

3rd Semester B.Tech (Automobile)

Code	Title of the course	L	T	P	Maximum Marks		Total Marks	Duration of Theory Examination (in Hours)
					Internal	External		
AE-201	Mechanics of Materials	3	1	-	40	60	100	3
ME-203	Theory of Machines-I	3	1	-	40	60	100	3
AE-203	Automotive Chassis & Components	3	-	-	40	60	100	3
AE-205	Applied Thermodynamics	4	1	-	40	60	100	3
AE-207	Automotive Materials and Metallurgy	3	-	-	40	60	100	3
AE-209	Mechanics of Materials Lab.	-	-	2	30	20	50	
AE-211	Automotive Chassis Lab	-	-	2	30	20	50	
AE-213	Automotive Materials and Metallurgy Lab	-	-	2	30	20	50	
ME-207	Machine Drawing	1	-	6	40	60	100	4
ME-215	Workshop Training*	-	-	-	60	40	100	
	Advisory meeting			1				
	Total				390	460	850	

Total contact hours = 33**4th Semester**

Code	Title of the course	L	T	P	Maximum Marks		Total Marks	Duration of Theory Examination (in Hours)
					Internal	External		
AM-201	Mathematics-III	4	1	-	40	60	100	3
AE-202	Internal Combustion Engines	4	1	-	40	60	100	3
ME-204	Theory of Machines – II	3	1	-	40	60	100	3
AE-204	Manufacturing Processes	3	1	-	40	60	100	3
AE-206	Fluid Mechanics and Machinery	4	1	-	40	60	100	3
AE-208	Automotive Pollution & Control Systems	3		-	40	60	100	3
AE-210	Internal Combustion Engines Lab	-	-	2	30	20	50	
ME-212	Theory of Machines Lab	-	-	2	30	20	50	
AE-212	Manufacturing Processes Lab	-	-	2	30	20	50	
AE-214	Fluid Mechanics and Machinery Lab			2	30	20	50	
	General Fitness				100	-	100	-
	Advisory meeting			1				
	Total	21	5	9	460	440	900	

Total contact hours =35

There shall be industrial training of 06 weeks duration in reputed industries manufacturing/ Servicing automobiles/ auto components/ OEM at the end of 4th semester. The marks for this will be included in the 5th semester.

5th Semester

Code	Title of the course	L	T	P	Maximum Marks		Total Marks	Duration of Theory Examination (in Hours)
					Internal	External		
AE-301	Automotive Design-I	3	1	-	40	60	100	3
AE-303	Automotive Transmissions	3	1	-	40	60	100	3
AE-305	Automotive Electricals & Systems	3	-	-	40	60	100	3
AE-307	Heat Exchangers & Air Conditioning	4	1	-	40	60	100	3
AE-309	Numerical Methods & Simulation in Engg.	3	-	-	40	60	100	3
CE-216	Environmental Science	3	-	-	40	60	100	3
AE-311	Computer Aided Design Lab	-	-	2	30	20	50	-
AE-313	Automotive Transmissions Lab	-	-	2	30	20	50	-
AE-315	Automotive Electricals & Systems Lab	-	-	2	30	20	50	-
AE-317	Heat Exchangers & Air Conditioning Lab	-	-	2	30	20	50	-
AE-319	Numerical Methods & Simulation in Engg. Lab	-	-	2	30	20	50	-
	Institutional Training**	-	-	-	60	40	100	-
	Advisory meeting			1				-
	Total	19	3	11	450	500	950	

** Industrial Training in reputed industries will be arranged for 6 weeks duration at the end of fourth semester.

6th Semester

Code	Title of the Course	L	T	P	Maximum Marks		Total Marks	Duration of Theory Exam.(in hrs)
					Int	Ext		
AE-302	Automotive Design-II	4	1		40	60	100	4
AE-304	Vehicle Body Engineering	4	1	-	40	60	100	3
AE-306	Measurements & Instrumentation	3			40	60	100	3
AE-308	Vehicle Dynamics	4	1	-	40	60	100	3
AE-310	Automotive Electronics & Microcontrollers	3			40	60	100	3
AE-	Elective-1	3	1	-	40	60	100	3
AE-320	Advance CAD / CAM Lab	-	-	3	30	20	50	-
AE-322	Vehicle Body Engineering and Dynamics Lab	-	-	2	30	20	50	-
AE-324	Measurements & Instrumentation Lab	-	-	2	30	20	50	-
AE-326	Automotive Electronics & Microcontrollers Lab	-	-	2	30	20	50	-
	General Fitness	-	-	-			100	-
	Total	21	4	9			900	

Total Contact Hours = 34

List of Elective-I

- AE-312 Computer Aided Vehicle Design
- AE-314 Servo Mechanism and Automatic Controls
- AE-316 Automotive Aerodynamics
- AE-318 Design of Energy Systems

AE- 201 MECHANICS OF MATERIALS

Introduction

Stress, strain, and their types. Hooke's law, Poisson's ratio, Fatigue and Creep, Modulus of elasticity and their relationship, Stress-strain diagrams for ductile and brittle materials, Deformation of simple and compound bars.

Biaxial stresses

Analysis of biaxial stresses - Mohr's circle - Principle stresses and maximum shear stress - Deductions from Mohr's circle - Stresses in thin walled pressure vessels - Combined bending and torsion.

Bending of beams

Beams, Loads, Shear force and bending moment diagrams for simply supported and cantilever beams and overhanging. Pure bending. Bending stresses in straight beams. Shear stresses distribution in beams of rectangular and I-section curved beams.

Torsion and springs

Torsion of circular shafts, shear stresses and twist in solid and hollow shafts, Types of springs, stiffness, springs in series and parallel, Analysis of closed coil helical springs.

Deflection of beams

Slope and deflection of cantilever, simply supported and fixed beam by Double integration method, area moment methods - Strain energy in tension, compression, shear, bending and torsion – Castigliano's theorem.

Columns and Struts

Definition of Column, types and their failure. Crippling load, Euler's formula. Rankine formula, and their applications.

Text Books

1. Strength of Materials DS Bedi
2. Mechanics of Materials by Dr.Kirpal Singh, Standard Publishers & Distributors.
3. Strength of Materials by R.S. Lehari, S.K Kataria and Sons
4. Khurmi R.S., " Strength of Materials ", S.C. Chand and Co., 1998

Reference:

1. Elements of Strength of Materials by Timoshenko and Gere
2. Advanced Solid Mechanics by LS Srinath
3. Advanced Mechanics of Materials by Seely and Smith
4. Strength of Materials by GH Ryder
5. Mechanics of Materials-I by EJ Hern; Paragaman, New York
6. Introduction to Mechanics of Solids by Crandell, Dahl and Lardner, McGraw

ME-203 THEORY OF MACHINES-I

Course Objectives

1. Understand the basic concepts of machines and mechanisms.
2. Understand/ compute the velocity and acceleration diagrams of all basic mechanisms.
3. Draw velocity and acceleration diagrams of basic link mechanism.
4. Understand turning moment and crank effort diagram.
5. Understand the types of lower pairs.
6. Understand the types of cam & follower.
7. Understand the types of drives such as: belts, ropes and chains.
8. Derive the relationship between tension on tight and slack sides of belts and HP transmitted by the belt.
9. Understand different types of brakes and dynamometers.
10. Applied different formulae to compute problems on brakes.
11. Understand the functions, types and characteristics of governors.
12. Apply the theory of governors to solve numerical problems.

Detailed Contents

1. Basic Concept of machines: link mechanism kinematic pair and chain, principles of inversion, inversion of a four bar chain, slider-crank-chain, double slider-crank chain and their inversions, kinematic pairs, Graphical (relative velocity vector and instantaneous center methods) and Analytical methods for finding: Displacement, velocity, and acceleration of mechanisms (including Coriolis components).

2. Lower Pairs: Universal joint, calculation of maximum torque. Steering Mechanisms including Ackerman and Davis approximate steering mechanism, engine indicator, Pentograph, Straight line mechanisms

3. Belts, Ropes and Chains: Material, types of drives, idle pulley, intermediate or counter shaft pulley, angle and right angle drive, quarter turn drive, velocity ratio, crowning shaft pulley, loose and fast pulley, stepped or cone pulleys, ratio of tension on tight and slack sided of belts, HP transmitted by belts including consideration of creep and slip, centrifugal tensions and its effect on HP transmitted. Use of gravity, idle, flat, V-belts and rope materials. Length of belt, rope and chain drives, type and cone type.

4. Cams: Types of cams and follower, definitions of terms connected with cams, displacement velocity and acceleration diagrams for cam followers. Analytical and Graphical design of cam profiles with various motions (SHM, uniform acceleration and retardation, cycloidal). Analysis of follower motion for circular convex, tangent cam profiles. Calculation of pressure angle.

5. Friction Devices: Concepts of frictions and wear related to bearing and clutches. Types of brakes, principle of function of brakes of various types. Braking of front and rear tyres of a vehicle, Problems to determine braking capacity, Types of dynamometers,(absorption, transmission).

6. Flywheels: Turning moment and crank effort diagrams for reciprocating machines Fluctuations of speed, coefficient of fluctuation of speed and energy, Determination of flywheel mass and dimensions for engines and Punching Machines

7. Governors : Function, types and characteristics of governors, Watt, Porter and Proell governor. Hartnell and Willson-Hartnell, spring loaded governors. Simple numerical problems on these governors. Sensitivity, stability, isochronisms and hunting of governors. Governor effort and power controlling force curve, effect of sleeve friction.

Books

1. Jagdish Lal, Theory of Mechanisms & Machines, Metropolitan Book Co. Pvt. Ltd, New Delhi.
2. S. S. Rattan, Theory of Machines, Tata McGraw Hill, New Delhi
3. Thomas Beven, Theory of Machines, Longman's Green & Co., London
4. W. G. Green, Theory of Machines, Blackie & Sons, London
5. Shigley , Theory of Machines, Mcgraw Hill , New York

AE –203 AUTOMOTIVE CHASSIS AND COMPONENTS

Introduction

Types of chassis layout with reference to power plant locations and drive, Vehicle frames. Load acting on vehicle frame due to different systems.

Front Axle & Steering System

Types of front axles. Constructional details. Materials. Front wheel geometry viz. Castor, Camber, King pin inclination, Toe. Wheel Alignment. Cornering force and Side thrust. Steering geometry. Ackerman and Davis steering system. Different types of steering gear boxes. Steering linkages and their layouts. Power and power assisted steering. Steering of crawler tractors. Multi axle steering systems.

