, torque and speed, various types of engine dynamometers, engine performance parameters and performance maps, indicating diagram and measurement of IHP. Engine friction, various methods of measuring steady state and transient engine friction. Determination of thermal, mechanical and volumetric efficiencies of an engine. Engine heat balance.

5AE7 : THERMAL ENGINEERING LAB - II

2P

MM:100

1. For Given apparatus determine :
 - a. Thermal conductivity of given insulating powder.
 - b. Critical thickness of insulation.
 - c. Thermal resistant of insulating powder five parts.
 - d. To plot theoretical temperature profile by dividing the thickness in minim
 - e. State all assumption applied in above calculation
2. To find emmissivity of a grey body relative to a given black body and to find out the Stefan Boltzman constant.
3. To perform the experiments on pin fin test rig in forced convection by neglecting radiation losses and to calculate:
 - a. Convective heat transfer coefficient. (Experimentally & using empirical correlation).
 - b. Efficiency, Effectiveness.
 - c. Comparison of experimental & theoretical temperature profile
 - d. Heat the same exercise by considering radiation losses.
4. To find the connective heat transfer coefficient of a given cylinder in vertical position by neglecting radiation losses by assuring.
 - a. Constant surface temperature.
 - b. Constant heat flux & compare with experimental heat transfer coefficient by neglecting radiation losses & by considering radiation losses.
5. Perform the experiment No. 4 by using cylinder in horizontal position.
6. To find the overall heat transfer coefficient of parallel flow / Counter flow Heat Exchanger.
7. To determine the efficiency and effectiveness of an automobile radiator.

5AE8 : AUTOMOTIVE ELECTRICALS AND ELECTRONICS LAB

2P

MM: 50

1. Study of different type of Battery construction and different battery test.
2. Study of different automotive electrical system (Starting system, Ignition system, lighting system, wiring harness.)
3. Assembling and dismantling of Starter motor used in automobile.
4. Assembling and dismantling of alternator used in automobile.
5. Trouble shooting with Ignition system.
6. Study of different color code system used in automotive wiring system.
7. Study of different Electrical Equipments & Accessories (Speedometer, Warning lights , Electric Horn , Wind shield wipers system)
8. Study of different sensor used in modern automotive system.
9. Study of various electronics system (Electronic fuel injection system, Electronic ignition system , Air bag , ABS , Electronic fuel injector cleaner).

5AE9 : SOFTWARE AND COMPUTER GRAPHICS LAB

2P

MM:100

1. Exercises using Auto LISP
2. Components drawing, assembly drawing and 3-D modeling on AutoCAD. Solid Modeling using Autocad, ANSYS/NISA/ Pro-engineer/CATIA/ IDEAS or equivalent software.
3. Four assignments on 3-D wire frame/surface/solid modeling using any advanced modeling software such as ADAMS CAR & Packages mentioned above containing solid models of complicated machine parts and simple 3D assembly containing 5 or more parts
Programming on Graphics using Visual C++ and Open GL.

5AE10 : DYNAMICS OF MACHINE LAB

2P

MM:100

1. To verify the relation $T = I \cdot \omega \cdot \omega_p$ for gyroscope.
2. To plot force v/s radius and lift v/s speed curves for governors.
3. To plot pressure distribution curves on a journal bearing.
4. To perform wheel balancing and wheel alignment test.
5. To perform static and dynamic balancing on balancing setup.
6. To determine mass moment of inertia of a fly wheel.
7. Study of a lathe gear box.
8. Study of a sliding mesh automobile gear box.
9. Study of planetary gear box.
10. Study of single suspension Test , seat Dynamic Test.
11. Study of ride comfort test system , noise measurement system.
12. Study of damping material effectiveness measurement system , Various Hydraulic and electromechanical actuator.

5AEDC DISCIPLINE AND EXTRA CURRICULAR ACTIVITIES

MM:50

6AE1 : AUTO CHASSIS AND AUTO SYSTEM DESIGN

3L+1T

MM:100

Unit-1

Introduction of Auto System Design: Aspects of Auto Design, Design Procedure, Principle of Design, Classification of design, Basic requirements of design, Quality of Design Engineer.

Automotive chassis and chassis frame: general considerations related to chassis layout, power plant location, weight distribution, stability, types of frame, materials, calculation of stresses on sections construction details, loading points, testing of frames in bending and torsion.

Unit -2

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

Unit – 3

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

Unit – 4

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

Unit – 5

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

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

6AE2 : AUTOMATIC CONTROL ENGINEERING

3L+1T

MM:100

Unit-1

Introduction: Concepts of automatic controls, open and closed loop systems, concept of feedback control. Requirements of an ideal control system.

Differential equations for mechanical systems, translational and rotational systems, Electrical systems such as servos, D.C. motors, A.C. Servomotors, Hydraulic systems, hydraulic servos meters, thermal systems, integrating devices, temperature control systems, error detection.

Unit-2

Systems Response: First and second order system response to step, ramp and sinusoidal inputs. Concept of time constant and its importance in speed response. Response of a system to an external disturbance. Mathematical concept of stability. Routh's Hurwitz criterion.

Unit-3

Block diagrams, Signal Flow Graphs and Transfer Function: Definition of transfer function, block representation of system elements. Reduction of block diagrams and signal flow paths, Basic properties, signal flow graphs, gain formula to block diagrams.

Unit-4

Frequency Response: Polar and rectangular plots for frequency response. Experimental determination of frequency response. System analysis using Nyquist diagrams, relative stability, concept of margin gain and phase margin. M & N cycles.

