

SHIVAJI UNIVERSITY, KOLHAPUR

Syllabus

For

Bachelor of Vocation (B.Voc.)

in

Automobile

2nd Year, Sem – III and IV

ADVANCE DIPLOMA IN AUTOMOBILE

To be implemented from Academic Year 2016-2017

Bachelor of vocation in automobile

2nd Year, Sem – III and IV

Advance Diploma in Automobile Curriculum Structure and Scheme of Examination

Theory

Semester III				Semester IV			
Sr. No.	Subjects	Credits	Marks	Sr. No.	Subjects	Credits	Marks
201	Thermodynamics	3	50	211	Fluid Mechanics and Machines	3	50
202	Manufacturing of Automotive Components	3	50	212	Heat Transfer	3	50
203	Strength of Materials	3	50	213	Vehicle Body Engineering and Safety	3	50
204	Theory of Machines	3	50	214	Elements of Machine Design	3	50
Total		12	200	Total		12	200

Practical

Semester III				Semester IV			
Sr. No.	Subjects	Credits	Marks	Sr. No.	Subjects	Credits	Marks
251	Thermodynamics lab	4	50	261	Fluid Mechanics and Machines	4	50
252	Machine shop I	4	50	262	Heat Transfer	4	50
253	Theory of Machines	4	50	263	Elements of Machine Design	4	50
254	Machine Drawing and Auto Cad	4	50	264	Machine shop II	4	50
255	Seminar II	2	50	265	Driving Training	2	50
Total		18	250	Total		18	250

201-Thermodynamics

Unit No.	Topics	Hours
01	<p>Fundamentals of Thermodynamics</p> <p>Define fundamental concepts of Thermodynamics, Apply first law of thermodynamics to various thermodynamic devices, Apply second law of thermodynamic. Concepts of pure substance, types of systems , properties of systems-Extensive and Intensive properties, processes and cycles, Quasi-static process, flow and non-flow process, Thermodynamic equilibrium, Point and path function. Work, Heat Transfer and Energy. Thermodynamic definition of work & heat, Difference between heat and work. Energy –Potential Energy, Kinetic Energy, Internal Energy, Flow Work, concepts of enthalpy & entropy. Laws of Thermodynamics-Zeroth Law, principle of law of conservation of energy First law of Thermodynamics, Second Law of Thermodynamics- Kelvin Planks, Clausius statements and their equivalence, Clausius inequality, Concept of perpetual motion machine of first and second kind</p>	10
2	<p>Ideal Gases:</p> <p>Concept of Ideal gas- Charle’s law, Boyle’s law, Avogadro’s law, equation of state, characteristic gas constant and universal gas constant. Ideal gas processes: - Isobaric, Isochoric, Isothermal, Isentropic, Polytropic, and their representation on P-V and T-S diagram</p>	08
3.	<p>Steam and Steam Boiler</p> <p>Generation of steam at constant pressure with representation on various charts such as T-S, H-S. Properties of steam and use of steam table, Dryness fraction, Degree of superheat Vapour processes :- Constant pressure, constant volume, constant enthalpy, constant entropy process (numerical using Mollier chart), Rankine Cycle. Steam Boilers: - Classification, Construction and working of - Cochran, Babcock and Wilcox, La-mont and Loeffler boiler. Boiler draught. Indian Boiler Regulation (IBR) Boiler mountings and accessories</p>	06
4	<p>Cooling Towers</p> <p>Cooling Towers.-Construction and working of forced, natural and</p>	09

	induced draught cooling tower.	
5	<p>Steam Turbines</p> <p>Steam turbine: - Classification of turbines, Construction and working of Impulse and Reaction turbine. Compounding of turbines and its types, Regenerative feed heating, bleeding of steam, governing & its types, losses in steam turbines</p>	07
6	<p>Steam Condensers</p> <p>Dalton's law of partial pressure, function and classification of condensers, construction and working of surface condensers. Sources of air leakage and its effect, concept of condenser efficiency, vacuum efficiency (Simple numerical).</p>	08

TEXT BOOKS:

1. "Thermal Engineering", Kumar and Vasandani, D. S . Publisher Metropolitan Book Co, Delhi, 3rd Edition.
2. "Thermal Engineering", Mathur and Mehta, Jain Bros. Publishers, Delhi, 3rd Edition.
3. "Thermal Engineering", Ballaney P.L, Khanna Publishers, New Delhi, 27th Edition.
4. "Engineering Thermodynamics", P.K. Nag., Tata McGraw Hill, New Delhi, 4th Edition.
5. "Engineering Thermodynamics", D.P. Mishra, Cengage learning, 1st Edition
6. "Principles of Engineering Thermodynamics", Moran, Shapiro, Boettner, Wiley, 8th Edition
7. "Engineering Thermodynamics", Gupta and Prakash, Nemichandand Sons, 2nd edition.
8. "Thermal Engineering", R. K. Rajput, Laxmi Publications, 3rd Edition.
9. "Steam and Gas Turbines", R. Yadav, CPH Allahabad, 2nd Edition , 2005.
10. "Thermal Engineering", M.M Rathod, Tata McGraw Hill Education Pvt.Ltd, 1st Edition , 2010

REFERENCE BOOKS:

1. "Fundamentals of Thermodynamics", Claus Borgnakke, Sonntag R. E., John Wiley and Sons.
2. "Thermodynamics", Holman, , McGraw Hill, London.
3. "Principles of Engineering Thermodynamics", Moran, Shapiro, Boettner, Wiley, 8th Edition.
4. "Thermodynamics: an Engineering Approach", Cengel and Boles, Tata McGraw-Hill, New Delhi , 3rd Edition, .
5. "Applied Thermodynamics", Estop Mcconkey , Pearson Education, 5th Edition
6. "Engineering Thermodynamics" G.Rogers Yon Mayhew, Pearson Education, 4th Edition.
7. "Fundamentals of Thermodynamics", R.E.Sonntag, C. Borgnakke, V. Wylen, Wiley India Pvt.Ltd, 6th Edition

202 - Manufacturing of Automotive Component

Unit No.	Topics	Hours
01	<p>Casting Processes:</p> <p>Foundry layouts and mechanization, casting as manufacturing Process, moulding machines and core making. Components of gating system, functions and importance of runners and risers, solidification control devices: chills, ceramics bricks, directional solidification Gravity and pressure die-casting -Centrifugal casting - Continuous casting Melting practices and Metallurgical control in Cupola furnace, oil/gas fired furnaces, Induction and Arc Furnace - Metal pouring equipment's, fettling and inspection of casting</p>	10
2	<p>Forming Processes:</p> <p>Rolling, Hot and cold Rolling, Rolling Mill Classification, Defects in Rolling, forging, Hand Forging Operations, Forging Machines (board Hammer, Air and Steam, Hydraulic Hammer) Open and Closed Die Forging, Defects in Forging Extrusion, Direct , Indirect , Tube , Impact and Hydraulic Extrusion, Defects in Extrusion Drawing Types of Wire, rod and pipe drawing, Defects in Drawing.</p>	08
3.	<p>Plastic Shaping:</p> <p>Introduction to blow moulding, injection moulding, extrusion, calendaring and thermo forming</p>	06
4	<p>Machine Tools for Metal Cutting I:</p> <p>Introduction to lathe, Types of lathe, Working principle, types, specifications, principle parts, accessories, attachments, and various lathe operations, Capstan, turret lathe comparison with centre lathe, Turret indexing mechanism, Bar feeding mechanism, Turret tool holders. Introduction to Boring Machines-Horizontal and vertical boring machine, Construction and operation, Introduction to Drilling Machines - Classification of drilling machines, Construction and working.</p>	09
5	<p>Machine Tools for Metal Cutting II:</p> <p>a. Shaping Machine - Types-crank shaper, hydraulic shaper, Crank and slotted link quick return mechanism, Table feed mechanism, Various operations. Introduction to Planing Machine, principle</p>	07

	parts, table drive and feed mechanism, Various operations. Introduction Milling Machine, Classification of milling machines, gear shaping, Gear hobbing. Gear finishing processes –Gear shaving, Gear burnishing and gear rolling.	
6	Nonconventional Machining: Fundamental principle, machining unit, tool material, advantages, limitations and applications of Abrasive Jet Machining, Electrical Discharge machining, Electro- Chemical machining, Laser beam machining, Ultrasonic machining, Water jet machining	08

Text Books:

- 1) “Elements of Workshop Technology Vol. II”, S. K Hajra Choudhury , Media Promoters and Publishers, Mumbai.
- 2) “Text Book of Production Engineering”, P.C. Sharma, S. Chand Publication, 11th Edition.
- 3) “Machine Tool Engineering” G.R. Nagarpal, Khanna Publication.
- 4) “Principles of Modern Manufacturing”, Groover, Wiley Publication., 5th Edition.