Driveline and Differential

Effects of driving thrust and torque reactions. Hotch kiss drive, torque tube drive and radius rods. Transverse rods. Propeller shaft. Universal joints. Constant velocity universal joints. Drive Shaft. Front wheel drive. Different types of final drives. Spiral bevel gear and hypoid gear final drives. Double reduction and twin speed final drives. Differential principles. Constructional details of a differential gear unit. Non-slip and Limited slip differential. Differential locks - Differential housings. Comparison of front wheel, rear wheel and all wheel drive arrangement.

Drive axles

Construction of rear axles. Types of loads acting on rear axles. Fully floating, three quarter floating, and semi floating rear axles. Rear axle housing. Construction of different types of axle housing, multi axled vehicles. Construction details of multi drive axle vehicles. Dead axles.

Suspension system

Need of suspension system, Types of suspension, Suspension springs, Constructional details and characteristics of leaf, coil and torsion bar springs, Independent suspension, Types: Mc Pherson strut, Double wishbone, Five link type, etc, Rubber suspension, Pneumatic suspension, Shock absorbers.

Wheels and Tyres

Types of wheels – wire spoke, disc – solid and split type, alloy type, offset, onset & zero set, denomination of rim. Tyres - construction, structure, denomination and function of tyres, types of tyres, comparison of radial and bias ply tyres. Tubes – construction and types, Tubeless tyres. Tyre inflation, effects of tyre pressure on tyre performance. Tyre wear patterns and their causes. Wheel Balancing – need, procedure.

Braking system

Weight transfer during braking and stopping distances. Classification of brakes - drum brakes and disc brakes. Constructional details. Theory of braking. Brake split and proportioning. Mechanical, hydraulic and pneumatic brakes - Servo brake, power and power-assisted brakes - Different types of brake retarders like eddy current and hydraulic retarder. Skidding of wheels on braking and remedies - Anti lock braking systems.

Text Books:

1. Automobile Engineering Vol-1 by Kirpal Singh..

References:

1. Steed W., " Mechanics of Road vehicles ", Iliffe Books Ltd., London.
2. Newton Steeds & Garrot, " Motor vehicles ", Butterworths, London.
3. Judge A.W., " Mechanism of the car ", Chapman and Halls Ltd., London.
4. Giles.J.G., " Steering, Suspension and tyres ", Iliffe Book Co., London.
5. Crouse W.H., " Automotive Chassis and Body ", McGraw Hill. Newyork
6. Heldt P.M., " Automotive chassis ", Chilton Co., New York

AE – 205 APPLIED THERMODYNAMICS

Fuels

Types and properties of fuels, Hydrocarbon Chemistry, Refining, Gasoline Fuels, Diesel Fuels, Rating of Automotive fuels. Alternative Fuels- LPG, CNG, and biogas. Fuel Blending – alcohols and vegetable oils like "jatropa".

Combustion

Combustion reactions, Combustion problems IC Engines, Stoichimetric (or Chemically) air fuel ratio, analysis of products of combustion, conversion of volumetric analysis into gravimetric analysis and vice-versa, actual weight of air supplied, use of mols.

Positive displacement Compressors

Use of compressed air in industry. Classification of air compressors, Types of compressors, Operation of Single/Multistage stage reciprocating compressors. comparison of rotary compressors with reciprocating processors; operation of positive displacement type of rotary compressors like roots blower, Lysholm compressor and Vane type Blower. Preguide vanes and prewhirl; surging and choking in centrifugal compressors. Different components of axial flow compressors and their arrangement; discussion on flow passages and simple theory of aerofoil blading; angle of attack; coefficients of lift and drag; turbine versus compressor blades; Surging, choking and stalling in axial flow compressors, Comparison on axial flow compressor with centrifugal compressor and reaction turbine; field of application of axial flow compressors.

Heat Transfer

Introduction, Concept of heat transfer, Difference between the subject of "Heat Transfer" and "Thermodynamics". Different modes of heat transfer - Conduction, convection, and radiation.

Heat Exchanger (Condensers, Radiators and Evaporator)

Function. Heat rejection ratio. Elements of Heat exchanger. Working fluid: Liquid and Gas, Different types. Dalton's law of partial pressures; Effect of leakage of air. Methods to check and prevent air infiltration.

Psychrometry

Meaning of air conditioning. Psychrometry and psychrometric properties, Psychrometric relations, Psychrometric Charts, Psychrometric processes.

Refrigerants

Classification, properties, selection criteria, commonly used refrigerants, alternative refrigerants, eco-friendly refrigerants, and applications of refrigerants. Refrigerants used in automobile air conditioning

Books

1. Heat Engineering by VP Vasandani and DS Kumar; Metropolitan Book Co.
2. An Introduction to Energy Conversion by V Kadambi, Manohar Prasad; Wiley International, New Delhi
3. Thermal Engineering by PL Ballaney; Khanna Publishers, Delhi
4. Engineering Thermodynamics: Work and Heat Transfer By Rogers and Mayhew; ELBS Publications
5. Thermodynamics and Heat Engines Vol. I and II by R Yadav; Central Publishers, Allahabad
6. Applied Thermodynamics by TD Eastop & A Mc Conkey, ELBS Publications
7. Refrigeration and Conditioning by CP Arora, Tata McGraw Hill

AE-207 - AUTOMOTIVE MATERIALS AND METALLURGY

1. Atomic structure of metals & crystal system, crystallographic notation of atomic planes, polymorphism and allotropy, solidification of crystallization (i) nuclear formation (crystal growth) (ii) crystal imperfection Elementary treatment of theories of plastic deformation, phenomenon of slip twinning, dislocation, identification of crystallographic possible slip planes and direction in FCC, BCC, C.P., recovery, re-crystallization, preferred orientation causes and effects on the property of metals.

2. General principles of phase transformation in alloys, phase rule and equilibrium diagrams, Equilibrium diagrams of (i) Binary system in which the components form a mechanical mixture of crystals in the solid state and are completely mutually soluble in both liquid state. (ii) systems whose components have complete mutual solubility in the liquid state and limited solubility in the solid state in which the solid state solubility decreases with temperature(iii) alloys whose components have complete mutual solubility in the liquid state and limited solubility in solid state (iv) system whose components are subject to allotropic change. Iron carbon equilibrium diagram and their Phase transformation

3 Engineering materials and their properties, classification. Classification of ferrous and non-ferrous materials. Classification of cast iron-properties and their applications. Effects of alloying elements on properties of steel, carbon steel, low alloy steels, stainless steel, tool steels and die steels. Alloys of Ni, Al, Cu, Mg; properties and their applications. Classification of composite materials and their properties and applications.

4. Heat treatment and surface treatment: Heat treatment of steel – Annealing, Normalising, Hardening and tempering with their types and application to automotive components, surface hardening techniques, Induction, flame and chemical hardening, coating of wear and corrosion resistance, Electroplating. Phosphating, Anodizing, hot dipping, thermal spraying, hard facing and thin film coatings.

5. Selection of materials: Cryogenic wear, corrosion, fatigue, creep and oxidation resistance application. criteria of selecting materials for automotive components viz cylinder block, Cylinder head, piston, piston ring, Gudgeon pin, connecting rod, crank shaft, crank case, cam, cam shaft, engine valve, gear wheel, clutch plate, axle, bearings, chassis, spring, body panel - radiator, brake lining etc.

Application of non-metallic materials such as composite, ceramic and polymers in automobile.

References:

1. Khanna.O.P., " Material Science and Metallurgy ", Dhanapal Rai & Sons,
2. Kapoor, " Material Science and Processes ", New India Publishing House,
3. Raghavan.V., Physical Metallurgy, Principle and Practice, Prentice Hall,
4. Bawa.H.S., Materials Metallurgy, McGraw-Hill,.
5. Avner S.H". Introduction to Physical Metallurgy" McGraw-Hill, New York,
6. Dieter, G.E., Mechanical Metallurgy, McGraw-Hill, New York, 1996.
7. Heat treatment of metals B. Zakhary

AE –209 MECHANICS OF MATERIALS LAB

List of experiments

1. To perform tensile test in ductile and brittle materials and to draw stress-strain curve and to determine various mechanical properties.
2. To perform compression test on C.I. and to determine ultimate compressive strength.
3. To perform shear test on different materials and determine ultimate shear strength.
4. To perform any one hardness test (Rockwell, Brinell & Vicker's test) and determine hardness of materials.
5. To perform impact test to determine impact strength.
6. To perform torsion test and to determine various mechanical properties.
7. Study of performance of Fatigue & Creep tests
8. To perform bending test on beam (wooden or any other material) and to determine the Young's modulus and Modulus of rupture
9. To perform Torsion test on helical springs in tension and compression and to determine modulus of rigidity/stiffness
10. Determination of Buckling loads of long columns with different end conditions.\

AE-211 AUTOMOTIVE CHASSIS LAB

List of Experiments

1. Study of layout of a chassis and its different components, of a vehicle.
2. Trouble shooting in different types of steering systems - mechanical and power and various steering linkages.
3. Measurement of steering geometry angles – Wheel Alignment.
4. Study of impact of steering geometry angles on vehicle
5. Study of different types of wheels (rims) and tyres and their defects
6. Conducting Wheel balancing of a given wheel assy.
7. Trouble shooting in Propeller Shafts and Drive shafts including constant velocity joints.
8. Trouble shooting in different types of dead axles (front or rear)
9. Trouble shooting in different types of live axles and Differential systems.
10. Trouble shooting in suspensions of following types:
 - a. Leaf Spring
 - b. Double Wishbone with Torsion Bar or Coil Spring
 - c. McPherson Strut Type
 - d. Five Bar Link type
 - e. Air Suspension system
 - f. A shock absorber (damper)

Trouble shooting in braking system in master and wheel cylinder, drum and disc brakes,overhauling and adjusting of system and its testing on brake tester

AE-213 AUTOMOTIVE MATERIALS AND METALLURGY LAB

1. Study of different Engineering materials and their mechanical properties.
2. To study the microstructures of the following materials
 - i) Hypo Eutectoid & Hyper Eutectoid steels.
 - ii) Hypoeutectic cast iron and hyper eutectic cast iron.
 - iii) Grey and white cast iron
 - iv) Non – ferrous metals i.e. Al. Mg. Cu. Ni. Sn. And their alloys.
3. Study of iron carbon diagram and its engineering applications.
4. Annealing of steel, effect of annealing temperatures and time on hardness.
5. Study of microstructure and hardness of steel at different rates of cooling.
6. Hardening of steel, effect of quenching minimum and agitation of the medium on hardness.
7. Effect of carbon percentage on the hardness of steel.
8. Hardenability test by Jominy's End quench test.
9. Normalizing tempering of steel components.
10. To study the case hardening processes i.e. carburizing, Nitriding, cyaniding etc.