Unit-5

Systems Analysis: Systems Analysis using logarithmic Plots: Bode attenuation diagrams, Stability analysis using Bode diagrams, Simplified Bode diagrams; Systems Analysis using Root Locus Plots: Definitions of root locus plots and root loci. Graphical relationship, setting systems gain. System Compensation

6AE5 : AUTO EMISSION AND POLLUTION CONTROL

3L

MM:100

Unit-1

Engine emissions and air pollution: Constituents of engine exhaust responsible for air pollution and their effect on human health, plant ecology, ozone layer depletion and global warming, Photochemical smog, greenhouse gases. Kyoto protocol and carbon trading.

Formation of Pollutants: Combustion generated and other pollutants, general mechanisms and kinetics of formation of carbon-monoxide, unburnt hydrocarbon, oxides of nitrogen and particulate matter due to combustion, effect of air-fuel ratio on emissions, extended Zeldovitch mechanism for formation of NO_x, soot and smoke formation. NO_x-particulate trade-off.

Unit-2

Emissions from Spark ignition engines: Types of emission from spark ignition engines, importance of mixture formation, lean and rich mixture, study of various mechanism of formation of unburnt hydrocarbon, effect of various design and operating variables on formation of CO, UBHC and NO_x. Discussion on different technologies for reducing engine out emissions from a spark ignition engine, gasoline port injection and gasoline direct injection. Evaporative emissions and their control.

Unit-3

Emissions from Compression Ignition engines: Types of emissions from compression ignition engine, effect of various design and operating variables on formation of NO_x, smoke and particulate matter. Discussion of various technologies for reducing engine out emissions from a compression ignition engine such as turbo charging, inter-cooling, fuel injection pressure, injection timing retard, exhaust gas recirculation (EGR) etc.

Unit-4

Exhaust Aftertreatment: Need for exhaust aftertreatment, fundamentals of catalytic converters, three-way catalyst, diesel oxidation catalyst, diesel particulate filter, effect of fuel sulfur on aftertreatment devices.

Emission Test Procedures: Various test cycles for emission testing of two-three wheelers, passenger cars, utility vehicles, light and heavy duty commercial vehicles used in India, Europe, Japan and USA. Test procedures for various types of evaporative emissions.

Unit-5

Study of emission standards for two-three wheelers, passenger cars, utility vehicles, light and heavy duty commercial vehicles used in India, Europe, Japan and USA.

Equipment for Emission Measurements: NDIR analyzers, Flame ionization detector, chemiluminescence analyzer, constant volume sampling, measurement of smoke and particulate matter.

6AE3 : DESIGN OF MACHINE ELEMENTS II

3L

MM:100

Unit 1

Fatigue Considerations in Design: Variable load, loading pattern, Endurance stresses, influence of size, surface finish, notch sensitivity & stress concentration, Goodman line, Soderberg, design of machine members subjected to combined, steady and alternating stresses. Design of finite life. Design of shafts under Variable Stresses.

Design of Springs: Helical compression, torsional and leaf springs. Springs under Variable Stresses.

Unit 2

Design of Bolts: Preloading of bolts; effects of initial tension and applied load bolts subject to variable stresses.

Design of weldments: welds subjected to eccentric loading and combined stresses.

Design of curved members: Crane hook, body of C-clamp, machine frame etc

Unit 3

Design of flywheels

Design of belt, rope and pulley drive system, chain & sprocket drive systems.

Unit 4

Design of Gear: Lewis and Buckingham equations; wear and Dynamic load considerations, design and force analysis of spur, helical, bevel and worm analysis of spur, helical, bevel and worm gears.

Bearing reactions due to gear tooth forces,

Unit 5

Design of sliding & journal bearing: method of lubrication, hydrodynamic, hydrostatic, boundary etc. Minimum film thickness and thermal equilibrium.

Selection of anti-friction bearings for different loads and load cycle Mounting of the bearings.

Methods of lubrication, selection of oil seals.

6AE4 : VEHICLE DYNAMICS

3L+1T

MM:100

Unit-1

Introduction; Vehicle Dynamics Definitions as prescribed by SAE, Newtonian and lagrangian formulations of multibody systems.

Handling and stability characteristics: Steering geometry, fundamental equations for true rolling, Ackerman steering gear. Steady state handling neutral steer, under steer and over steer, steady state response, yaw velocity, lateral acceleration, curvature response, directional stability

Unit-2

Performance characteristics of road vehicle; Various forces opposing vehicle motion, their nature and factors affecting these forces. Tractive effort and power available from the engine, equation of motion, maximum tractive effort and weight distribution, stability of vehicle on slop, road performance curves, acceleration, gradability, drawbar pull.

Transient operation of vehicles: inertia effects, equivalent mass, equivalent moment of inertia, time taken in synchronization during change of gears, effect of flywheel inertia on acceleration, dynamic of vehicles on banked track, gyroscopic effects , net driving power.

Unit-3

Braking performance; Braking of vehicles, brakes applied to rear wheels, front wheel and all four wheels, motion on straight and curved path, mass transfer effects, braking efficiency, stopping distance, reaction time and stopping time, brake locking anti lock drives, calculation of mean lining pressure and heat generation during brakes.

Unit-4

Vehicle ride characteristics: Human response to vibration, vehicle ride models, road surface profile as a random function, frequency response function, evaluation of vehicle vertical vibration to ride comfort criterion.

Unit-5

Two wheeler dynamics: Stability & handling, vehicle motion ride control, various vehicle models, gyroscopic effect, effect of tyre and vehicle parameter on stability and handling characteristic.

