

Subject Code: 01ME1603
Subject Name: Machine Design II
B. Tech. Year - III (Semester - 6)

Type of course : Program core

Prerequisite : Machine Design and Industrial Drafting, Machine Design I

Rationale : Understanding the design of I.C. engine components, Gear systems and Bearings

Course Outcome :

Students will be able to

1. Analyze the functional requirements and design of various I.C. Engine Components
2. Design bearings based on application requirements
3. Design gears based on application requirements.
4. Design gear boxes for various applications.

Teaching and Examination Scheme :

Teaching Scheme			Credits C	Examination Marks					Total Marks
Theory	Tutorial	Practical		Theory Marks			Practical Marks		
				ESE(E)	IA	CSE	Viva (V)	Term Work (TW)	
3	0	2	4	50	30	20	25	25	150

Content :

Sr. No.	Content	Total Hrs.
1	Design of I.C. Engine Components Introduction, selection of type of engine, engine power requirements, design of cylinder and cylinder liners, design of cylinder head, design of piston, piston ring, piston pin, design of connecting rod, whipping stress in connecting rod, design of center crankshaft and overhung crankshaft.	14
2	Design of Rolling Contact Bearings: Classification, static load carrying capacity, Stribeck's equation, dynamic load carrying capacity, Load-life relation, selection of bearing from catalogue, design for cyclic load and speed, Bearing with probability of survival other than 90%, Lubrication for rolling contact bearing.	08

3	<p>Design of spur gears: Classification of gears, selection of type, gear terminology, standard system of gear tooth, interference and undercutting, gear tooth failures and gear materials, force and stress analysis, dynamic effects, fatigue strength, factor of safety, module and face width, power rating calculation based on beam strength and wear strength consideration.</p>	08
4	<p>Parallel axis helical gears: introduction, pressure angle in normal and transverse plane, helix angle, equivalent numbers of teeth, force and stress analysis, estimating size of helical gears.</p>	04
5	<p>Design of gear boxes: Introduction, geometric progression, general design procedure, selection of best structure diagram, selection of gear layout and ray diagram, determination of number of teeth on gears.</p>	08
6	<p>Design of bevel gears and worm gears: Bevel Gears: Introduction, tooth terminology, straight and spiral bevel gears, force and stress analysis, equivalent number of teeth, safety of bevel gears. Worm gears: Introduction, Advantages and limitation, terminology and designation of worm and worm gears, force and stress analysis, estimating size of the worm gear pair, efficiency of worm and worm gears, modes of failure and materials for worm gears.</p>	**

Distribution of Theory Marks

R Level	U Level	A Level	N Level	E Level	C Level
10	20	25	25	10	10

Legends: R: Remember; U: Understand; A: Apply; N: Analyze; E: Evaluate; C: Create

List of Experiments :

1. To design the cylinder for given requirements of an engine.
2. To design the piston for given requirements of an engine.
3. To design the connecting rod for given requirements of an engine.
4. To design the crank shaft for given requirements of an engine.
5. To design the spur gears for given requirements.
6. To design the helical gears for given requirements
7. To design the gear box for given requirements of machine tool.
8. To design the ball and cylindrical roller bearing for given situation to support the rotating part of an engine.
9. To select the taper roller bearing for given situation to support the rotating part of an engine
10. To design the bevel and worm gears for given applications.
11. Make 3-D model of any IC Engine component using CAD Software.

Reference Books :

1. Bhandari, V.B., "Design of Machine Elements", Tata McGraw-



2. Norton R.L, “Design of Machinery”, McGraw-Hill Book co
3. Maitra G.M., Prasad L.V., “Hand book of Mechanical Design”, II Edition, Tata McGraw-Hill.
4. P.C.Sharma & D.K. Agrawal Machine Design – S.K.Kataria & Sons
5. Shigley J.E and Mischke C. R., “Mechanical Engineering Design”, McGraw-Hill
6. PSG design data book.
7. V.B. Bhandari, Machine Design Data Book, McGraw Hill.

List of Open Base Software / learning website :

1. N.P.T.L. Lecture Series, www.nptel.iitm.ac.in
2. <https://www.machinedesignonline.com/>
3. <http://machinedesign.com/>

Design based problems/Open ended problems :

1. Design an I.C. engine component and prepare a CAD model.