11. To study and construct the T-T- T diagram for steels.

ME-207 MACHINE DRAWING

Course Objectives

1. Understand the principles and requirements of production drawings.
2. Understand the various symbols used in drawing.
3. Assemble and disassemble the following manually and using computer aided drafting :-
 - a) Various types of couplings
 - b) Pipe fittings
 - c) Boiler mountings
 - d) Types of bearings
 - e) Few machine tool parts
 - f) Screw jack and drill press vice
4. Use bill of materials in each of the above drawings.
5. Record the surface finish of the parts and reason as well as interpretation of drawing.

Detailed Contents

1. Principles of drawing, requirements of production drawing, sectioning and conventional representation, dimensioning, symbols of standard tolerances, machining symbols, Introduction and familiarization of the code IS:296.
2. FASTENERS : Various types of screw threads, types of nuts and bolts, screwed fasteners, welding joints and riveted joints
3. Assembly and Dis-assembly of the following manually and using computer aided drafting.
 - a) Couplings: Solid or rigid Coupling, Protected type flange coupling, Pin type flexible coupling, muff coupling, Oldham, universal coupling, claw coupling, cone friction clutch, free hand sketch of single plate friction clutch.
 - b) Knuckle and cotter joints
 - c) Pipe and Pipe fittings: flanged joints, spigot an socket joint, union joint, hydraulic an expansion joint
 - d) IC Engine Parts : Piston, connecting rod
 - e) Boiler Mountings : steam stop valve, feed check valve, safety valve, blow off cock.
 - f) Bearings : swivel bearing, thrust bearing, Plummer and angular plummer block
 - g) Miscellaneous : Screw Jack, Drill Press Vice, Crane hook.
4. Drafting of simple mechanical components on computer.

NOTE :

Drawing Practice is to be done as per IS:296 code.

First angle projection to be used. Drawings should contain bill of materials and Should illustrate finish. The syllabus given above indicates the broad outlines and the scope of the subject to be covered. It is not necessary to cover all the drawing exercises of the types of machine tools mentioned above.

Books

1. Text-book of Machine Drawing by V Lakshmi Narayanan and Mathur
2. Machine Drawing by PS Gill, BD Kataria and Sons, Ludhiana
3. Machine Drawing by ND Bhatt, Charotar publications
4. Machine Drawing by N Sidheshwar, Tata McGraw Hill

4th Semester

AM-201 MATHEMATICS-III

Detailed Contents

1. Fourier Series Periodic functions, Euler's formula. Even and odd functions, half range expansions, Fourier series of different wave forms.

2. Laplace Transforms Laplace transforms of various standard functions, properties of Laplace transforms, inverse Laplace transforms, transform of derivatives and integrals, Laplace transform of unit step function, impulse function, periodic functions, applications to solution of ordinary linear differential equations with constant coefficients, and simultaneous differential equations.

3. Special Functions Power series solution of differential equations, Frobenius method, Legendre's equation, Legendre polynomial, Bessel's equation, Bessel functions of the first and second kind. Recurrence relations, equations reducible to Bessel's equation, Error function and its properties.

4. Partial Differential Equations Formation of partial differential equations, Linear partial differential equations, homogeneous partial differential equations with constant coefficients Applications: Wave equation and Heat conduction equation in one dimension. Two dimensional Laplace equation, solution by the method of separation of variables. Laplacian in polar coordinates.

5. Functions of Complex Variable Limits, continuity, derivative of complex functions, analytic function, Cauchy-Riemann equation, conjugate functions, harmonic functions; Conformal Mapping: Mapping of a complex function, conformal mapping, standard transforms, mapping of standard elementary transformations, complex potential, applications to fluid flow problems; Complex Integration : Line integrals in the complex plane, Cauchy's theorem, Cauchy's integral formula and derivatives of analytic function. Taylor's and Laurent's expansions, singular points, poles, residue, complex integration using the method of residues, evaluation of real integrals by contour integration.

Books

1. Advanced Engineering Mathematics by Kreyszing Erwin ; Wiley Eastern, New Delhi
2. Higher Engineering Mathematics by BS Grewal ; Khanna Publishers, New Delhi.
3. Numerical Solutions of Differential Equations by NK Jain ; Prentice Hall, Delhi.
4. Differential Equations by Sharma and Gupta ; Krishna Prakashan Media (P) Ltd., Meerut.

AE –202 Internal Combustion Engines**Fundamentals:**

Engine terminology, classification. Working principle of two stroke and four stroke engine, Scavenging, scavenging processes. Thermodynamic cycles for automobile engine- Air standard cycle, Otto cycle, Diesel cycle, Dual cycle, Comparison between different cycles, Valve timing diagram for engine under different conditions, Firing order, Factors affecting on selection of firing order. Square Engine, Wankel engine. Engine Mountings.

Constructional Details

Cylinder block, Engine cylinder, Cylinder liner, Cylinder Head and cover, Piston for C.I. and S.I. engine, Piston rings, Piston pin, Connecting rod, Crank shaft, Main bearings, Cam shaft, Oil pan, Engine mountings and Engine balancing, Vibration Damper, Cam shafts & drives, Inlet and exhaust valves, Valve actuating mechanism including variable control system, Air cleaner, Manifold & gasket – intake and exhaust, silencer, tail pipe.

Combustion in S.I. Engine

Ignition limits, Stages of combustion in petrol engine, Ignition lag, Effect of engine variables on ignition lag, Effect of engine variables on flame propagation, Abnormal combustion, Detonation, Effects of detonation, Theories of detonation, Effects of engine variables on knock, Control of knock. Surface ignition, Pre ignition, Post ignition, S.I. engine combustion chamber design, Types of combustion chambers for S.I. engine, Very high output combustion chamber engines

Combustion in C.I. Engine

Air fuel ratio in C.I. engine, Stages of combustion in C.I. engine, Delay period, Variables affecting on delay period, Diesel knock, Methods of controlling diesel knock, C.I. engine combustion chamber, Direct injection type, Open type, Turbulent type, Pre chamber, M combustion chamber, Cold starting of C.I. engine- decompression devices, heater plug, inlet manifold heater, Chemical spray

Petrol Engine Fuel Supply System

Methods of fuel supply system- gravity system, pressure system, Vacuum system, pump system, Components of fuel supply system –Fuel tank, fuel pump (Mechanical and Electrical) Vapor return line, Air cleaner, Fuel filters, Carburetion, Functions of carburetor, simple carburetor, Limitations of simple carburetor, Types of Carburetor-Solex and SU carburetor, Special features of modern carburetor. Benefits of electronic fuel injection system.

Diesel Engine Fuel Supply System

Comparison of diesel engine with petrol engine, Requirements of diesel injection system, Fuel feed pump, Types of injection system, fuel injection pump, and fuel injectors. Fuel filter, air cleaner, Phasing and calibration of fuel injection pump, Injector Testing (pressure test, leak test) Electronic control of fuel injection system

Engine Friction, Lubrication And Lubricants.

Total engine friction, Effects of engine variables on engine friction, Lubrication- Objectives of lubrication, Lubricants used, Requirements & selection of lubricants, Viscosity rating, Multi grade oil, Additives used in lubricant, Effects of engine variables on lubricating oil, Oil consumption, Different parts of engine to be lubricated, Types of lubrication system- petrol system, Wet sump method, Dry sump method, Fully and partially pressurized lubrication system, Components of lubrication system- oil strainer, Oil filter and its types.

Engine Cooling System:

Distribution of heat supplied to engine, Necessity of engine cooling, Piston and engine Cylinder temperatures, Factors affecting on piston temperature, Types of cooling system, Air cooling system, Water cooling system, Thermosyphon cooling, Cooling with thermostatic regulator. Components of water cooling system-Radiator, Pressure Cap, Expansion Reservoir, Coolants, Thermostat, Water Pump, Viscous coupling, Comparison between water cooling and air cooling. Effects of over and under cooling.

Supercharging

Objects of supercharging, Relative power with and without supercharging, Supercharging of spark ignition engine, Supercharging of C.I. engine, Effects of supercharging on performance of engine, Supercharging limits for S.I. and C.I. engine, Methods of super charging, Supercharges, Turbo charging, Comparison with supercharging, Methods of turbo charging, Limitations of turbo charging.

Performance Testing of Engine

Losses in the engine, Performance parameters, Performance curves, Methods of improving performance of engine, Testing of engine, Classification of testing, Basic measurement- Speed, Fuel consumption, Air consumption, Mean effective pressure, Brake power, Indicated power, Frictional power (with different methods), Mechanical efficiency, Thermal efficiency, volumetric efficiency, Heat balance sheet, Engine analyzer.

Text Book:

1. Ganesan.V., " Internal Combustion Engines ", Tata-McGraw Hill Publishing Co., New Delhi

2. Dr.K.K.Ramalingam "Internal Combustion Engines Theory and Practice", Scitech Publications(India) Pvt.Ltd, Chennai

References:

1. Heldt.P.M., " High Speed Combustion ", Oxford IBH Publishing Co., Calcutta.
2. Obert.E.F., " Internal Combustion Engine analysis and Practice ", International Text Book Co., Scranton, Pennsylvania.
3. Maleev.V.M., " Diesel Engine Operation and Maintenance ", McGraw Hill,
4. Dicksee.C.B., " Diesel Engines ", Blackie & Son Ltd., London,
5. William H. Crouse, " Automotive Engines ", McGraw Hill Publishers,
6. Ellinger H.E., " Automotive Engines ", Prentice Hall Publishers,
- 7 .IC Engines by ML Mathur and RP Sharma; Dhanpat Rai and Sons

Course Objectives

1. Compute, both analytically and graphically forces and couples for reciprocating parts and dynamically equivalent system.
2. Understand the theory of inertia force and apply to four-bar linkage mechanism.
3. Understand types of balancing and its need.
4. Apply the theory of balancing to reciprocating and Rotating masses.
5. Understand the types of both tooth gear and the nomenclature of gears.
6. Understand the concepts of interference in gears, and its removal.
7. Compare the cycloid and involute tooth profile.
8. Understand the various types of gear trains.
9. Apply the theory of gear trains to solve simple numerical problems.
10. Understand gyro effect on moving bodies
11. Understand techniques of kinematic synthesis

Detailed Contents

1. Static force analysis: Static equilibrium of mechanism, concept of force and couple, free body diagram, condition of equilibrium, methods of static force analysis of simple mechanisms and power transmission elements, considerations of frictional forces
2. Determination of forces and couples for a crank, inertia of reciprocating parts, dynamically equivalent system, analytical and graphical method, inertia force analysis of basic engine mechanism torque required to overcome inertia and gravitational force of a four bar linkage.
3. Balancing: Classifications, need for balancing, balancing of single and multiple rotating masses, static and dynamic balancing, primary and secondary balancing for reciprocating masses, partial balancing of locomotives, swaying couple, hammer blow, variation in tractive effort, balancing of V-engine, concept of direct and reverse crank, balancing of machines, rotors, reversible rotors.
4. Gears : Toothed gears and spur gears, types of toothed gears, definitions, pitch circle diameter, pitch surface, pitch point, circular pitch, module pitch, diametrical pitch, addendum, Dedendum clearance, outside and internal diameters, root diameter, base circle diameter, face and flank of tooth, pressure angle, path of contact, arc of contact, conditions for correct gearing, forms of teeth, involute and its variants, interference and methods of its removal. Calculation of minimum no of teeth on pinion/wheel for involute rack, helical/spiral/bevel/worm gears. Center distance for spiral gears and efficiency of spiral gears
5. Gear Trains : Types of gear trains, simple, compound and epicyclic gear trains, problems involving their applications, estimation of velocity ratio of worm and worm wheel.
6. Gyroscopic motion and gyroscopic couples: Effect on supporting and holding structures of machines, Effect on 2 and 4-wheeled vehicles,
7. Kinematic synthesis of Mechanism: Freudenstein equation, Function generation errors in synthesis. Two/three points synthesis. Transmission angles, least square techniques.