6AE6 : AUTOMOTIVE HEATING, VENTILATION AND AIR CONDITIONING

3L+1T

MM:100

Unit-1

Air conditioning fundamentals; fundamentals of refrigeration, basics of vehicle air conditioning system, location of air conditioning component in a car – schematic layout of a refrigeration system, component like compressor, condenser, fan blower, expansion device – expansion valve calibration , evaporator pressure regulator ,low and high pressure switch.

Unit –2

Air conditioning heating system; automotive heaters – manually controlled air conditioner – heater system –automatically control air conditioner – air conditioning protection with heater diagnosis chart.

Unit –3

Refrigerants: Introduction ,classification, properties, selection criteria, commonly used refrigerants, eco friendly refrigerants, global warming and ozone forming potential of refrigerants, containers, handling of refrigerants.

Unit-4

Psychrometry; Introduction, Psychrometric properties, Inside and outside design conditions of air conditioning system.

Air distribution: introduction, factors affecting design of air distribution system, types of air distribution system, air flow through the dashboard recirculating unit, duct system, ventilation, vacuum reserve

Unit-5

Air conditioning maintenance and service : cause of air conditioner failure, trouble shooting of air conditioning system, servicing heater system, removing and replacing components, leak testing, compressor service, charging and discharging, performance testing.

6AE7 : AUTO TRANSMISSION LAB

2P

MM:100

1. Technical Specification of two and four wheeled (Petrol and diesel) vehicle and trouble shooting chart of all the chassis and transmission components.
2. Dismantling and assembly of chassis and transmission component by using special tools measurement and comparison like clutches, gearboxes, propeller shafts, differential gearbox, steering mechanism and braking system, inspection for wear and tear, crack breakdown, servicing and cleaning and necessary adjustments.
3. Calculation of gear ratios of respective assemblies.
4. Study of torque converter.
5. Study of janny hydrostatic drive.
6. Study of Ward Leonard control system.

6AE8 : VEHICLE DYNAMICS LAB

2P

MM:75

1. Study of Vehicle stability test.
2. To perform static and dynamic balancing on balancing setup.
3. To perform the wheel balancing test.
4. Study of various parameter at the time of application of brake (Braking efficiency & stopping distance , Reaction time and stopping time)
5. Study of Antilock braking system.
6. Study of different steering system used in automobile.
7. Study of ride comfort in Vehicle.

6AE9 : AUTOMOTIVE SYSTEM AND POLLUTION LAB

2P

MM:100

1. Chassis and transmission components- sketches, functions, material
2. Study of NDIR Gas analyzer and Fill
3. Study of Chemi-luminescent NOx analyzer.
4. Measurement of HC, CO, CO₂, O₂ using exhaust gas analyzer. Diesel smoke measurement.
5. Testing and servicing of electrical equipments and accessories; battery, generator, alternator, starter motor, ignition systems and spark plug.
6. Inspection and testing of vehicle and engines and preparation of test charts.

6AE10 : MACHINE DESIGN LAB-II

2P

MM:75

Problem Solve:

1. Fatigue Loading
2. Helical compression tension, torsional and leaf spring
3. Design of Weldments
4. Curved Beams
5. Clutches and brakes
6. Belt Rope and Chain Drive
7. Gear Design
8. Bearing Design
9. Design of flywheel

6AEDC : DISCIPLINE AND EXTRA CURRICULUM ACTIVITY

MM:50

7AE1 : ADVANCED IC ENGINE II

3L+1T

MM:100

Unit-1

Combustion in Spark Ignition Engines: Thermodynamic analysis of SI engine combustion, burned mass fraction, analysis of cylinder pressure data, combustion process characterization, flame structure and speed. Cycle-to-cycle variation-causes, effects measurement and control, Ignition systems,

Unit-2

Combustion in Compression Ignition Engines: Types of diesel combustion systems, direct injection systems, indirect injection systems, their comparison. Fuel injection-fuel spray behavior, overall spray structure, atomization, droplet size distributions, Sauter Mean Diameter, Spray penetration, wall wetting and its effect.

Unit-3

Modern Development in I.C. Engine:

Diesel Engine Developments: Electronic injection systems: Distributor systems, Common Rail Fuel Injection systems; Unit injectors; multiple injections, rate shaping. Trends injection nozzle designs, sac volume, VCO nozzles.

Unit-4

Gasoline Engine Developments: Gasoline Port Injection (GPI). Gasoline Direct Injection (GDI)

Stratified Charge Engines, Lean Burn Engines.

Special developments: Variable Valve Timing (VVT), Variable Swirls Concepts, Variable Geometry Turbochargers (VGT), two valves vs. four valve engines.

Unit-5

Unconventional Engines: Rotary Engines, Variable compression ratio engines, free piston engine.

Hybrid vehicles, Fuel Cells.

7AE2 : PRODUCT DEVELOPMENT

3L

MM:100

Unit-1

Introduction to Product Design: Asimov's model, definition of production design, design by evolution, design by innovation. Essential factors for product design. Morphology of design. Process capability. Tolerance in detailed design and assembly.

Unit-2

Product Design Practice: Introduction, product strategies. Time to market, analysis of the product, basic design considerations, standardization, preferred numbers, simplification, role aesthetics in product design, functional design, criteria and objectives of design. Strength, stiffness and rigidity considerations in Product design, principle stress trajectories (force flow lines), balanced design, designing for uniform strength.

Unit-3

Design for production: Producibility requirements for machine components, design for casting, forging, presswork, role of manufacturing process in design, design of ease of machining. Design for assembly and disassembly.

