

GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: AUTOMOBILE ENGINEERING (02)
SUBJECT NAME: AUTOMOBILE COMPONENT DESIGN
Subject Code: - 2170202
B.E 7th SEMESTER

Type of Course: - Advanced / Application

Pre-requisite:- Automobile engine, Automobile Transmission and Machine Design and Industrial Drafting.

Course Objective: - To make student get acquainted with to standardize the automobile part after designing the component like gear, gear box, piston, connecting rod, piston pin, crank shaft, valve mechanism, Cylinder liner, flywheel etc and to select the required bearing for same by considering the different design considerations.

Teaching and Examination Scheme:

TEACHING SCHEME				EXAMINATION MARKS					TOTAL MARKS
LECT.	TUT.	PRAC.	CREDITS	THEORY MARKS			PRACTICAL MARKS		
				ESE (E) 3 Hrs	PA (M)		VIVA (V)	PA (I)	
				PA	ALA				
4	0	2	6	70	20	10	30	20	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment; OEP-Open Ended problem; AL-Active learning; RP: Review Presentation.

CONTENT:-

Sr. No.	Course Content	Total Hours	% Weightage
1	standardization in automobile system design Preferred numbers – preferred series – derived series- and their applications in design.	4	7%
2	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.	9	15%
3	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: Bearing material and their properties, Bearing types and their constructional details, Hydrodynamic Lubrication- Basic theory, Design consideration in hydrodynamic bearings, Raimondi and Boyd method relating bearing variables.	07	12%
4	Design of Gears: Types of gears, Design consideration of gears, material selection,	14	23%

	<p>Types of gear failures, Gear lubrication.</p> <p>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.</p> <p>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</p> <p>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.</p> <p>Worm Gears: Force analysis, Friction in worm gear, Vector method, Strength rating of worm gears, Wear rating of worm gear.</p>		
5	<p><u>Design of Gearbox</u> 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>	08	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. <p>Introduction to CFD analysis (flow & thermal impact related inputs and outcome).</p> <ul style="list-style-type: none"> - Engine lubrication system and pumps. 	18	30%
	Total	60	100%

SUGGESTED SPECIFICATION TABLE WITH MARKS (THEORY):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
10	10	15	11	10

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

NOTE: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

ReferenceBooks:

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

The term work shall be based on the topics mentioned above and one component assembly must be design and sheet must be drawn for assembly and parts.

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.
9. To select the bearing for given situation to support the rotating/sliding part of an engine.
10. To give reason of design considerations during the above part and assembly design for which you made assumptions.

COURSE OUTCOME:

1. Student will be able to select and design the different automobile components.
2. Student will be able to standardize the 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.

LEARNING ASSIGNMENTS:

Preparation of power-point slides, which can include mathematical calculations, videos, animations, pictures, graphics for better understanding of theory and practical work . The faculty will allocate chapters/ parts of chapters to various groups of students so that the entire syllabus can be covered. The power-point slides should be made available on the College/ Institute's web-site along with the name of the students, faculty, Department and College on the first slide. Best three presentations should be submitted to GTU.