

Subject Code: 01AE0504

Subject Name: AUTOMOBILE COMPONENT DESIGN

B.Tech. III Year – (Sem-5) Automobile Engineering

Type of course: Advanced / Application

Prerequisite: Automobile engine, Automobile Transmission and Machine Design and Industrial Drafting.

Rationale: This subject will make students well versed with concept of design of different components like piston, gear, gearbox, piston pin, connecting rod, crank shaft, cylinder liner, flywheel, valve mechanism etc. and how to standardize this design. They will also learn about bearings that are required for the components by considering different design considerations.

Course Outcome

After learning the course the students should be able to:

1. Demonstrate knowledge and understanding of selection and designing of different automobile components.
2. Use practical and theoretical knowledge to standardize different parts.
3. Student will be able to give reasons of assumptions made while designing the component with reference to manufacturing assembly, thermal and wear considerations point of view.

Teaching and Examination Scheme:

Teaching Scheme (Hours)			Credits	Evaluation Scheme					Total Marks
Theory	Tutorial	Practical		Theory Marks			Practical Marks		
				ESE(E)	IA	CSE	Viva(V)	Term Work(TW)	
4	0	2	5	50	30	20	25	25	150

Sr. No.	Content	Duration	Weightage
1	Standardization in automobile system design Preferred numbers –preferred series – derived series- and their applications in design.	3	7

2	<p>Design Considerations : Manufacturing and assembly considerations, Design of components for casting, welding, forging, hot and cold working, machining etc. assembly considerations in design. Design for Fatigue and Creep – thermal considerations – wear considerations in design – Human considerations in design.</p>	7	15
3	<p>Design of Bearings: Bearing Identification/Designations. Rolling Contact Bearing: Types of rolling contact bearings, static and dynamic load capacities, Stribeck's Equation, Equivalent bearing load, load life relationship, Bearing life, Load factor, Selection of bearings from manufacturers catalogue. Lubrication and mountings, dismounting and preloading of bearings, Oil seals and packing. Sliding Contact Bearings: Bearings- types, material, properties, constructional detail, hydrodynamic lubrication- design consideration, Raimondi and Boyd method relating bearing variables.</p>	07	12
4	<p>Design of Gears: Types of gears, Design consideration of gears, material selection, Types of gear failures, Gear lubrication. Spur Gears: Force analysis, Number of teeth, Face width & Beam strength of gear tooth. Dynamic tooth load. Effective load on gear tooth. Estimation of module based on beam strength. Wear strength of gear tooth. Estimation of module based on wears strength. Spur gear design for maximum power transmission. Helical Gears: Virtual number of teeth, Tooth proportions, Force analysis, Beam strength of helical gears, Effective load on gear tooth, Wear strength of helical gears, Design of helical gears Bevel Gears: Terminology of bevel gears, Force analysis, Beam strength of bevel gears, Wear strength of bevel gear, Effective load on gear tooth, Design of bevel gear. Worm Gears: Force analysis, Friction in worm gear, Vector method, Strength rating of worm gears, Wear rating of worm gear.</p>	13	23
5	<p>Design of Gearbox Design considerations of gearbox, selection of proper gear ratios for an automobile gearbox, design of shafts, splines, and gears for gear box used in automobiles.</p>	6	13

6	<p>Design of I.C. Engine Components:</p> <ul style="list-style-type: none"> - Engine power requirements, Selection of engine type, Stroke & Bore, compression ratio, clearance volume and swept volume, mean piston speeds. - Design of Piston & Piston pin: Materials used, design of piston crown, pin dimensions. - Design of Crank shaft & Connecting Rod -Forces, material, types, design criteria, dimensions etc. - Design of main journal bearing pin and connecting rod bearing pin of Crank shaft. - Main journal bearing and connecting rod bearing (small end & big end), Cam shaft bearings: Bearing materials, design criteria, types and dimensions. - Cylinder block dimensions, Types of liner– Dry & Wet type. - Valve mechanism Design: Valve, rocker arm, Valve spring design, Push rod, cam shaft and cam follower etc. - Design of cylinder head: Stresses, materials, Combustion chamber design. - Flywheel types & construction, criteria of design for solid and rim type. - Selection of Engine layouts. - Design Criteria of intake manifold and exhaust manifold. Introduction to CFD analysis (flow & thermal impact related inputs and outcome). - Engine lubrication system and pumps. 	16	30
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Distribution of Theory Marks

R Level	U Level	A Level	N Level	E Level	C Create
20	20	15	15	20	10

Legends: R: Remembrance; **U:** Understanding; **A:** Application, **N:** Analyze, and **E:** Evaluate

Reference Books :

1. Automotive Mechanics by N. K. Giri, Khanna Publishers
2. Machine Design by Sadhu singh, Khanna Publishers
3. Automobile Chassis Design by Dean Aaverns, Llife Books Ltd (1992)
4. Automobile Engg. Vol-I & II by Kirpal Singh, Standard Pub.
5. Automobile Engg. Vol-I & II by K.M.Gupta, Umesh Pub.
6. Auto Design by R. B. Gupta, Satya Prakashan
7. “Mechanical Engineering Design”, Fourth Edition, by Joseph E. Shigley & Larry D.Mitchell, McGraw-Hill International Book Company
8. Design of Machine Elements by Bhandari, Tata McGraw-Hill Publishing Company Ltd
9. Machine Design by, Sharma and Agrawal, S. K. Kataria & Sons
10. Transmission System Design by R. B. Patil, Tech Max Pub, Pune.
11. Elements of Motor Vehicles Design by D T Bdonkins, TMH

12. Automobile Chassis Design and calculations by P. Lukin, Mir Publishers
13. Auto design Problems by K. M. Agrawal, Satya prakashan.
14. Machine Design Vol-II & III by F.Haideri, Nirali Prakashan, Pune.
15. PSG Design Data Book.
16. Automotive Chassis by P. M. Heldt, Chilton Co., NY(1992)
17. Machine Design by Pandya and Shah, Charotar Publishing House.
18. Machine Design by R. S. Khurmi, J. K. Gupta, Schand & Co.
19. Bearing Manufacturers Catalogues.

List of Experiments

1. To standardize the given automobile part for size, torque and power, point of view.
2. To design the spur, helical, bevel and worm gear for given situation of automobile vehicle.
3. To design the gear box for given situation of automobile vehicle.
4. To design the engine cylinder for given situation of automobile vehicle.
5. To design the piston for given situation of automobile vehicle.
6. To design the flywheel for given situation of automobile vehicle.
7. To design the valve and valve mechanism for given situation of automobile vehicle.
8. To design the connecting rod for given situation of automobile vehicle.

List of Open Source Software/learning website

1. <http://nptel.ac.in/>
2. <http://ocw.mit.edu/>