Optimization of Design: Design approaches, optimization by differential calculus, Lagrange multipliers, linear programming, geometric programming. Johnson's method of optimum design.

Unit-4

Ergonomic and economic factors in design: Human being as applicator of forces, anthropometry, design of controls, displays. Man-machine interaction; product value vs. cost; economic considerations, economics of new product design (Samuel Elion Models).

Unit-5

Modern Approached to Product Design: Concurrent design, simultaneous engineering, Quality Function Deployment (QFD), Product development cycle, Program management.

7AE3 : CAD/CAM

3L

MM:100

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 and CAM. Advantages and disadvantages of CAD and CAM

Hardware for CAD: Basic hardware structure, working structure, working principles, usages and types of hardware for CAD. Input/output devices, memory, CPU, hardcopy and storage devices.

Unit-2

N C System: Definition, applications, Historical background Role of Computers in Manufacturing.

Numerical Control in CAM: Definition , Historical Background, basic components of NC system, Fundamentals of NC: Procedure, Coordinate system, motion control systems, Advantages of NC systems. Economic of NC. machining centers.

Unit-3

Part Programming: Numerical control part programming: punched tape, tape coding & format. Manual part programming, Computer aided part programming NC part programming languages. Automatically programmed, tools programming (APT). Description of compact & NC programming with interactive graphics.

Unit-4

Computer Numerical Control: Principle of operation of CNC, Features of CNC, Development in CNC systems, Adaptive Control, Direct Numerical Control (DNC) Standard Communication interfaces, Programmable Logic Controllers (PLCs) Communication networks, Trends* New Development in NC.

Unit-5

Robot Technology: Introduction, Industrial Robots, Robot physical Configuration, Basic Robot motions, Technical features such as work volume, precision of movement speed of movement, weight carrying capacity, type of drive systems, Introduction to Robot Languages, End Erectors, work cell control and interlocks, Robotic sensors, Robot applications & economics, Intelligent robots, interfacing of a vision system with a Robot.

7AE4 : MICROPROCESSOR APPLICATION IN AUTOMOBILE

3L+1T

MM:100

Unit-1

Architecture: General 8 bit microprocessor and its architecture 8085, Z-80 and MC 6800
MPU and its pin function: Architecture-Function of different sections.

Unit-2

Instruction Set: instruction format-addressing modes-instruction set of 8085 MPU-T-STATE-Machine cycle and instruction cycles-Timing diagrams-Different machine cycles-
Fetch and execute operations-estimation of execution times.

Unit-3

Assembly Language Programming: Construct of the language programming-Assembly
format of 8085-Assembly Directive-Multiple precision addition and subtraction-BCD to
Binary and Binary to BCD, Multiplication, Division, Code conversion using look up tables-
Stack and subroutines.

Unit-4

Data Transfer Schemes: Interrupt structure-Programmed I/O-Interrupt driven I/O, DMA-
Serial I/O.

Types of interfacing devices: Input/Output ports 8212, 8255, 8251, 8279. Octal latches and
tristate buffers-A/D and D/A converters-Switches, LED's ROM and RAM interfacing.

Unit-5

Applications: Data acquisitions- Temperature control-Stepper motor control-Automotive
applications Engine control, Suspension system control, Driver information.

7AE5 :VEHICLE AERODYNAMICS AND VEHICLE BODY ENGINEERING

3L+1T

MM:100

UNIT-1

Introduction: Importance of vehicle design in modern automobile industries. Criteria for vehicle body design, Types of frame , construction details, loading points, testing of frames in bending and torsion. Different types of metal joining process used in vehicle body construction.

UNIT-2

Car Body Details: Types : Saloon , Convertibles, Limousine, Sedan , Hatchback , Racing and sports car. Car visibility- driver's visibility, regulation , visibility test, method of improving visibility and space in cars , Safety in design of car , Car body construction.

Bus Body Details : Types: Mini bus, single Decker bus, Double Decker bus, articulated bus , Bus body layout , floor height, engine location, entrance and exit , seat layout , seat dimension. Construction details- frame construction , double skin construction, types of metal section used , conventional and integral type construction.

Commercial vehicle Details: Types of body : Flat platform , drop side , fixed side , tipper body , tanker body , light commercial vehicle body types – dimension of driver seat in relation to control- Driver cabin design.

UNIT –3

Vehicle aerodynamics: Introduction , Aerodynamics forces , Drag, Drag reduction , stability and cross winds various body optimization technique for minimum drag, Wind tunnel testing, Scale model testing,

UNIT-4

Body Load: symmetric & asymmetrical vertical loads in car. different load case in vehicle- Bending case , Torsion case, Combined bending and torsion , lateral loading Idealized structure – Structural surface –shear panel method.

Body material trim and mechanism: Steel sheet , timber , plastic , GRP, FRP , Properties of materials- corrosion – anticorrosion method. Selection of paints and various processes. Body trimming process- dent beating tools, riveting method, welding method. Body mechanism- door lock mechanism , window glass winding mechanism.

UNIT-5

Safety in vehicle design: Basics of impacts protection, design for crashworthiness , front impact and side impact analysis, bumper system , energy absorbent forms.

Indian Motor acts and its application- The motors vehicle acts 1988, Driving license , Registration of vehicles, Rules of the road, Motor Insurance.

7AE6.1 : MECHATRONICS (ELECTIVE-I)

3L+1T

MM:100

Unit-1

INTRODUCTION: Definition and an overview of mechatronics, design of mechatronics system. Objectives, advantage and disadvantage of mechatronics. Microprocessor based controllers. System and design – mechatronics approach, modeling, and simulation, man – machine interface.