Books

1. Theory of Machines by PL Ballaney
2. Theory of Machines by Hams Crone and Roggers
3. Theory of Machines by Shigley, Mc Graw Hill, New Delhi
4. Theory of Machines by Dr. Jagdish Lal
5. Theory of Machines by SS Rattan, Tata Mc. Graw Hill, New Delhi
6. Theory of Mechanisms and Machines by Ghosh and Mallick, Affiliated East West Pvt.Ltd

1. Casting processes

Introduction to metal casting, types of patterns, their materials and allowances. Moulding materials: Moulding sand compositions and moulding sand properties, sand testing types of moulds, moulding machines cores, core sands, types of cores, core banking, elements of gating system, and risers. Cupola and its operation, types of furnaces, Casting processes: sand casting, shell mould casting, investment casting, permanent mould casting, full mould casting, vacuum casting. Die casting. Centrifugal casting, continuous casting. Casting defects, their causes and remedies. Solidification of metal and alloys

2. Welding

Welding introduction and classification of welding, processes, welding terminology, general principles, welding positions, filler metals.

Gas welding and gas cutting, principle, and oxyacetylene welding equipment

Oxyhydrogen welding. Flame cutting.

Electric arc welding. Principle, equipment, types- MIG, TIG submerged arc and others.

Welding electrodes, classification and selection of electrodes, welding arc and its characteristics, arc stability, arc blow. Thermal effects on weldment.

Resistance welding- principle and their types i.e. spot, seam, projection, upset and flash

Thermit welding, electro slag welding, friction welding, plasma arc welding, electron beam welding.

Welding defects, their cases and remedies.

Brazing, braze welding and soldering.

3. Metal Forming

Introduction : Classification of forming processes,

Rolling : Classification of rolling processes, rolling mills, rolling defects,

Drawing : Drawing of rods, wires and tubes, Draw benches.

Forging : Introduction to forging, their types, forging defects.

Extrusion : Classification of extrusion processes

Sheet metal forming operations : Spinning, deep drawing, bending.

Introduction to press working. Types of presses, press working operation, Press working tools.

4. Metal cutting and Machine tools

Cutting tool materials, Signature of cutting tools, Twist Drill and milling cutter,

Coolants: Classification, purpose, its effect

Lathe: Machine and its accessories, Lathe operations,

Shaping and Planing Machine, slotting machine, Introduction to broaching machine

Milling machine and its classification, Indexing: Simple compound and differential

Drilling & Boring Operation and their machines

Grinding: Cylindrical, surface and centreless grinding

Introduction to non traditional machining.

Books

1. Heine, R.W. C.R. Loper and P.C. Rosenthal, Principles of metal casting Mc Graw Hill New York- 1967
2. Welding Technology by R.S. Parmar, Khanna Publishers.
3. Manufacturing Technology: Foundry, Forming and Welding by Rao, Tata McGraw Hill, New Delhi.
4. Principles of Manufacturing Materials and Processes by J.S. Campbell, Tata McGraw Hill.
5. Metal forming fundamentals and applications by Alton.

PTU/BOS/AE/101/20-12-2007/Batch 2005
AE-206 Fluid Mechanics & Machinery

Purpose

This is a core subject, basic knowledge of which is required by all the engineers. This course aims at developing an understanding of the behaviour of fluids in motion or at rest and the subsequent effects of the fluids on the boundaries. The study of this subject will develop analytical abilities related to fluid flow.

Instructional Objectives

The students should be able to have:

1. Conceptual understanding of fluids and their properties.
2. Understanding of fluid statistics, fluid kinematics and fluid dynamics.
3. Basic knowledge of dimensional analysis and similitude.
4. Understanding of laminar and turbulent flows, and flow measurement.
5. Basic knowledge and understanding of the pumps.

Detailed Contents

1. Fluid and their properties : Concept of fluid, difference between solids, liquids and gases; ideal and real fluids; capillarity, vapour pressure, compressibility and bulk modulus; Newtonian and non- Newtonian fluids.
2. Fluid Statics: Concept of pressure, Pascal's law and its engineering applications, Hydrostatic paradox. Action of fluid pressure on a plane (horizontal, vertical and inclined) submerged surface, resultant force and center of pressure, force on a curved surface due to hydrostatic pressure. Buoyancy and flotation, stability of floating and submerged bodies, metacentric height and its determination, periodic time of oscillation, pressure distribution in a liquid subjected to constant horizontal/ vertical acceleration, rotation of liquid in a cylindrical container.
3. Fluid Kinematics : Classification of fluid flows, velocity and acceleration of fluid particle, local and convective acceleration, normal and tangential acceleration, streamline, path line and streak line, flow rate and discharge mean velocity, continuity equation in Cartesian and cylindrical, polar coordinates. Rotational flows, rotation velocity and circulation, stream and velocity potential functions, flow net.
4. Fluid Dynamics : Euler's equation, Bernoulli's equation and steady flow energy equation; representation of energy changes in fluid system, impulse momentum equation, kinetic energy and momentum correction factors, flow along a curved streamline, free and forced vortex motions.
5. Dimensional Analysis and Similitude : Fundamental and derived units and dimensions, dimensional homogeneity. Rayleigh's and Buckingham's Pi method for dimensional analysis. Dimensionless numbers and their significance, geometric, kinematic and dynamic similarity, model studies. Laminar and Turbulent Flows: Flow regimes and Reynolds number, critical velocity and critical Reynolds number, laminar flow in circular cross- section pipes. Turbulent flows and flow losses in pipes, Darcy equation, minor head losses in pipes and pipe fittings, hydraulic and energy gradient lines.
6. Flow Measurement: Manometers, pitot tubes, venturi meter and orifice meters, orifice, mouthpieces, notches and weirs, rotameter.

Fluid machinery

Basic components of a turbo machine and its classification on the basis of purpose, fluid dynamic action, operating principle, geometrical features, path followed by the fluid and the type of fluid etc. Classification. Principle of operation of centrifugal and axial pumps. Turbo blowers and turbines. Const., operation and utility of simple accumulator, intensifier, fluid coupling and torque converter, gear, vane and piston pumps.

Books

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar : S.K. Kataria and Sons Publishers.
2. Mechanics of Fluids by Massey BS; Van Nostrand Reinhold Co.
3. Fluid Mechanics by Douglas JF, Gasiorek JM, Swaffield JP; Poitman
4. Fluid Mechanics by Streetes VL and Wylie EB; McGraw Hill Book Co.
5. Hydraulic Machines by Jagdish Lal; Metropolitan Book Co Pvt. Ltd

AE-208 AUTOMOTIVE POLLUTION AND CONTROL SYSTEMS

Introduction

Pollutants - sources - formation - effects - transient operational effects on pollution. Introduction, Pollutants, sources, formation of HC and CO in SI engines, NO formation in SI and CI engines, Particulate emission from SI and CI engines, Smoke Emission in CI engines. Effect of operating variables on Emission formation

SI Engine Combustion And Pollutant Formation

Chemistry of SI engine combustion - HC and CO formation in 4-stroke and 2-stroke SI engines - NO formation in SI engines - Particulate emissions from SI engines - Effects of operating variables on emission formation.

CI Engine Combustion And Emissions

Basics of diesel combustion. Smoke emission in diesel engines, NOx emission from diesel engines. Particulate emission in diesel engines. Color and aldehyde emissions from Diesel engines. Effects of operating variables on emission formation.

Post Combustion Treatment

Introduction, physical conditions and exhaust gas compositions before treatment, catalytic mechanism. Thermal reactions, installation of catalyst in exhaust lines, NOx treatment in diesel engines. Diesel trap oxidizers

Control Techniques Engine Emission Reduction

Design changes - Optimization of operating factors - Exhaust gas recirculation - Fumigation - Air injection PCV system - Exhaust treatment in SI engines - Thermal reactors - Catalytic converters - Catalysts - Use of unleaded petrol.

Test Procedure & Instrumentation For Emission Measurement

Test procedures, NDIR analyser, thermal conductivity and flame ionization detectors, Chemiluminescent analyser, analysers for NOx, Gas chromatograph - Orsat apparatus -Smoke meters, spot sampling and continuous indication types like Bosch, Hart ridge.

Laws and Regulations

Historical background, regulatory test procedures (European cycles), exhaust gas pollutants (European rail road limits), particulate pollutants, European statutory values, inspection of vehicles in circulation (influence of actual traffic conditions and influence of vehicle maintenance) Indian Emission Standards

Text Books:

1. Springer and Patterson, Engine Emission, Plenum Press, 1990.

References:

1. Ganesan.V., " Internal Combustion Engines ", Tata McGraw Hill Co.,
2. SAE Transactions, " Vehicle emission ", 1982 (3 volumes).
3. Obert.E.F., " Internal Combustion Engines ",.
4. Taylor.C.F., " Internal Combustion Engines ", MIT Press,.
5. Heywood.J.B. "Internal Combustion Engine Fundamentals", McGraw Hill
6. Automoblies and Pollution SAE Transaction.
7. Motor Vehicles Act / Emission Norms – Govt of India Publications.

AE –210 Internal Combustion Engines Lab

1. Study of layout of different components in an IC Engine
2. Study and draw a valve timing diagram for a 4-stroke multi cylinder engine
3. Study of valve actuating mechanisms of an multi cylinder engine
4. Study of different carburettors in Indian make of vehicles
5. Study of different fuel injection system in Indian make of vehicles
6. Trouble shooting in an IC engine
7. Morse test on petrol and diesel engines.
8. Heat balance test on an automotive engine.
9. Performance study of IC engine at full throttle and part throttle conditions with alternative fuels and their comparisons
10. Exhaust emission analysis of an SI and CI engine.
11. Study of emission control systems on a vehicle.