Reference Books:

- 1) “Production Technology”, HMT –Tata McGraw-Hill Publishing Ltd., ISBN, 0070964432, 9780070964433., (2001).
- 2) “Metal Cutting Theory and Tool design” Mr. Arshinnov, MIR Publication.
- 3) “Fundamentals of Tool Design” ASTME,Prentice-Hall of India Private Ltd., New Delhi Publication, (1976).
- 4) “Tool Design”, Donaldson,THM Publication, 3rd Edition.
- 5) “Machine Tool Engineering”, G.R. Nagarpal, Khanna Publication.
- 6) “Theory of Metal Cutting”, Sen and Bhattacharya, New Central Book Agency, (1965).
- 7) “Production Engg. Design (Tool Design)”, S. Chandar and K. Surendra, Satya Prakashan, Delhi.
- 8) “Production Tooling Equipment” , S.A.J.Parsan.
- 9) “Jigs and Fixtures”, Kempster ,ELBS.
- 10) “Metal Cutting and Machine Tools”, Thirupati Reddy, Scitech Publication, 1st Edition.
- 11) “Production Technology”, Thirupati Reddy, Scitech Publication, 1st Edition.
- 12) “Principals of Metal Cutting”, C.Kuppuswamy Sangam Books.
- 13) “Fundamentals of Manufacturing Engineering”, D.K.Singh, Anes Book Pvt. Ltd., 2nd Revised Edition.

203 - Strength of Material

Unit No.	Topics	Hours
01	<p>Mechanical Properties of Materials</p> <p>Simple Stresses & Strains Specific Objectives. Acquire elementary knowledge of stresses, strains and material properties. Study and apply Euler's theory, Mechanical properties and Concept of Simple stresses & strains. Elasticity, Plasticity, Plastic flow, Ductility, Malleability, Stiffness & Strength. Types of loads, stresses- tensile, compressive, Shear, single & double shear, concept of plain strain –tensile ,compressive, direct shear strain, torsional shear strain, lateral strain, Hooke's law, Poisson ratio common values for C.I.& M.S. Relation between stress- strain. Stress-strain diagram for tensile & brittle materials, important points on the stress- strain diagram, Modulus of elasticity & modulus of rigidity, Volumetric Strain, Bulk modulus, relation between modulus of elasticity & modulus of rigidity. Thermal stresses - Temperature stresses & strains of uniform section. Stress & strains in bars of stepped & uniformly varying sections subjected to axial load at ends only, composite sections having same length. 'Euler's theory, Rankine's theory</p>	10
2	<p>Principal stresses and planes.</p> <p>Specific Objectives. Acquire elementary knowledge of hoop stresses & principal stresses. Concept of Principal stresses and Principal planes. Stresses on an oblique section of a body subjected to Direct stresses on one plane. Direct stresses on mutually perpendicular planes. Direct and Shear stress on one plane. Direct and Shear stress on mutually Perpendicular plane Mohr's circle method for finding principle stresses and planes.</p>	08
3.	<p>Bending Moment & Shear Force</p> <p>Relation between rate of loading, shear force & bending moment. Shear force & bending moment diagrams for cantilevers, simply supported beam & over hanging beam subjected to point loads & uniformly distributed load. Location of point of contra flexure</p>	06
4	<p>Moment of Inertia</p> <p>Concept & definition of Moment of inertia, Parallel & perpendicular axes theorem. Moment of inertia of solid sections- square, rectangular, circular, semicircular, Triangular Hollow</p>	09

	sections- square, rectangular & circular cross sections only. Moment of Inertia of angle section, Channel section, Tee- section, I section about centroidal axis & any other axis parallel to centroidal axis. Polar moment of inertia.	
5	<p>Bending Stresses</p> <p>Assumptions in the theory of bending, moment of resistance, section modulus, neutral axis. Stress distribution diagram for Cantilever & simply supported beam. Equation of bending Concept of direct & transverse shear stress. Transverse Shear stress equation Shear stress distribution diagrams Average shear stress & Maximum shear stress for rectangular & circular section</p>	07
6	<p>Direct and Bending Stresses</p> <p>Concept of Axial load, eccentric load, direct stresses, bending stresses, maximum & minimum stresses. Stress distribution diagram. Problems on the above concepts for strut, machine parts such as offset links, C-clamp, Bench vice, Drilling machine frame etc. Condition for no tension in the section, core of section</p>	08