Unit-2

SENSORS AND SIGNAL CONDITIONING: Classification of transducers, development in transducers technology, (no detailed discussion on different type of transducers), classification of sensors, principle of working and application of light sensors, proximity sensors and hall effect sensors. Concept, necessity op-amps protection, filtering, and wheat stone bridge- Digital- Multiplexer. Data acquisition.

Unit-3

MICROPROCESSOR: Introduction, 8085 A processor architecture and terminology – such as, CPU, memory and address, ALU, assembler, data, register, fetch cycle, write cycle, state bus, interrupts. 8085 pin diagram. Micro controller. Difference between microprocessor and micro controller.

Unit-4

ELECTRICAL ACTUATOR: Classification of actuator system with examples, mechanical switches. Concept of bouncing method of preventing bouncing of mechanical switches. Solenoid relays. Solid state switches- diode thyristor, triacs, transistors, and Darlington pair. Electrical actuator, stepper motor, permanent magnet motor servo motor, servo system, derives circuit, open and closed loop control.

Unit-5

HYDRAULIC ACTUATOR: valves – classification, pressure control valves, pressure relief valves, pressure regulating valves, pressure sequence valve. Direction control valves – sliding spool valve, solenoid operated. Symbol of hydraulic element. Hydraulic cylinder – constructional features, classification and application. Hydraulic motor - types vane motors and piston motors, application.

EXAMPLE OF MECHATRONIC SYSTEM: Robotics, manufacturing, machine – diagnostic, road vehicles

7AE6.2 : FUEL CELL, ELECTRIC AND HYBRID VEHICLE (ELECTIVE-I)

3L+1T

MM:100

Unit-1

Introduction and types of Fuel cell: Introduction : the rationale behind fuel cell development, basic principle of fuel cell, operation of fuel cell, efficiency of fuel cell, co-generation of heat and power, important reactions such as hydrogen oxidation, methanol oxidation etc, Types of fuel cell: DMFC (direct methanol fuel cell), PAFC (phosphoric acid fuel cells), MCFC (molten carbonate fuel cells), SOFC (solid oxide fuel cells)

Unit-2

Fuel processing and application of fuel cells: Fuel processing- general, producing hydrogen from alcohol, producing hydrogen from hydrocarbon, hydrogen from other sources, Gas cleanup, reformer system, hydrogen storage
system Engineering: fuel cell engineering, vehicle cell design, stack engineering fuel processing system
application: stationary power, propulsion of vehicle, portable application

Unit-3

Electric Vehicle: Introduction, working. Electric car motors, electric car batteries, charging system of electric car, magnum charge system. conversion system for transmission.

Unit-4

Hybrid vehicle: Introduction, working. Power split devices. Hybrid car performance, gasoline hybrid structure. Gasoline Vs electric power. Transmission components of hybrid vehicle. Advantage and limitation.
Different types of hybrid vehicle.

Unit-5

Solar Vehicles: Introduction and working, photovoltaic cell, solar cell. Energy loss in solar cell. Solar powering house. Solar cost, anatomy of solar cells.

7AE6.3 : QUALITY CONTROL(ELECTIVE I)

3L+1T

MM:100

Unit 1

Quality Concept And Management: Evolution of quality control, Quality characteristics, need of control , quality objective and quality policy, quality cost, quality of design, conformance, Objective and application of Statistical quality control, process capability analysis.

Quality assurance, Concept of TQM, ISO 9000 and ISO 14000 system

Unit 2

Control Chart :General theory of control chart, control chart for variable and attributes, Group Control chart, moving average and moving range charts, acceptance control chart, CUSUM chart, difference control charts

Unit 3

Sampling Plans: Fundamental Concepts of acceptance sampling, multiple and sequential sampling plans, acceptance sampling by variables, sampling plans using different criteria. comparison of various types of sampling plans.

Unit 4

Life testing and Reliability: Models of probability of equipment failure, Exponential failure, density, MTTF, Weibull failure ,concept of reliability, designing for reliability, Maintainability, Reliability measurement and test

Unit 5

Quality Management:

Philosophies of Deming , Juran, Ishikawa and Philip Crosby, Seven Quality tools, Quality circle, Kaizen, Concept of poka yoke,5 S campaign, Six sigma, Quality function deployment, Benchmarking

7AE6.4 : VEHICLE TRANSPORT MANAGEMENT (ELECTIVE I)

3L+1T

MM:100

Unit-1

The Infrastructure: Road, Approach Road, National, state Highways. Traffic condition, Bus-stop, shelters, bus station. Garages layout of premises, equipment, use of machinery. Conveyance of staff. Facilities for passengers. Maintenance- preventive, breakdown, overhauling-major, minor.

Unit-2

Organization and Management: Forms of ownership, principle of transport management. Internal organization, centralized condition, decentralized condition (Engineering, Traffic and administration), staff administration- industrial relation, administration, requirement and training, welfare, health and safety.

Unit-3

Public relation division: Dissemination of information, maintaining goodwill, handling complaints, traffic advisory committees, Local contractor co-operation with the press. Facilities for the visitors, forms of publicity, Importance of quality, advertisements, signs- notices and directions, specialized publicity.

Unit-4

Prevention of accidents: Emphasis of safe driving, annual awards bonus encouragement vehicle design, platforms layout, location of steps, scheduled route, records.

Route planning: Sourcing of traffic, town planning, turning points, stopping places, shelters, survey of route, preliminary schedule test runs, elimination of hazards factors affecting frequency, possibility single verses double deck.

Timing, bus working and schedules: Time table layout uses of flat graph method of presentation preparation of vehicle, numbering determination of vehicle efficiency checking, efficiency of crew.