ME-212 THEORY OF MACHINES-II LAB

1. Study of various links and mechanisms.
2. Study and draw various inversions of 4- bar chain and single slider crank chain.
3. Draw velocity and diagram of engine mechanism using graphical methods including Klien's construction.
4. Conduct experiments on various types of governors and draw graphs between height and equilibrium speed of a governor.
5. Determination of gyroscopic couple (graphical method).
6. Balancing of rotating masses (graphical method)
7. Determination vibration characteristics of free and forced spring mass system with and without damping.
8. Cam profile analysis (graphical method)
9. Determination of gear- train value of compound gear trains and Epicyclic gear trains.
10. Study pressure distribution in a full journal bearing.

AE-212 MANUFACTURING PROCESSES LAB

List of experiments

WELDING PRACTICALS

1. Study of Arc welding equipment and making a weld joint by this process.
2. Study of MIG welding equipment and making a weld joint by this process.
3. Study of Spot welding and preparing a weld joint by this process.

MACHINING PRACTICALS

1. Study of constructional features of following machines through drawings/ sketches and an exercise based on them:-
 - a) Lathe
 - b) Radial drilling machine
 - c) Universal milling machine
 - d) Shaper
 - e) Grinding machines (Surface, cylindrical)
 - f) Hydraulic Press
2. Advanced exercises on Lathe where the students will work within specified tolerances, cutting of V- threads and square threads (internal as well as external).

PTU/BOS/AE/101/20-12-2007/Batch 2005
AE-214 Fluid Mechanics & Machinery Lab

List of experiments

1. To study the flow through a variable area duct and verify Bernoulli's energy equation.
2. To determine the coefficient of discharge for an obstruction flow meter (venturi meter/ orifice meter)
3. To study the transition from laminar to turbulent flow and to ascertain the lower critical Reynolds number.
4. To determine the hydraulic coefficients for flow through an orifice.
5. To determine the friction coefficients for pipes of different diameters.
6. To determine the head loss in a pipe line due to sudden expansion/ sudden contraction/ bend.
7. To determine the velocity distribution for pipeline flow with a pitot static probe.
8. To study the constructional features of reciprocating pump and to perform test on it for determination of pump performance
9. To draw the various characteristics of Centrifugal pump
10. To draw the various characteristics of reciprocating pump

AE – 301 AUTOMOTIVE DESIGN-I

Internal Marks: 40
External Marks: 60
Total Marks: 100

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3 1 0

Objectives

At the end the course the student will be able to understand the fundamental principles involved in design of components of automotive chassis, the complete design exercise and arrive at important dimensions of chassis components

Unit I Introduction

Problem identification - problem statement, specifications, constraints, Feasibility study-technical feasibility, economic & financial feasibility, societal & environmental feasibility, Generation of solution field (solution variants), Design Procedure, System Design Cycle, Life cycle costs, selection of fits and tolerances and analysis of dimensional chains, Human factors engineering. Concept of tearing, bearing, shearing, crushing, bending etc, Stress concentration, factor of safety under different loading conditions.

Unit II Selection of Materials

Mechanical properties of the commonly used Engg materials, hardness, and Strength parameters with reference to stress-strain diagram. Introduction to various theories of failure; selection of Engg Materials.

Unit III Mechanical Joints

Bolted joints in tension, eccentrically loaded bolted joints in shear and under combined stresses, Design of Power Screw; Coupling design; Design of various types of welding joints under different static load conditions, eccentrically loaded riveted joints; design of cotter and knuckle joints.

Unit IV Brakes

Self energizing condition of brakes, design of shoe brakes - internal & external expanding, band brakes, and disc brakes, Braking lever design, Thermal considerations in brake designing

Unit V Clutch

Design of single plate clutch, multi plate clutch, design of centrifugal clutch, cone clutch, energy dissipated, torque capacity of clutch, design of clutch components, design details of roller and sprag type of clutches

Unit VI Vehicle Frame

Study of loads, moments, and stresses on frame members. Design considerations for frame of passenger and commercial vehicles, materials for automobile structure.

Unit VII Front Axle and Steering Systems

Analysis of loads, moments and stresses at different sections of front axle, determination of loads at kingpin bearings and wheel spindle bearings, determination of optimum dimensions and proportions for steering linkages ensuring minimum error in steering.

Unit VIII Final Drive and Rear Axle

Detailed design of shafts for static and dynamic loading, Rigidity and deflection consideration, design of propeller shaft, design details of full floating, semi-floating and three quarter floating rear shafts and rear axle housings.

Books

1. Automobile Mechanics by Giri. N.K, Khanna Publisher, New Delhi –2002
2. Fundamental of Machine component design by Juvenal R.C, John Wiley, 3rd Edition
3. PSG Design Data book by PSG College of Technology, Combative, 2000
4. Selection & use of engineering materials – J.A. Charles – Butterworth – Heinemann 3 ed– 06
5. Design of Machine Elements – V.B. Bhandari- Mc Graw Hill
6. Automotive Chassis by Heldt. P.M., Chilton Co., New York – 1992
7. Steering, Suspension and tyres by Giles. K.G, Illiffe Books Ltd., London – 1998
8. Motor Vehicle by Newton Steeds & Garret, Illiffe Books Ltd., London- 2000
9. Automobile Chassis Design by Dean Aaverns, Illiffe Books Ltd. – 1992
10. Mechanical Engg. Design by Joseph Edward Shigley, MGH
11. Machine Design – An integrated Approach by R.L. Norton, Addison Wesley

Note:

1. The paper setter will be required to mention a note in the question paper that the use of only P.S.G design data book is permitted.

Internal Marks: 40
External Marks: 60
Total Marks: 100

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3 1 0

Introduction

Need for Transmission system. Tractive Effort and Resistances to Motion of a vehicle. Requirements of transmission system. Classification of Transmission systems. Single, Two or Four Wheel drive systems. Multi axle drives. Chain, Shaft and Electric drives. Location of transmission system. Different transmissions in scooter, car, MUVs and transport vehicles of Indian make.

Clutch

Principle of operation, Constructional details, torque capacity and design aspects. Different types of clutches. Operation of single plate: helical spring and diaphragm type, and multiplate clutch. Centrifugal and Automatic Clutch. Dry and Wet type of clutch. Friction lining materials. Over-running clutch. Modes of operating a clutch – mechanical, hydraulic and electric.

Gear box

Determination of gear ratios for vehicles. Performance characteristics in different speeds. Different types of gear boxes – sliding, constant and synchromesh type. Need for double declutching and working of synchronizing unit. Power and economy modes in gearbox. Transfer box. Transaxles. Overdrives. Gear shifting mechanisms – mechanical link and wire types

Hydrodynamic drive

Fluid coupling- principle of operation, constructional details. Torque capacity. Performance characteristics, Reduction of drag torque. Torque converter-Principle of operation, constructional details, performance characteristics, converter coupling, multistage torque converters and Polyphase torque converters.

Hydrostatic drive

Hydrostatic drive - Various types of hydrostatic systems - Principles of hydrostatic drive system, Advantage and limitations, Comparison of hydrostatic drive with hydrodynamic drive - Construction and working of typical Janny hydrostatic drive.

Electric drive

Electric drive Principle of early and modified Ward Leonard Control system. Advantage & limitations. Performance characteristics. Study of drive system in an electric and hybrid vehicle.

Automatic transmission applications

Chevrolet "Turboglide" Transmission, Powerglide Transmission Toyota "ECT-i" Automatic Transmission with Intelligent Electronic controls system, Hydraulic Actuation system.

References:

1. Heldt.P.M., " Torque converters ", Chilton Book Co.
2. Newton and Steeds, " Motor vehicles ", Illiffe Publishers.
3. Judge.A.W., " Modern Transmission systems ", Chapman and Hall Ltd.
4. SAE Transactions 900550 & 930910.
- 5." Hydrostatic transmissions for vehicle applications", I Mech E Conference,1981-88.
6. Crouse. W.H., Anglin., D.L., " Automotive Transmission and Power Trains construction ", McGraw-Hill.
7. Automobile Engineering Vol-1 by Kirpal Singh.

AE- 305 AUTOMOTIVE ELECTRICALS & SYSTEMS

Internal Marks: 40
External Marks: 60
Total Marks: 100

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3 0 0

Introduction

Earth returns and insulated return systems, 6, 12, and 24-volt systems. Positive & negative earth systems. Fusing of circuits, relays, switches, low and high voltage automotive cables, wiring diagram for typical automotive wiring systems, maintenance and servicing.

Batteries

Principles of lead acid cells and their characteristics - construction and working of lead acid battery, types of batteries, testing of batteries, effect of temperature on: capacity and voltage, battery capacity, voltage, efficiency, charging of batteries, sulphation and desulphation, maintenance and servicing, Battery failures & checking, Maintenance free Batteries, High energy and power density batteries for electric vehicles.

Charging system

Principle of generation of direct current. Shunt generator characteristics. Armature reaction. Third brush regulation. Cut-out. Voltage & current regulators, compensated voltage regulator. Alternators - principle, constructional and working aspects, bridge rectifiers. Principle of Magneto, Flywheel Magneto, Maintenance and servicing. Trouble shooting in charging systems.

Starting system

Condition at Starting – starting torque and power requirements, behavior of starter during starting. Series motor and its characteristics. Principle & construction of starter motor. Working of different starter drive units, care & maintenance of starter motor. Starter switches. Safety mechanism. Maintenance, servicing and trouble shooting.

Ignition system

Types, construction & working of battery & coil and magneto ignition systems. Relative merits, Ballast Resistor, Ignition coil, Distributor, Contact breaker Point, centrifugal and vacuum advance mechanisms, Limitations of conventional ignition systems, Transistorized Ignition systems, Spark plugs - construction, different types, plug fouling, maintenance, servicing and fault diagnosis, Electronic Ignition system. Programmed ignition, distributor less ignition.

Lighting system

Principle of automobile illumination, headlamp construction and wiring, reflectors – types, signaling devices- flashers, stop lights, fog lamps, auxiliary lighting-engine, passenger, reading lamp. Regn-plate lamps. Automatic illumination system. Head light levelling devices. Study of a modern headlight system with improved night vision.

Electrical Equipment and Accessories

Oil pressure gauge, fuel level gauge, engine temperature gauge, electrical fuel pump, speedometer, odometer, trip meter, engine rpm meter, Headlamp & Windshield washer and wiper, heaters and defrosters, horns, stereo/radio, power antennae. Central locking, power window winding. Sun/Moon Roof. Motorized rear view mirrors, reverse warning, Bumper collision warning. Other accessories in modern vehicles.