Reference books

- 1) Gere and Timoshenko - Mechanics of material, CBS Publisher, 1984.
- 2) E.P. Popov - Introduction to Mechanics of Solids, Prentice Hall Publication.
- 3) Singer and Pytel - Strength of materials, Harper and row Publication.
- 4) Timoshenko and Young - Strength of materials, CBS Publication.
- 5) Beer and Johnston - Strength of materials, CBS Publication.
- 6) Shigley J.E. and Mischke C.R. – “Mechanical Engineering Design” – McGraw Hill Publication Co. Ltd.
- 7) Spotts M.F. and Shoup T.E. – “Design of Machine Elements” – Prentice Hall International.
- 8) Bhandari V.B. – “Design of Machine Elements” – Tata McGraw Hill Publication Co. Ltd.
- 9) Black P.H. and O. Eugene Adams – “Machine Design” – McGraw Hill Book Co. Inc.
- 10) PSG Design Data Book
- 11) S.S. Rattan Strength of material – Tata McGraw Hill Publication Co. Ltd.
- 12) Dr. R. K. Bansal Strength of material, Laxmi publication Pvt. Ltd., New Delhi
- 13) Ramamurtham, Strength of material, Dhanpatrai Publication.

204 - Theory of Machine

Unit No.	Topics	Hours
01	<p>Basic Concept of Mechanisms:</p> <p>Links, kinematic pair (lower and higher), Kinematic chain, Mechanism, inversion, Types of constraints, Inversions of slider crank chain, Double slider crank chain, Four bar, Steering gear mechanisms, Analysis of Hooke's joint.</p>	08
2	<p>Gear Trains:</p> <p>Types of Gear trains - Simple, Compound, Reverted, Epicyclic gear train, Tabular method for finding the speeds of elements in epicyclic gear train, Torques in epicyclic gear train, Differential gear box.</p>	08
3.	<p>Cams:</p> <p>Types of cams and followers, Profiles of cams for specified motion of different followers, Spring load on the follower, Jumping of follower.</p>	08
4	<p>Belts:</p> <p>Types of belt drives, Calculation of power transmitted, Belt tension ratio, Actual tension in a running belt, Centrifugal and initial tension in belt, Slip and creep of belt</p>	07
5	<p>Screws:</p> <p>Forms of threads, Terminology of threads, Torque requirement (lifting and lowering load) Self locking and overhauling properties, Efficiency of square threaded, Self locking screw, Trapezoidal and Acme thread, collar friction torque, Design of power screw and nuts, Introduction to Recirculating ball Screw.</p>	09
6	<p>Governors:</p> <p>Types of governors, Porter and Hartnell governor, Controlling force and stability of governor, Hunting, Sensitivity, Isochronism, Governor effort and power, Insensitiveness of governors.</p>	08

Text Books:

1. "Theory of Machines", Rattan S.S. Tata McGraw Hill, 3rd Edition.
2. "Mechanism and Machine Theory", Rao, Dukkupati, New Age International, 2nd Edition.
3. "Theory of Machines", Dr. V.P.Singh, Dhanpat Rai Publications.
4. "Theory of Machines", Sadhu Singh, Pearson Education, 3rd Edition.
5. "Theory of Machines", Ballaney, Khanna Publication.
6. "Theory of Machines", R.K.Bansal, Laxmi Publications, 5th Edition.

Reference Books:

1. "Theory of Machines and Mechanisms" Shigley, Tata McGraw Hill.
2. "Theory of machines" Thomas Beven Pearson Education, 3rd Edition.
3. "Theory of Machines" Jagdishlal, Metropolitan Publication.
4. "Mechanisms and Dynamics of machines" J.Srinivas, SciTech Publication.
5. "Kinematics, Dynamics and Design of Machinery", Walidron, Wiley India Publication, 2nd Edition.
6. "Kinematics, Dynamics of Machinery", Wilson, sadler, Pearson Education.

251 - Thermodynamics Lab

1. Study and Demonstration of water tube and fire tube boilers.
2. Study and Demonstration of boiler mountings, Accessories and steam calorimeters
3. Study and Demonstration of condenser and study of cooling towers
4. Significance and relevance of lubrication properties and systems
5. Test on Grease penetrometer and dropping point apparatus
6. Test on Carbon residue, Cloud and Pour point apparatus.
7. Test on Red wood viscometer and Aniline point apparatus.
8. Determination of flash and fire point of a lubricating oil
9. Study / Trial on steam power plant
10. Report on industrial visit to a steam power plant

Instructions for practical examination

1. Four to five experiments shall be selected for practical examination.
2. The number of students for each practical set up would not be more than four students.

252 - Machine Shop I

- A.** To prepare process sheets with working drawings of all components.
- B.** To manufacture the components as per the drawing requiring following operations
 - i. Turning, Plain turning, step turning, taper turning should be carried out on lathe machine.
 - ii. Boring
 - iii. Drilling

Note: For each component, at least one dimension should be monitored within close tolerance.