Unit-5

The fare structure: Basis of fare, historical background, effect of competition. Calculating average zone, system straight and tapered scale, fares concession system. Fare collection system.

Operating Cost and types of vehicles: Classification, average speed running costs, supplementary costs, life of vehicles, factor affecting cost per vehicles km traveled.

Indian Motor vehicle Act.:

7AE7 : IC ENGINE LAB-II

2P

MM:75

1. Assembly and dismantling of multi point fuel injection.
2. Determine the following engine performance properties for each observation: engine brake power (KW), engine brake torque (N-m), Brake specific fuel consumption (kg/kWh), and brake mean effective pressure (kPa).
3. To perform preventive maintenance of the ignition, fuel, cooling and lubricating systems.
4. Perform laboratory course covering the basics of automotive electric and electronic. Study of circuit construction emphasizing meter usage, including analog, digital and oscilloscopes.
5. To perform computerized engine control systems including sensor testing, onboard diagnosis, scan tool use and fuel injector testing, cleaning and preventive maintenance.
6. Study of electronic fuel injection system.
7. Study of Common rail direct injections engine.
8. Study of various sensor and Electronic control module used in automobile.
9. Study of Electronic fuel pump.
10. Study of alternative fuels used in I.C. Engine.

7AE8 : CAD/CAM LAB

2P

MM:75

1. Analysis of simple automotive components by using FEM package.
2. Auto lisp programming – writing and execution of at least 3 programs (2D only)
3. Using Pro/E or any other standard solid modular getting a hardcopy of 4 different automotive 3D objects.
4. a). Study of NC Machine and simulation of cutting/milling operations using CAM package.
b) Machining and simulation of at least two jobs using NC Machine /CAM package.
5. Clutch Complete design of clutch component, components and assemblies drawing using drafting software.
1. Gear Box : Gear train calculation , Layout of gear box , calculation of bearing loads and selection of bearing. Complete assembly drawing using drafting software.

7AE9 : BODY ENGINEERING LAB

2P

MM:50

1. Perform the visibility test on the vehicle.
2. Study of different types of tool used in body shop
3. Perform the various joining processes welding, riveting) in the body material.
4. Assembling and dismantling of various body mechanisms like door lock mechanism, window winding machine mechanism, passenger seat mechanism.
5. Perform the dent beating process on the metal sheet.
6. Study and perform the various painting process on the car.
7. Make the different scale model (Bus body model, TATA 407 model).
8. Study of Modern vehicle design.
9. Study of vehicle crash analysis.

7AE10 : Practical training + Industrial visit

2P

MM:100

7AE11 : Project - I

2/2P

MM:50

7AEDC : DISCIPLINE AND EXTRA CURRICULUM ACTIVITIES

MM:50

SAE1 : ALTERNATIVE FUELS AND ENGINE TRIBOLOGY

3L+1T

MM:100

Unit-I

Introduction: estimation of petroleum reserves, need for alternative fuels, availability and properties of alternative fuels. Merits and demerits of alternative fuels.

Alcohols: properties of alcohol as SI engine fuel, ethanol and methanol, ethanol- gasoline blends, methanol -gasoline blend, combustion characteristics in the fuel engines, performance and emission characteristics.

Unit-II

Compressed natural gas, LPG and biogas, availability of CNG properties, modification required to use in engine- performance and emission characteristics of CNG vehicles SI and CI Engines.

Use of LPG in SI engine: performance and emission for LPG.

Biogas generation, properties, performance and emission characteristics, storage, handling and safety aspects,

Unit-III

Bio-diesel: different sources of vegetable oils use of straight vegetable oils in engine, -Trans-esterification, bio-diesel, bio-diesel properties and standards, biodiesel blends. Engine performance and emission characteristics with use of biodiesel and its blends, worldwide trends in use of bio diesel.

Hydrogen : hydrogen as SI engine fuel, properties combustion characteristics, port injection, timed injection, direct injection of hydrogen in engines, backfire arrest, performance and emission characteristics, production, storage and handling, safety aspects.

Unit-IV

Engine Tribology of Fundamentals: function of engine lubrication, fundamental of lubrication-regimes of lubrication-hydrodynamic, mixed and boundary lubrication, elasto hydrodynamic lubrication, description of engine components working of each of these regimes .

Unit-V

Engine Lubrication System: engine lubrication system and their components, bearing lubrication, lubrication of piston, ring and liners, mechanisms of lubricating oil consumption, method of measuring engine oil consume\ptin, positive crank case ventilation.

Cylinder liner and its fitment, characterization and measurement of cylinder liner surface finish, oil filters- full flow and bypass filters, importance of air filter, wet and dry air filtration. Wear of different engine parts.

Lubricating Oils: classification and service rating of lubricating oils, detailed study of different properties of lubricating oils, oil additives, oil drain intervals and used oil analysis, oil coolers.

8AE2 : INDUSTRIAL ROBOTICS

3L+1T

MM:100

Unit-1

Introduction : Automation and robotics, Brief history of robotics , Development in robotics, Economics aspects of robots, Advantage and disadvantage of using robots I industries. Overview of robots – Present and future applications.

Production Design for Robotic Assembly: Production design for robotic and automatic assembly, consideration for assembly oriented product design. Robot safety.

Unit –2

Classification and structure of robotic system :.Classification, Geometrical configurations, wrist and its motions, End effectors and its type, links and joints.

Robot drive system : – Hydraulic, Electric and pneumatic drive system, Resolution, accuracy and repeatability, Advantage and disadvantage of drive system.