Fuel Cells

Thermodynamic aspects; types-hydrogen and methanol, power rating and performance. Various components and working of fuel cell. Heat dissipation.

Drive Motors and controllers:

Drive arrangements in Hybrid and Electric vehicles. Drive motors: types and construction. Controlling of motor operations. Motor-generator in hybrid vehicles and its controls.

Books

1. "Automotive Electrical Equipment ", P.L. Kohli, Tata McGraw-Hill Co. Ltd. New Delhi, 1975.
2. "Principles of Electricity and electronics for the Automotive Technician", Chapman, Thomson Asia, 2000.
3. "Modern Electrical Equipment of Automobiles", A.W. Judge. Chapman & Hall, London.
4. "Automobile Electrical and Electronic Equipments ", A.P. Young. & L. Griffiths, English Languages Book Society & New Press, 1990.
5. "Storage Batteries ", G.W. Vinal. John Wiley & Sons Inc., New York, 1985.
6. "Automobile Electrical Equipment ", W.H. Crouse. McGraw Hill Book Co. Inc., New York,
7. "Electrical Ignition Equipment ", F.G. Spreadbury, Constable & Co Ltd., London, 1962.
8. "Basic Automotive Electrical Systems", C.P.Nakra, Dhanpat Rai
9. Fuel Cells by Bockris and Srinivasan; McGraw Hill
10. Automobile Engineering Vol –II by Kirpal Singh

AE-307 HEAT EXCHANGERS & AIR CONDITIONING

Internal Marks: 40
External Marks: 60
Total Marks: 100

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4 1 0

Heat Exchanger

Function, Classification, types and applications of heat Exchangers, heat rejection ratio, elements of heat exchanger, Working fluid: Liquid and Gas, Dalton's law of partial pressures; Effect of leakage of air. Methods to check and prevent air infiltration, selection of heat exchangers, heat exchanger design methodology.

Single Phase Heat Exchangers: LMTD and NTU methods for evaporator and condenser tubes, and parallel and counter flow heat exchangers, calculation of number and length of tubes in a heat exchanger. Rating and sizing methods, design criteria, geometry, process parameters, pressure drops and applications

Condensation Mechanism, types of condensers and design procedures, Evaporators, Design procedures, augmented surface heat exchangers, Heat transfer coefficients, pressure drops, compact heat exchangers and air coolers, plate heat exchangers and plate fin heat exchangers

Heat Pipe Heat Exchangers: Types and design procedure and applications

Installation, Operation and Maintenance: Fouling factors, type of fouling, and cleaning methods

Air Conditioning**Basic Concept**

Natural and Mechanical refrigeration; Application of Refrigeration; Units of refrigeration and Coefficient of performance; Refrigeration effect, cooling capacity and COP of a refrigerator; Reversed Carnot cycle and its limitations, Meaning of air conditioning,

Refrigerants

Classification, properties, selection criteria, commonly used refrigerants, alternative refrigerants, eco-friendly refrigerants, and applications of refrigerants. Refrigerants used in automobile air conditioning, Basic vapour compression system.

Air Conditioning Concept and Applications;

Psychometric properties of air; Dry bulb, wet bulb and dew point temperatures; Relative and specific humidity; degree of saturation adiabatic saturation temperature, enthalpy of air and water vapours; psychometric chart. Human requirement of comforts; effective temperature and comfort charts; Industrial and comfort air conditioning.

Psychometric Processes

Sensible heating and cooling, cooling with dehumidification; Heating with dehumidification; by-pass factor; chemical dehumidification; adiabatic mixing, air washer.

Calculations for Air –conditioning Load and for Rate and state of Supply Air

Sources of heat load; sensible and latent heat load; sensible heat factor; apparatus dew point temperature; Rate and state of air supply for air- conditioning of vehicles.

Air Conditioning Equipment

Brief description of compressors, condensers, evaporators and expansion devices; Cooling towers; Ducts; dampers; grills; air filters; fans; room air conditioners; split units; automotive air conditioning systems-HVAC model

Text Books:

1. Fundamentals of Heat and Mass transfer by DS Kumar, SK Kataria and Sons, Delhi
2. A Course in Heat and Mass Transfer by S Domkundwar; Dhanpat Rai and Sons, Delhi
3. Refrigeration and Conditioning by CP Arora, Tata McGraw Hill
4. Refrigeration and Conditioning by Manohar Prasad, Wiley Eastern Limited

Reference Books:

1. Heat Transfer by AJ Chapman; Macmillan Publishing Company, New York
2. Heat transfer by JP Holmans, McGraw Hill, London
3. Refrigeration and Conditioning by Jordan and Priester, Prentice Hall of India
4. Refrigeration and Conditioning by WF Stoecker, McGraw
5. Automotive Air conditioning by Paul Lung, CBS Publisher & Distributor, New Delhi.

AE-309 NUMERICAL METHODS AND SIMULATION IN ENGINEERING**Internal Marks: 40****L T P****External Marks: 60****3 0 0****Total Marks: 100**

Errors and significant digits, general error formula, errors in a series approximation

Bisection method, iteration method, Method of false position, Newton -Raphson method, Horner's Method, Graeffe's Root squaring method, methods of iteration: Jacobi's method, Gauss Siedel Method, Relaxation Method.

Errors in polynomial interpretation, finite difference, forward, backward and central difference, Difference of a polynomial, Newton's formulae for interpolation, central difference interpolation formulae (Gauss Forward, Gauss Backward), Interpolation with unevenly spaced points (Lagrange's Interpolation Formulae, Newton's divided difference formulae only)

Numerical differentiation-maximum and minimum values of a tabulated function;

Numerical Integration- Newton-cots integration formulae, Trapezoidal rule, Simpson1/3 rule, Simpson's 3/8 rule; Gaussian integration (One dimensional only)

Introduction, Inverse of Matrix, Solution of linear systems, Matrix inversion method, Gaussian Elimination method, Gauss Jordan Method, Partition Method for linear system of equations (Escalator Method), power method for partition and Eigen value problems

Solution by Picard method, Taylor's series, Euler's method, Runge-Kutta method

Simulation:

Introduction, Continuous and discrete system, System simulation, real time simulation, simulation models, steps and phases of simulation study, simulation – a management laboratory, advantages & limitations of system simulation, Monte Carlo simulation, application of Monte Carlo methods: Numerical Integration, value of pi.

Stochastic and random variables, discrete and continuous probability distribution functions, Central tendency, dispersion, Time flow mechanisms, Verification, Validation and calibration of Simulation Models, design of simulation experiment, Length of simulation run, Elimination of Initial bias, Variance and its reduction, Analog vs computer simulation, Simulation languages SIMULA, SIMSCRIPT, GPSS, SIMAN.

Formulation of model for a dynamic system and its simulation (case study).

Books:

1. Computer Oriented Numerical Methods- V. RajaRaman
2. Numerical Methods in Fortran -Mc Cromik and Salavatory
3. Elementary Numerical Analysis, S.D. Conte, & Cari De Boor. Mc Graw Hill.
4. Applied Numerical Methods, Cornahn B., Et al, John Wiley.
5. System Simulation with Digital Computer: Deo Narsingh PHI
6. System Simulation: Gordon, PHI
7. System Simulation Hira, D.S S.Chand & Co.

Internal Marks: 40
 External Marks: 60
 Total Marks: 100

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 3 0 0

Unit 1 : The Multidisciplinary nature of environmental studies:

Definition, scope and importance

(2 Lectures)

2 : Natural Resources :Renewable and non-renewable resources :

Natural resources and associated problems.

- a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- b) Water resources : Use and over-Utilization of surface and ground water, floods, drought, conflicts and water, dams-benefits and problems.
- c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.
- f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
 - Role of an individual in conservation of natural resources.
 - Equitable use of resources for sustainable lifestyles.

Unit 3 : Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Producers, consumers and decomposers.
- Energy flow in the ecosystem.
- Ecological succession.
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the following eco system:-
 - a. Forest ecosystem
 - b. Grassland ecosystem
 - c. Desert ecosystem
 - d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries

(6 lectures)

Unit 4 : Biodiversity and its conservation

- Introduction – Definition : genetic, species and ecosystem diversity.
- Biogeographically classification of India
- Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values
- Biodiversity at global, National and local levels.
- India as a mega-diversity nation
- Hot-spots of biodiversity.
- Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India
- Conservation of biodiversity : In-situ conservation of biodiversity.

Unit 5 : Environmental Pollution**Definition**

- Causes, effects and control measures of :-
 - a. Air pollution
 - b. Water pollution
 - c. Soil pollution
 - d. Marine pollution
 - e. Noise pollution
 - f. Thermal pollution
 - g. Nuclear hazards
- Solid waste Management : Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution.
- Pollution case studies.
- Disaster management : floods, earthquake, cyclone and landslides.

(8 lectures)

Unit 6 : Social Issues and the Environment

- From Unsustainable to Sustainable development

- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people ; its problems and concerns. Case studies.
- Environmental ethics : Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- Wasteland reclamation.
- Consumerism and waste products.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Public awareness.

(7 lectures)

Unit 7 : Human Population and the Environment

- Population growth, variation among nations.
- Population explosion – Family Welfare Programme.
- Environment and human health.
- Human Rights.
- Value Education.
- HIV / AIDS
- Women and Child Welfare.
- Role of Information Technology in Environment and human health.
- Case Studies.

Unit 8 : Field work

- Visit to a local area to document environmental and river forest grassland hill mountain.
- Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours)

AE – 311 Computer Aided Design Lab

Internal Marks: 30
External Marks: 20
Total Marks: 50

L T P
0 0 2

Select one of the chassis components as in the theory subject; design the component in details as per procedure and the model the designed components in CAD software in detail; carry out failure analysis and verify the design.

AE-313 AUTOMOTIVE TRANSMISSION LAB

Internal Marks: 30
External Marks: 20
Total Marks: 50

L T P
0 0 2

List of experiments

1. Study of a layout of transmission system for a front wheel drive, rear wheel drive and a four wheel drive arrangement
2. Trouble shooting in different types of friction clutches
3. Study of layout of gears and shafts in a manual type gearbox and a transaxle.
4. Trouble shooting in manual type of gearbox and a transaxle
5. Study of layout in a manual & automatic gearbox for a two wheeler
6. Trouble shooting in gearbox of two wheeler of previous experiment
7. Study of layout of an automatic gearbox.
8. Study of gear shifting controls in an automatic gearbox
9. Trouble shooting in an automatic gearbox
10. Study of performance of an automatic gearbox.
11. Study of a manual and electric Transfer Case.
12. Trouble shooting in Transfer Case of previous experiment.
13. Study of an electric drive in an Electric vehicle

AE- 315 AUTOMOTIVE ELECTRICALS & SYSTEMS LAB

Internal Marks: 30
External Marks: 20
Total Marks: 50

L T P
0 0 2

List of Experiments

1. To understand the layout of complete wiring system of an automobile.
2. Perform the various tests for checking the battery condition.
3. To understand and test the charging circuit and charging motor.
4. To conduct performance test on a dynamo, alternator & starter motor.
5. To understand & test the starting circuit and trouble shooting in it.
6. Understand and test the conventional ignition system, setting of contact breaker points and spark plug gap.
7. Understand the working and testing of an Electronic Ignition system
8. Understand and test the lighting circuit of a car.
9. Conduct headlamp focusing as per the procedure.
10. Study the working of different accessories of a modern car
11. To study the layout / working of a Fuel Cell powered electric car.