253 - Theory of Machines

1. Study of basic mechanisms. (Demonstration of models, Actual mechanisms, etc.)
2. Experiments on types different types of drive (Belt drive, chain drive and gear drive)
3. Experiment on gear Trains.
4. Experiment on Power Screw.
5. Verification of ratio of angular velocities of shafts connected by Hooks joint.
6. One A3 size sheet of Problems on cam profile. (Minimum 4 problems)
7. Experiment on Governor Characteristics for Porter or Hartnell governor.
8. Experiment on Cam Profile
9. Experiment on belt drives.
10. Experiment on selection of belts.

254 - Computer Aided Drafting

- 1 Basic command to draw 2- D objects like line, point, circle, arc, ellipse, polygon, polyline, spline etc.
2. Edit Commands: Erase, extension, break, fillet, chamfer, trim, scale, etc
- 3.Commands like linetype, Dimension,text style etc.
4. Viewing and other: Zoom, pan, mirror, rotate, move objects, arrange blocks, offset etc.
5. Hatching of sections.
6. Use of layers in drawing.
7. Plotting of drawing.
8. Introduction to 3- D modelling – sketcher, part design, assembly and drafting workbenches.
- 9.Modify commands , view port, UCS, etc.

TERM WORK

1. Computer aided drafting of four simple components and print out of the same.
2. One assignment on drawing of details and assembly containing 6 - 8 component with tolerance, machining symbol etc. and plotting the same.
3. One assignment on 3-D drawing of one simple component and plotting its 2D views along with 3 D object drawing.
4. Redraw given production drawing and to interpret it.

Note: Latest computer aided drafting software version like AutoCAD and any 3D modelling software are to be used.

- Instructions for practical examination

1. Every student shall be given one problem each.
2. Oral shall be based on the problem solved in AutoCAD and the journal.

255 - Seminar II

Topic:-

Any topic of Automobile engineering application may be a seminar topic.
The seminar may be based on proposed project work also.

Seminar Load:-

Maximum 9-10 students in one batch, Maximum 9-10 students shall work under one Faculty Member Group of one student is not allowed under any circumstances

Seminar Term :

Seminar report should be of 25 to 35 pages. For standardization of the seminar reports the following format should be strictly followed.

1. Page size : Trimmed A4
2. Top Margin : 1.00 Inches
3. Bottom Margin : 1.32 Inches
4. Left Margin : 1.5 Inches
5. Right Margin : 1.0 Inches
6. Para Text : Font - Times New Roman; 12 point
7. Line Spacing : 1.5 Lines
8. Page Numbers: Right aligned and in footer.
Font Times New Roman; 12 point
9. Headings : New Times Roman, 14 point, Boldface
10. Certificate : All students should attach standard format

The entire seminar should be documented as one chapter. References should have the following format

Marks

1. Seminar Report: 25
2. Presentation: 25

All students have to present their seminars individually in front of the faculties.

211 - Fluid Mechanics and Machines

Unit No.	Topics	Hours
01	<p>Properties of Fluid and Fluid Pressure</p> <p>Properties of Fluid- Density, Specific gravity, Specific volume, Specific Weight, Dynamic viscosity, Kinematic viscosity, Surface tension, Capillarity, Vapour Pressure, Compressibility Fluid pressure, Pressure head, Pressure intensity Concept of absolute vacuum, gauge pressure, atmospheric pressure, absolute pressure. Simple and differential manometers, Bourden pressure gauge. Total pressure, center of pressure- regular surface forces on immersed bodies in liquid in horizontal, vertical and inclined position</p>	10
2	<p>Fluid Flow</p> <p>State Bernoulli's theorem and apply it to venturimeter, orifice and pitot tube. Types of fluid flows-Laminar, turbulent, steady, unsteady, uniform, Continuity equation, Bernoulli's theorem non uniform, rotational, irrotational. Construction of venturimeter, principle of working, coefficient of discharge, Derivation for discharge through venturimeter. Construction of orificemeter, Principle of working, hydraulic coefficients. Derivation for discharge through Orifice meter Pitot tube –Construction, Principle of Working</p>	08
3.	<p>Flow Through Pipes</p> <p>State laws of friction and list various losses in flow through pipes. Solve numerical on laws of friction and list various losses in flow through pipes. Laws of fluid friction (Laminar and turbulent) Darcy's equation and Chezy's equation for frictional losses Minor losses in fittings and valves Hydraulic gradient line and total energy line Hydraulic power transmission through pipe</p>	06
4	<p>Hydraulic Turbines</p> <p>Explain working principle of various hydraulic turbines. Layout and features of hydroelectric power plant, surge tanks and its need. Classification of hydraulic turbines and their applications. Construction and working principle of Pelton wheel, Francis and Kaplan turbine. Draft tubes – types and construction, Concept of cavitation in turbines,</p>	09
5	<p>Pumps</p> <p>Construction, principle of working, priming methods and Cavitation Types of casings and impellers. Manometric head, Work done, Manometric efficiency, Overall efficiency, NPSH.</p>	07