Unit –3

Control system and components: Basic control system concept and models, Transfer function and block diagram of spring mass system, Controllers – proportional, proportional and integral, proportional and derivative, PID, transient and response to second order system. Robot actuation and Feedback component – position, velocity sensors.

Unit-4

Robot arm kinematics: Introduction, Direct and inverse kinematics, rotation matrix, rotation matrix about an arbitrary axis, Homogeneous transformation, links, joint and their parameters, D-H representation.

Trajectory Planning: Introduction, general consideration on trajectory planning, joint interpolated trajectory, planning of Cartesian path trajectories

Unit –5

Robot programming and languages : introduction, manual teaching, lead through teaching, programming language – AML and VAL, storing and operating, Task programs.

Sensors: Internal state sensors, tactile sensor, proximity sensing, range sensing, force torque sensor, elements of computer vision, sensing and digitizing function in machine vision- sampling- quantization-encoding-image storage. Image processing and analysis, feature extraction and object recognition. Artificial intelligence

8AE3 : AUTOMOTIVE MAINTENANCE & MANAGEMENT

3L+1T

MM:100

Unit-1

Automobile maintenance: Importance of maintenance, scheduled and unscheduled maintenance. Preparation of check lists, analysis of breakdown, preventive measures, unit replacement system, maintenance schedule, chassis lubrication schedule, component retrieval, estimating repair cost, maintenance record, warranty period, servicing. Inspection forms. Log books. Trip sheets. Other maintenance record forms.

Garage Practice: Types of service station/garage, layout of garage. Factors affecting layout, tools & equipments, transport service undertakings, design a layout for different garage.

Unit-2

Engine Maintenance: Dismantling of engine components, cleaning methods, visual inspection and dimensional check of various engine components, minor and major tune up, reconditioning and repairing methods of engine components. Assembly procedure, special tools used for maintenance, repair and overhauling.

Cooling systems- Anti corrosion and antifreeze solutions, radiator, and thermostat. Lubrication oil topping up, oil change, oil relief valve; fuel feed systems, FIP adjustment and testing, injector testing.

Unit-3

Chassis and drive line maintenance: mechanical automotive type gear box- mechanical automatic types. Final reduction, propeller shaft, front and rear suspension systems, brake systems-hydraulic, servo, air. Air bleeding, steering system, axles, wheel alignment- tires.

Unit-4

Electric system maintenance: Battery testing method, starter motor, charging system- a DC generator, AC alternator, regulator, ignition system- coil ignition, transistor assisted ignition, capacitor discharge ignition. Electric horn, wiper motor, flasher, electric fuel pump, gauges. Lighting system- head lights focusing. Wiring harness testing.

Unit-5

Body repair: minor body panel beating, tinkering, shouldering, ,

Painting : Introduction of automotive paints , types of paints, corrosion and anticorrosion method, rubbing polishing, working of paint booth ,door lock mechanism, window glass actuation mechanism.

8AE4.1 : FINITE ELEMENT METHODS (ELECTIVE-II)

3L+1T

MM:100

Unit-1

Basic Concept of Finite element method: Some mathematical preliminaries: Integral formulation and variational methods, Rayleigh-Ritz and weighted residual method of variational approximation. Numerical solution of equilibrium problem by Gaussian elimination.

Unit-2

Stiffness methods: for steady state problems of discrete systems (Bar, trusses, one dimensional heat transfer system) Element stiffness matrix, Assembly of elements, global stiffness matrix and its properties, Node numbering, Displacement and force Boundary conditions, Transformations matrix, Gauss elimination method

Unit-3

Displacement - Based FEM for solid mechanics;
Derivation of finite element equilibrium equations, Lagrangian elements (1-D & 2-D elements); CST, rectangle, aspect ratio shape functions, lumping of loads, compatibility and convergence requirements. Stress calculations
Isoparametric Derivation of Stiffness matrices, bar and plane bilinear elements, Serendipity elements, natural coordinates, numerical integration, Co-continuity p and h refinement

Unit-4

Variational Method: Variational Approach for known functional of field problems
Weighted Residual Methods: Point collection, subdomain collocation, methods of least square, Galerkin
Application of these methods to one dimensional boundary value problems; Structures, fluid mechanics and heat transfer.

Unit-5

Finite Elements in Dynamics and Vibrations: Introduction, Dynamic Equations, Mass and Damping Matrices, Mass Matrices, Consistent and Diagonal, Damping, Natural frequencies and Mode Shapes.

8AE4.2 : EARTH MOVING EQUIPMENT (ELECTIVE-II)

3L+1T

MM:100

Unit-1

Fundamentals soil and machinery, equipments and operation, different types and purpose, System of Earth Moving Equipments:-

- (a) Engine- All systems of engine and special features like automatic timer, turbochargers, after collars etc.
- (b) Transmission- Basic types and planetary transmission constructional and working principles. Hydro shift automatic Trans torque converters, retarders, Trans hydraulic circuits and controls valves.
- (c) Hydraulics- Basic components of hydraulic systems like pumps (types), control valves, relief valves and hydraulic motors, hydraulic cylinders.

Unit-2

- (a) Final Drive- Types of reductions, structure and function suspensions like hydraulic suspension.
- (b) Brakes and Steering- Hydraulic power steering, main components and circuit. Tyre brakes and components and functions.
- (c) Under carriage- Tyre and tracked vehicle, advantages and disadvantages, tractor and components.