AE-317 Heat Exchanger & Air Conditioning Lab

Internal Marks: 30
External Marks: 20
Total Marks: 50

L T P
0 0 2

List of Experiments

1. Determination of thermal conductivity of:
 - a solid insulating material by slab method
 - powder materials by concentric spheres method / or by some transient heat transfer technique
 - liquids by employing thin layer
 - a metal by comparison with another metal by employing two bars when kept in series and / or in parallel under different boundary conditions
2. Determination of coefficient of heat transfer for free/forced convection from the surface of a cylinder / plate when kept
 - along the direction of flow
 - perpendicular to the direction of flow
 - inclined at an angle to the direction of flow
3. Determination heat transfer coefficient by radiation and hence find the Stefan Boltzman's constant using two plates/two cylinders of same size by making one of the plates/cylinders as a black body
4. To plot the temperature profile and to determine fin effectiveness and fin efficiency for
 - A rod fin when its tip surface is superimposed by different boundary condition
 - Straight transfer fins of various sizes and optimization of fin proportions
 - Circumferential fins of rectangular/triangular section
5. Study of various elements of an air conditioner system through cut sections models / actual apparatus
6. Study of design of an AC condenser / evaporator as an heat exchanger.
7. Calculation/ Estimation of cooling load for a vehicle
8. Study and performance of car air conditioner (HVAC model)

AE-319 Numerical Methods and Simulation in Engg. (Lab)

Internal Marks: 30
External Marks: 20
Total Marks: 50

L T P
0 0 2

List of Experiments

1. To develop computer program to determine roots of a given equation using method of Newton -Raphson method,
2. To develop computer programs for solution of system of simultaneous linear equations using Gauss Elimination Technique
3. Numerical Integration with Simpson's rule and Gaussian Integration
4. Solution of ordinary differential equations by (i) Euler Method (ii) Runge-Kutta Method (iii) Taylor Series Methods
5. Develop a computer program to generate random numbers.
6. Develop a computer program to carry out a numerical integration using Monte Carlo Method.
7. Develop a computer program to find the value of pi using Monte Carlo method with different total number of computations.
8. Develop a computer program to simulate the car wash station problem

1. Belts and Chains systems

Design for the selection of V-belt, toothed belt and chains. Design of pulley for belt, and sprocket for chain.

2. Suspension Systems

Type of springs and their uses, Design for helical springs, under tension, compression and fluctuating loads, design of leaf springs, Belleville springs, Air (Pneumatic) springs, Surging phenomenon in springs.

3. Transmissions

Basics of gears and gear trains, nomenclature, design of spur, helical, straight bevel gears, worm and worm wheel.

4. Bearing

Basics of bearings, their types, nomenclature. Selection criteria, Design of sliding and rolling type of bearings, Details of design of bearing housings

5. Engine Components

Details of cylinder and piston assembly and their failures. Choice of material for piston and cylinder.

Details, failures, and design of connecting rod, crankshaft, and camshaft. Material for crankshaft, connecting rod, and camshaft.

Basics of Valves and their design. Design aspects of intake and exhaust manifolds, valves springs, tappets, valve trains. Materials for the same.

6. Design of Lubrication systems for different assemblies in vehicles

Text Books

1. Design Data Book by PSG College of Technology, Coimbatore, 2000.
2. Automobile Mechanics by Giri. N.K., Khanna Publisher, New Delhi – 2002.
3. Fundamental of Machine Component Design by Juvenal R.C, John Wiley.
4. Vehicular Engine Design, “ by Kevin L Hoag, SAE Publication
5. An Introduction to Modern Vehicle Design, Julian Happiah Smith, SAE Publication
6. High Speed Combustion Engines by P.M.Heldt, Oxford-IBH Publishing Co.
7. Mechanical Engg. Design by Joseph Edward Shigley, MGH
8. Machine Design – An integrated Approach by R.L. Norton, Addison Wesley
9. Automobile Chassis Design by Dean Aaverns, Illiffe Books Ltd.

Note: The paper setter will be required to mention a note in question paper (time 4 hrs) that the use of only PSG design data book is permitted.

AE – 304 VEHICLE BODY ENGINEERING**Introduction**

Classification of automobiles on different basis. Types of vehicle bodies.

Car body details

Types: Saloon, convertibles, Limousine, Estate Van, racing and sports car, etc. Car body construction types – frame and unitary (monocoque). Various body panels and their constructional details. Methods of improving space in cars.

Bus body details

Types: Mini bus, single and double decker, two level, split level and articulated bus, Bus body lay out, Floor height, Engine location, Entrance and exit location, Seating dimensions, Constructional details: Frame construction, Double skin construction, Types of metal section used, Regulations, Conventional and integral type construction.

Commercial vehicle details

Types of commercial vehicles. Commercial vehicle body details, flat platform, drop side, fixed side, tipper body, tanker body, tractor trailer.

Body loads

Idealized structure, structural surface, shear panel method, symmetric and asymmetric vertical loads in a car, longitudinal load, and different loading situations.

Body materials, trim and mechanisms

Steel sheet, timber, plastic, GRP, properties of materials, Corrosion, Anticorrosion methods, Scallation of paint and painting process, Body trim items, Body mechanisms.

Safety:

Safety aspects in vehicle bodies. Safety equipments for cars – Anti roll bars, Roll over bar, Collapsible steering, multistage bumpers, side impact beams in doors, collision crumple zones. Seat belts, Air bags, Bucket seats with headrest. Laminated/toughened glasses. Anti jamming door locks. Fibre fuel tanks.

Testing the vehicle bodies for the safety.

Special Purpose vehicle details

Various types, Needs and constructional details - Fire station vehicle: tankers, pumping vehicles, ladder vehicle; Concrete mixer transport vehicles; Ambulance; Towing vehicle; Road trains. Off road vehicles.

Vehicle aerodynamics

Objectives - Vehicle drag and types -various types of forces and moments - Effects of forces and moments - Side wind effects on forces and moments - Various body optimization techniques for minimum drag – Wind tunnel testing: Flow visualization techniques, Scale model testing, Component balance to measure forces and moments.

Ergonomics

Man machine system, anthropometry data, and anthropometric considerations in the design of seat, controls and displays, gear lever, steering wheel, foot controls, etc. Dimensions of driver's seat in relation to controls. Visibility: regulations, driver's visibility, tests for visibility, methods of improving visibility in vehicles. Effect of Noise, vibration and heat, on human body and their control, Driver Cab design

Text Book:

1. Braithwaite.J.B., " Vehicle Body building and drawing ", Heinemann Educational Books Ltd., London,
2. Sydney F. Page, "Body Engineering", Chapman & Hill Ltd., London,
3. Dieter Anselm, "The Passenger Car Body" SAE Store
4. Jason C Brown, "Motor Vehicle Structures", SAE Store
5. J Fairbrother, "Fundamentals of Vehicle Body work", Hutchinson, London.
6. John Fenton, "Handbook of Automotive Body and Systems Design", Wiley.
7. J Powloski, "Vehicle Body Engineering", Business Books Ltd., London.
8. Aerodynamics of Road vehicles by Hucho W H, Butterworths Co Ltd
9. Automotive Aerodynamics by Brian Peacock and W Karwowski, Taylor and Francis Ltd, London
10. Noise and vibration in road vehicles by Mathew Harrison, SAE store
11. Vehicle Noise and Vibration; Recent Engg developments, SAE store

PTU/BOS/AE/101/20-12-2007/Batch 2005
AE -306 MEASUREMENTS AND INSTRUMENTATION

Basic Statistical Concepts : Types of Measured Quantities (Discrete and Continuous), Central Tendency of Data, Mode, Median, Arithmetic Mean, Best Estimate of true Value of Data, Measures of Dispersion, Range, Mean Deviation, Variance, Standard Deviation, Normal Distribution, Central Limit Theorem, Significance Test, Method of Least Squares, Graphical Representation and Curve Fitting of Data.

Instruments and Their Representation: Introduction, Typical Applications of Instrument Systems, Functional Elements of a Measurement System, Classification of Instruments, Standards and Calibration

Static and Dynamic Characteristics of Instruments: Range and span, accuracy and precision, calibration, hysteresis and dead zone, sensitivity and linearity, threshold and resolution; speed of response, lag, fidelity and dynamic error, dead time and dead zone. Zero, first and second order systems and their response to step, ramp and sinusoidal input signals.

Errors in Measurement: Sources of errors, systematic and random errors; statistical analysis of test-data, probable error and probability tables, ejection of test data; curve fitting, error propagation; Design and planning of experiments and report writing.

Sensors and Transducer: Introduction, Analog and Digital Transducers, Electromechanical; Potentiometric, Inductive and reluctance type, Electromagnetic, Electrodynamical, Eddy Current, Magnetostrictive, Variable Inductance, Linearly Variable Differential Transformer, Variable Capacitance, Piezo-Electric Transducer and Associated Circuits, Unbonded and Bonded Resistance Strain Gages. Strain Gage Bridge circuits, Temperature Compensation, Balancing and Calibration, Opto-Electrical Transducers, Photo Conductive Transducers, Photo Voltaic Transducers, Digital Transducers, Frequency domain transducer, Vibrating string transducer, Data Acquisition Systems, Data processing, Data Display and Storage. Modern Automotive Instrumentation, Study of automotive sensors and actuators

Position, displacement, and velocity Measurement: Introduction, Relative motion Measuring Devices, Electromechanical, Optical, Photo Electric, Moire-Fringe, Pneumatic, Absolute Motion Devices.

Force, Acceleration and Torque Measurement : Seismic Devices, Spring Mass & Force Balance Type, Calibration, Hydraulic Load Cell, Pneumatic Load Cell, Elastic Force Devices, Separation of Force Components, Electro Mechanical Methods, Strain Gage, Torque Transducer, Torque Meter.

Pressure Measurement: Moderate Pressure Measurement, Monometers, Piezo Transducer, Dynamic Effects of Connecting Tubing, High Pressure Transducer, Low Pressure Measurement, Calibration and Testing,

Flow Measurement: Quantity Meters, Positive Displacement Meters, Flow Rate Meters, Variable Head Meters, Variable Area Meters, Rotameters, Pitot-Static Tube Meter, Drag Force Flow Meter, Turbine Flow Meter, Electronic Flow Meter, Electro Magnetic Flow meter. Hot-Wire Anemometer.