	Performance Characteristics of Centrifugal pumps	
6	<p>Pumps</p> <p>Construction, working and applications multistage pumps Submersible pumps and jet pump Construction, working principle and applications of single and double acting reciprocating pumps. Slip, Negative slip, Cavitation and separation. Use of Air Vessels. Indicator diagram with effect of acceleration head & frictional head.</p>	08

TEXT BOOKS:

1. "Fluid Mechanics", K. L. Kumar, S. Chand Publication. New Delhi, 2nd Edition , 2000
2. "Theory and Applications of machines", K. Subramanya, , Tata McGraw Hill Publication, 1993
3. "Fluid Mechanics", R. K. Bansal, Laxmi publications. New Delhi, 1998.
4. "Fluid Mechanics and Hydraulic Machines", Ramamrutham,.
5. "Fluid mechanics and Hydraulic Machines", Modi and Seth,.
6. "Fluid mechanics and Hydraulic Machinery", R. K Rajput, Laxmi publishers.
7. "Fluid Mechanics", J.F.Douglas, J.M.Gasiorek, J.A.Swaffied, Pearson Education, 4th Edition.

REFERENCE BOOKS:

1. "Fluid Mechanics", V. L. Streeter and E. B. Wylie, Tata McGraw Hill Pvt Ltd. New Delhi , 2nd Edition , 1997
2. "Introduction to Fluid Mechanics", Edward J. Shaughnessy, Oxford University press
3. "Mechanics of Fluid", Merle C. Potter, Prentis Hall of India, New Delhi , 2nd Edition .
4. "Fluid Mechanics", Fox and McDonald, John Wiley and Sons, New York , 8th Edition.
5. "Fluid Mechanics", Fraizini, Tata McGraw-Hill, New Delhi, 4th Edition.
6. "Fluid Mechanics", White, Tata McGraw-Hill, New Delhi., 4th Edition
7. "Fluid Mechanics –Fundamentals and Application", Y.A.Cengel, J.M.Cimbala, TMI,
8. "Fundamentals of Fluid Mechanics", B.R. Munson, D.F. Young, T.H. Okiishi Wiley India Pvt.Ltd.
9. "Fluid Mechanics and Machinery", C.S. Ojha, , Oxford University Press

212 - Heat Transfer

Unit No.	Topics	Hours
01	<p>Heat Transfer</p> <p>Modes of heat transfer: - Conduction, convection and radiation. Conduction Fourier's law, thermal conductivity, conduction through cylinder, thermal resistance, and composite walls Radiation Thermal Radiation, Absorptivity, Transmissivity, Reflectivity, Emissivity, black and gray bodies, Stefan-Boltzman law.</p>	08
2	<p>Condensation and Boiling :</p> <p>Boiling heat transfer, types of boiling, pool boiling curve and forced boiling phenomenon, condensation heat transfer, film wise and drop wise condensation (No numerical treatment).</p>	08
3.	<p>Heat exchangers:</p> <p>Classification and applications, heat exchanger analysis–LMTD for parallel and counterflow heat exchanger, effectiveness– NTU method for parallel and counter flow heat exchanger, introduction to cross flow heat exchanger, LMTD correction factor, introduction to heat pipe.</p>	08
4	<p>Conduction</p> <p>Introduction and Basic Concepts. Application areas of heat transfer, Modes and Laws of heat transfer, Three dimensional heat conduction equation in Cartesian coordinates and its simplified equations, thermal conductivity, thermal diffusivity. Heat conduction in plane wall, composite slab, composite cylinder, composite sphere, electrical analogy, concept of thermal resistance and conductance.</p>	10
5	<p>Convection</p> <p>Fundamentals of convection: Mechanism of natural and forced convection, local and average heat transfer coefficient, concept of velocity & thermal boundary layers. Forced convection, Natural Convection.</p>	06
6	<p>Radiation</p> <p>Thermal Radiation: Fundamental concepts of radiation, different laws of radiation, Radiation shape factor, Heat exchange by radiation between two black and diffuse grey surfaces, Radiation shields.</p>	08