Unit-3

Earth Moving Equipments Management-

- (a) Earth moving equipments maintenance- Type of maintenance schedules, purpose and advantages, organization set ups and documentation.
- (b) Method of selection of equipments- selection of machine, basic rules of matching machine, selection of equipment including the nature of operation, selection based on type of soil, based on haul distance, based on weather condition.

Unit-4

Calculation of operation capacity and estimating owning and operating cost: Methods of calculation operating capacity, calculation of productivity of bulldozer shovel, wheel landers and dump truck. Owing cost and operating cost.

Unit-5

Construction and working of earthmovers:- Tractors, Crane, Bulldozer, army tanks, Safety methods and attachments for earth moving equipments, hydraulic lift, Differential lock. Trolley, shovel and scrapers.

8AE4.3 : INDUSTRIAL ENGINEERING

3L+1T

MM:100

Unit-1

Introduction: Work of F.W. Taylor, Frank and Lillian Gilbreth and others; Productivity definition, Means of increasing productivity work study,

Motion Study; Definition, aims; Procedure for method study: selection of jobs; Recording Techniques: Micro motion study: Therbligs; Cychography and Chronocycle graph: Principles of motion economy. design of work place layout: Analysis in the form of a chart; operation chart; flow process chart; flow diagrams; string diagram; Man Machine chart; Two hand chart; Simon chart.

Unit-2

Work Measurement (Time Study): Definition; uses; procedure; time study equipment; performance rating; allowances, number of cycles to be studied. Determination of standard time: Predetermined Motion Time Systems.

Job Evaluation: Objective of job evaluation; Methods of Job evaluation; Non-quantative and quantative.

Unit-3

Production Planning and Control: Types of production; function of production planning and control; planning Preplanning, sales forecasting; routing; Scheduling; dispatching and control with other departments.

Wages and incentives: Characteristics of a Good wage for incentive system. Methods of wage payment Concept of wage incentive schemes, financial and non financial Holsely premium plan. Merric's Multiple piece rate system.

Unit-4

Facility Design: Facility location factors and evaluation of alternate location, types of plant layout and their evaluation.

Line Balancing: Need, Heuristic approach for the line balancing

Computerized Layout:

Unit-5

Project planning and Control: Network Control, CPM, PERT, control cost consideration and optimization. Resource allocation and leveling.

Aggregate Production planning model:

8AE4.4 : VEHICLE VIBRATION & NOISE CONTROL

3L+1T

MM:100

Unit-1

Undamped free vibration: Introduction, single degree of freedom system, undamped free vibration, Natural frequency of free vibration. Raleigh method stiffness of spring elements, effect of spring mass.

Damped free vibration: introduction, single degree of freedom system, different type of damping. Concept of critical damping and its importances, response study of viscous damped system for case of under damping. Critical damping and over damping logarithmic decrement.

Unit –2

Forced vibrations: single degree of freedom system, steady state solution with viscous damping due to harmonic force. Solution by complex algebra, concept of response reciprocating and rotating unbalance vibration isolation, Transmissibility ration, energy is dissipated by damping, equivalent viscous damping, structural damping, sharpness of resonance, base excitation.

Vibration measuring instruments, accelerometer and vibrometer, whirling of shafts with and without damping, discussion of speeds above and below critical speeds.

Unit -3

System with two degree of freedom system: introduction, principle modes and normal modes coordinates coupling, generalized and principle coordinates. Free vibrations in terms of initial conditions, geared systems.

Forced oscillations- harmonic excitation. Applications- vehicle suspension. Dynamic vibration absorber, dynamic of reciprocating engines.

Unit- 4

Continuous systems: Introduction, vibration of spring, longitudinal vibration of rods, torsional vibrations of rods. Euler equations for beams, simple problems.

Unit-5

Noise and noise control – sound, noise decibel scale, pressure and density level, addition of levels, overall noise from different frequency ranges, sound level meters, perceived noise level, traffic noise index, NC curves, Building Acoustics, effect of noise on people, noise reduction, noise due to industrial equipments, important I.S codes related to noise.

8AE5 : AUTO MAINTENANCE LAB

3P

MM:125

1. Study and practice on service station equipments and their specifications and servicing of vehicles.
2. Study of the faults in the electrical systems such as headlights, side or parking lights, trafficator lights, electric horn, starter and charging system, wind screen wiper.
3. Simple tinkering and soldering works of body panel, study of door lock and window glass rising mechanisms.
4. Adjustment of pedal play in clutch, brake and hand brake lever and steering wheel play; air bleeding from hydraulic brakes and diesel fuel system
5. Wheel bearing, tightening and adjustment.
6. Removal and fitting of tires and tubes.
7. Drawing of general wiring diagram of various vehicles, like mopeds, scooters, motorcycles, cars.

8AE6 : AUTO RECONDITIONING LAB

3P

MM:125

1. Study and practice of engine analyzer.
2. study and practice of wheel alignment (Mechanical and computerized) and wheel balancing.
3. Testing of vehicle on chassis dynamometer and models on wind tunnel.
4. Study and practice on
 - a. Connecting rod alignment
 - b. Cylinder re-boring machine
 - c. Valve re-facing machine
 - d. Brake drum skimming machine
5. Study and practice on
 - a. Fuel injection pump calibration equipment
 - b. Nozzle tester
 - c. Nozzle grinding machine
6. Study of tyre re-treading and vulcanizing.
7. study and practice on body repair- tinkering and painting
8. Heat light focusing test and visibility test
9. experimental study of microprocessors as applied to automobiles

8AE7 : SEMINAR

2P

MM:100

8AE8 : PROJECT - II

2P

MM:200

8AEDC : DISCIPLINE AND EXTRA CURRICULUM ACTIVITY

MM:50