Temperature Measurement : Introduction, Measurement of Temperature, Non Electrical Methods, Solid Rod Thermometer, Bimetallic Thermometer, Liquid-in-Glass thermometer, Pressure Thermometer, Electrical Methods, Electrical Resistance Thermometers, Semiconductor Resistance Sensors (Thermistors), Thermo-Electric Sensors, Thermocouple Materials, Radiation Methods (Pyrometry), Total Radiation Pyrometer, Selective Radiation Pyrometer.

Text Books :

1. Measurement systems Application and Design. Ernest O. Doebelin, Tata McGraw Hill Edition (Fourth Edition) 2002.
2. Measurement and Instrumentation in Engineering, Francis S. Tse and Ivan E. Morse, Marcel Dekker.
3. Principles of Measurement and Instrumentation – Alan S. Morris, Prentice Hall of India.
4. Mechanical Measurements: T.G. Beckwith, W.L. Buck and R.D. Marangoni Addison Wesley.
5. Instrumentation, Measurement and Analysis – B.C. Nakra and K.K. Chaudhary, Tata McGraw Hill
6. Mechanical Measurements by D. S. Kumar, Kataria & Son
7. Instrumentation devices & systems : Rangan, Mani, Sarma
8. A course in mechanical instrument & instrumentation: A.k.Sawhney

Introduction

Single degree of freedom, two degree of freedom, free, forced and damped vibrations modeling and simulation studies, model of an automobile, magnification factor, transmissibility, vibration absorber.

Multi Degree Freedom Systems

Closed and coupled far system, orthogonality of mode shapes, modal analysis.

Stability Of Vehicles

Load distribution, stability on a curved track slope and a banked road, calculation of tractive effort and reactions for different drives.

Suspension Tyres And Vehicles Handling

Requirements, sprung mass frequency, wheel hop, wheel wobble, wheel shimmy, choice of suspension spring rate, calculation of effective spring rate, vehicle suspension in fore and aft, roll axis and vehicle under the action of side forces, tyre, dynamics, ride characteristics power consumed by a tyre. Oversteer, under steer, steady state cornering, effect of braking, driving torques on steering, effect of camber, transient effects in cornering.

Numerical Methods

Approximate methods for determining fundamental frequency, Dunkerleys lower bound, Rayleighs upper bound, Holzer method for closed coupled system and branched system.

Text Books

1. Ellis.J.R - "Vehicle Dynamics"- Business Books Ltd., London- 1991
2. Ham B, Pacejka - Tyre and Vehicle Dynamics - SAE Publication - 2002.
3. Gillespie T.D, "Fundamentals of Vehicle Dynamics", SAE USA 1992.
4. Dean Karnopp, "Vehicle Stability" Marcel Dekker Limited
5. Giri N.K – Automotive Mechanics, Khanna Publishers, 2002.
6. Rao J.S and Gupta. K "Theory and Practice of Mechanical Vibrations", Wiley Eastern Ltd., New Delhi –
7. John C Dixon, "Tires Suspension and Handling" SAE Publication
8. M V Blundell and Damian Harty, "The Multibody Systems Approach to vehicle Dynamics" SAE Publication
9. Giles.J.G.Steering - "Suspension and Tyres", Illiffe Books Ltd., London- 1998
10. Matthew Harrison, " Vehicle Refinement: Controlling Noise and Vibration in Road Vehicles, SAE Publications

AE – 310 AUTOMOTIVE ELECTRONICS AND MICROCONTROLLERS

Basic Electronics

Introduction, Electronic devices and circuits, Amplifiers, Converters, Digital Electronics.

Microprocessors

Block diagram of microcomputer, Architecture of Intel 8085, Importance of Data, Address and Control buses, Instruction formats, Addressing modes and types of instructions in Intel 8085, Instruction set of 8085. Memory Devices, RAM, ROM Types, Microprocessor interfacing with memory chips. LAN and CAN Network basics

Microcontrollers

Comparison of microprocessor & microcontrollers, survey of 4,8,16 & 32 bit microcontrollers. Architecture of 8051:Block Diagram, oscillator & clock, Program Counter, registers, Flags, Internal memory, stack & stack pointer, special function register, Input/Output Pins, Ports and Circuits, External memory, Counters & Timers, Serial Data input/output interrupts. DC Motor and Stepper motor controls.

Electronic fuel control system

Introduction, components, Open loop and closed loop control systems, intake manifold pressures, mass air flow rate sensor, Throttle body injection and multi port or point fuel injection, Fuel injection system, Injector operations, Injection system controls.

Digital engine control system

Motivation for electronic engine control, concept, parameters, variables, Engine mapping, control strategy, Electronic engine management components, layout. Engine cranking and warm up control, Acceleration enrichment, Deceleration leaning and idle speed control. EGR control, Variable valve timing control, Electronic Ignition control, Electronic spark timing control.

Exhaust emission control engineering, Integrated engine control system.

Transmission control systems:

Electronic transmission management: components, layout. Electronic control of automatic transmissions, valve actuating control system, two-wheel drive control, four-wheel drive control, all wheel drive auto control system.

Electric vehicle drive controls

Electronic control of hybrid and electric vehicles. Digital controllers for drive-motor, motor-generator, battery and fuel cell.

Chassis Control system

Electronic management of chassis system, Cruise control systems. Electronic suspension system, antilock braking controls system, traction control system, and vehicle stability control system. Electronic Steering control.

Body controls and Security

Body control systems: Remote central locking, Key less entry, Automatic Air conditioning systems. Security systems: immobilizer, and warning systems. Telematics, GPS Systems, Electronic control system diagnostics.

Text Books:

1. William B.Riddens, " Understanding Automotive Electronics ", 5th Edition, Butterworth, Heinemann Woburn, 1998.
2. William L Husselbee, " Automotive Computers and Control System: Fundamentals and Service ". Hartcourt Brace Professional Publications.
3. Thomas H Denton, "Automobile Electrical and Electronic Systems", SAE Publication.
4. Bosch Automotive Handbook, Latest Edition, SAE Publication
5. Bechtold., " Understanding Automotive Electronic ", SAE Publication
6. Ronald K Jurgen, "Automotive Microcontrollers" SAE Publications
7. Ronald K Jurgen, " Passenger Safety and Convenience Systems" SAE Publications
8. T.Mellard, " Automotive Electronics ".

AE-316 AUTOMOTIVE AERODYNAMICS

INTRODUCTION

Scope, historical development trends, Fundamental of fluid mechanics, Flow phenomenon related to vehicles, External & Internal flow problem, Resistance to vehicle motion, Performance, Fuel consumption and performance, Potential of vehicle aerodynamics.

AERODYNAMIC DRAG OF CARS

Cars as a bluff body, Flow field around car, drag force, types of drag force, analysis of aerodynamic drag, drag coefficient of cars, strategies for aerodynamic development, low drag profiles.

SHAPE OPTIMIZATION OF CARS

Front end modification, front and rear wind shield angle, Boat tailing, Hatch back, fast back and square back, Dust flow patterns at the rear, Effects of gap configuration, effect of fasteners.

VEHICLE HANDLING

The origin of forces and moments on a vehicle, side wind problems, methods to calculate forces and moments, vehicle dynamics Under side winds, the effects of forces and moments, Characteristics of forces and moments, Dirt accumulation on the vehicle, wind noise, drag reduction in commercial vehicles.

WIND TUNNELS FOR AUTOMOTIVE AERODYNAMIC

Introduction, Principle of wind tunnel technology, Limitation of simulation, Stress with scale models, full scale wind tunnels, measurement techniques, Equipment and transducers, road testing methods, Numerical methods.

Text Books:

1. Hucho.W.H., " Aerodynamic of Road vehicles ", Butterworths Co. Ltd., 1997.
2. Pope. A., " Wind Tunnel Testing ", John Wiley & Sons, 2nd Edn, New York, 1974.
3. Automotive Aerodynamic : Update SP-706, SAE, 1987.
4. Vehicle Aerodynamic, SP-1145, SAE, 1996.

AE-320 ADVANCED CAD/CAM Lab

Basic Theory of CAD Software, Structure and designing of CAD Software.

Design of Gearbox in CAD software with following details:

Gear train calculations

Layout of gear box

Calculation of loads

Concepts of manufacturing system using CAD/CAM

Text Books

1. Computer aided design in Mechanical Engg by V Ramamurthy, Tata McGraw Hill,
2. CAD/CAM by Groover & Jimmers, Prentice Hall of India

AE- 322 VEHICLE BODY ENGINEERING & DYNAMICS Lab

1. Study of typical car body construction and propose new design sketches.
2. Study the ergonomics involved in man machine interface.
3. Study driver's seat position, its requirement, construction and suggest alternative design.
4. Study passenger seat position, its requirement, construction and suggest alternative design.
5. Study the construction of typical truck/bus body and propose new design sketches.
6. Study of pitching, rolling, bouncing, yawing moments on a vehicle.
7. To prepare the analysis of the vehicle body weight and the weight distribution in different conditions.
8. Measurement of drag, lift force of a scaled model in wind tunnel
9. Study the anti corrosion and body painting and repainting procedures.
10. Study of various safety systems and components in a vehicle
11. Measurement of Noise, Vibration and Harshness in a vehicle.
12. Study the construction of an special purpose vehicle

AE -324 MEASUREMENTS AND INSTRUMENTATION

1. Measurement with the help of vernier caliper and micrometer
2. Measurement of an angle with the help of sine bar
3. Measurement of surface roughness
4. Measurement of speed and torque of a shaft
5. Measurement of acceleration and vibrations
6. Calibration of a pressure guage with the help of a dead weight guage tester
7. Measurement of temperature using RTD / thermocouple
8. Determination of frequency & phase angle using C.R.O.
9. Measurement of Inductance by Maxwell's Bridge.
10. Measurement of flow rate and quantity

AE – 326 AUTOMOTIVE ELECTRONICS AND MICROCONTROLLERS LAB

1. Study of 8085 Microprocessor Kit.
2. Write a program to add and subtract two 8-bit number using 8085
3. Study of 8051/8031 Micro controller kits.
4. Write a program for multiplication of two numbers using 8051
5. Write a program to interface the ADC.
6. Write a program to control a stepper motor in direction, speed and number of steps.
7. Write a program to control the speed of DC motor
8. Write a program to control the traffic light system using 8085/8086 microprocessors and 8255 PPI
9. Programming of a PLC based system to control speed of DC motor
10. Programming of a PLC based system to control stepper motor