Text Books:

1. "Heat Transfer", J.P. Holman, Tata McGraw Hill Book Company, New York, 2nd Edition.
2. "Fundamentals of Heat and Mass Transfer", R.C. Sachdeva, Willey Eastern Ltd.,
3. "A Text Book on Heat Transfer", Dr. S. P. Sukhatme, Orient Longman Publication Hyderabad.
4. "Heat and Mass Transfer", S.C.Arrora and S. Dokoundwar, Dhanpat Rai and Sons, Delhi.
5. "Fundamentals of Heat and Mass Transfer", C.P. Kothandaraman.
6. "Heat and Mass Transfer", R.K.Rajput, S. Chand and Company Ltd., New Delhi., 5th Edition.
7. "Heat and Mass Transfer", Dr.D.S. Kumar, S.K.Kataria and Sons, Delhi.
8. "Heat Transfer", P.K.Nag, Tata McGraw hill Publishing Company Ltd., New Delhi.
9. "Heat and Mass Transfer", G.Kamraj, Raveendran, SciTech Publication.
10. "Heat Transfer", V C Rao, University press.
11. "Heat Transfer", Dr. S. N. Sapali , Techmach Publication Pune.
12. "Heat and Mass transfer", M.M.Rathod, Laxmi Publications.
13. "Heat Transfer", S.P.Venkateshan , Ane Books Pvt.Ltd., 2nd Edition.

Reference Books:

1. "Heat Transfer – A Practical approach", Yunus. A .Cengel, Tata McGraw Hill.
2. "Heat Transfer" Chapman A.J., Tata McGraw Hill Book Company, New York.
3. "Fundamentals of Heat and Mass Transfer", Frank P.Incropera, David P.Dewitt, Wisley India. 5th Edition.

213 -VEHICLE BODY ENGINEERING AND SAFETY

Unit No.	Topics	Hours
01	<p>Types of bodies:</p> <p>Classification of coachwork type, coach and bus body style, layout of cars, buses and coach with different seating and loading capacity, commercial vehicle types, Vans and Pick-ups. Terms used in body building construction, Angle of approach, Angle of departure, Ground clearance, Cross bearers, Floor longitudes, posts, seat rail, waist rail, cant rail, Roof stick, Roof longitude, Rub rail, skirt rail, truss panel, wheel arch structure, wheel arch, post diagonals, gussets</p>	07
02	<p>Vehicle Body Materials:</p> <p>Aluminium alloys, Steel, alloy steels, plastics, Metal matrix composites, structural timbers - properties, glass reinforced plastics and high strength composites, thermoplastics, ABS and styrenes, load bearing plastics, semi rigid PUR foams and sandwich panel construction.</p>	07
03.	<p>Load distribution:</p> <p>Type of body structures, Vehicle body stress analysis, vehicle weight distribution, Calculation of loading for static loading, symmetrical, longitudinal loads, side loads, stress analysis of bus body structure under bending and torsion.</p>	06
04	<p>Interior Arrangements in Vehicle:</p> <p>Introduction, Seating dimensions, Interior ergonomics, ergonomics system design, seat comfort, suspension seats, split frame seating, back passion reducers, dash board instruments, electronic displays, commercial vehicle cabin ergonomics, mechanical package layout, goods vehicle layout. Visibility, regulations, drivers visibility, methods of improving visibility, Window winding and seat adjustment mechanisms.</p>	06
05	<p>Body building Processes:</p> <p>Introduction , Stepwise description of different processes, tools and technologies</p>	06

06	<p>Body repair, finishing and Painting:</p> <p>Denting and painting, Paints adhesives and their properties, corrosion and their prevention.</p>	06
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TEXT BOOKS:

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

REFERENCE BOOKS:

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

214 - Elements of machine design

Sr No	Topics	Hours
01	Fundamentals of Machine Design Concept of Machine design, Types of loads, Factor of safety- its selection and significance, Review of theories of elastic failure and their applications, Basic procedure of design of machine elements, Review and selection of various engineering material properties and I.S. coding for ferrous materials, Factors governing selection of Engineering materials.	08
2	Design of Shaft, Design of solid and hollow shafts, splined shafts, ASME code for shaft design,	08
3.	Design of Pulley and Selection of Belts Design of Pulley- flat and V belt pulley, Selection of flat belt, V belt as per the standard manufacturer's catalogue, Introduction to timing belts.	08
4	Unit 4 Design of springs Types of springs and their applications, Styles of end, Design of Helical Compression Spring subjected to static loading.	08
5	Design of Keys, and Couplings Types and Design of Keys, Types of Couplings, Design of Muff, Rigid Coupling, flexible bushed pin type flanged coupling.	08
6	Statistical considerations in design Ergonomics and aesthetics in design, statistics in design, design for natural tolerances, statistical analysis, and mechanical reliability	08

Text Books:

1. "Design of Machine Elements", V.B. Bhandari, Tata McGraw Hill, 3rd Edition.
2. "A Text Book of Machine Design", R.S. Khurmi and J.K.Gupta.
3. "Mechanical Engineering Design", J. E. Shigley, Tata McGraw Hill.
4. "Design of Machine Elements", Sharma and Purohit, Prentice Hall of India.
5. "Design of Machine Elements II", J.B.K.Das and P.L.S. Murthy, Sapna Publishers, 2nd Edition.

Reference Books:

- 1) "Machine Design Integrated approach", Robert L. Norton, 5th Edition.
- 2) PSG Design Data Book

- 3) Bearing Manufacturers Catalogue.
- 4) "Design of Machine Element", M.F. Spotts, 3rd Edition.
- 5) "Mechanical Analysis and Design", H. Burr and Cheatham, 2nd Edition.
- 6) "Introduction to Tribology", Mazumdar B.C., 2nd Edition.
- 7) "Machine Design", Black and Adams, Tata McGraw Hill International.
- 8) "Fundamentals Machine Component Design", Robert C. Javinal Wiley India, 5th Edition.
- 9) "Design of Machine Elements", Kannaiah SciTech Publication, 1st Edition. 9. "Mechanical Engineering Design", Joseph E. Shigley and Larry D. Mitchell, Fourth Edition, McGraw-Hill.

261 - Fluid Mechanics and Machines Lab

The term work shall consist of the report on any ten experiments from the following:

1. Study and demonstration of Pressure Measuring Devices
2. Flow visualization by plotting of streamline (Heleshaw's apparatus).
3. Reynolds experiment.
4. Verification of Bernoulli's equation.
5. Calibration of venturimeter/Orifice-meter
6. Calibration of notches.
7. Orifice under steady and unsteady flow condition
8. Determination of velocity profile through circular pipes for laminar flow.
9. Determination of minor losses in pipes-fittings
10. Determination of coefficient of friction in pipes of different materials.
11. Determination of loss of friction in series/parallel pipes.
12. Demonstration or trial on wind tunnel for measurement of lift and drag on any model.
13. Demonstration on fluid flow by using CFD tools.

262 - Heat Transfer Lab

LIST OF EXPERIMENTS

Any eight experiments (1-11) and two assignments (12-14) from the following list

1. Determination of Thermal Conductivity of metal rod
2. Determination of Thermal Conductivity of insulating powder
3. Determination of Thermal Conductivity of Composite wall
4. Determination of heat transfer coefficient in Natural Convection
5. Determination of heat transfer coefficient in Forced Convection
6. Determination of temperature distribution, fin efficiency in Natural / Forced Convection
7. Determination of Emissivity of a Test surface
8. Determination of Stefan Boltzmann Constant
9. Determination of effectiveness of heat exchanger
10. Study of pool boiling phenomenon and determination of critical heat flux
11. Determination of equivalent thermal conductivity of heat pipe
12. Assignment on 1-D transient heat transfer programme using finite difference methods.
13. Assignment to solve transient heat transfer problem using Heisler and Grober charts.
14. Assignment on multipass / crossflow heat exchanger using effectiveness charts.

263- Elements of Machine Design Lab

List of Experiment:

- 1) Selection of materials for various engineering applications showing their IS codes, composition and properties.
- 2) Design and Drawing of Knuckle joint.
- 3) Design and Drawing of flexible bushed pin type flanged coupling.
- 4) Design of helical compression spring subjected to static load.
- 5) Design of Power Screw.
- 6) Selection of Belts as per the manufacturer's catalogue.
- 7) Design of key.
- 8) Design of shaft.

264 - Machine Shop (II)

A. To prepare process sheets with working drawings of all components.

B. To manufacture the components as per the drawing requiring at least four of the

Following operations

- a. i. Milling,
- b. ii. Shaping,
- c. iii. Grinding,
- d. iv. Tapping,
- e. v. Slotting

This Operations Should be carried out on CNC Machine.

Note:

For each component, at least one dimension should be monitored within close tolerance.

265 - Driving Training

Course Outcome-

1. Student must be well known about the traffic rules and regulations.
2. He must possess both two wheeler and four wheeler License before the end of the course.
3. Trial will be taken before the end of the semester by the examiners.