

Subject Code: 01ME0603
Subject Name: Machine Design II
B.Tech. III Year – (Sem-6) Mechanical Engineering
Type of course: Programme core

Prerequisite: Machine Design and Industrial Drafting, Machine Design I

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

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

COURSE OUTCOME

Students will be able to

- 1 Analyze the functional requirements of various I.C. Engine Components.
- 2 Design various I.C. Engine Components
- 3 Design gears and gear boxes based on application requirements.
- 4 Evaluate the performance parameters of gears for various applications.
- 5 Design and select the bearings based on application requirements.

SR NO	CONTENTS	TOTAL HOURS	WEIGHTAGE
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, design of various components of valve gear mechanism.	16	26 %
2	Design of sliding contact bearings Classification of bearings, journal bearing types, basic modes	10	18 %

	<p>of lubrication, viscosity, viscosity index, bearing materials.</p> <p>Hydrodynamic Bearings: petroff's equation, McKee's investigation, Reynold's equation, Raimondi and Boyd method for design of journal bearing, selection parameters for bearing design.</p> <p>Hydrostatic Bearings: Viscous flow through rectangular slot, hydrostatic step bearing, Energy losses</p>		
3	<p>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.</p>	05	10 %
4	<p>Design of spur gears and parallel axis helical gears: Classification of gears, selection of type, gear terminology, standard system of gear tooth, interference and undercutting, gear tooth failures and gear materials</p> <p>Spur gears: 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> <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>	12	20 %
5	<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>	08	14 %
6	<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>	5	12 %

Distribution of Theory Marks

R Level	U Level	A Level	N Level	E Level
15	15	35	20	15

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

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 the Experiments

- 1 To design the cylinder and piston for given requirements of an engine.
- 2 To design the connecting rod for given requirements of an engine.
- 3 To design the valve gear mechanism for given requirements of an engine.
- 4 To design the spur and helical gears for given requirements.
- 5 To design the bevel and worm gears for given requirements.
- 6 To design the gear box for given requirements of machine tool.
- 7 To select the bearing for given situation to support the rotating/sliding part of an engine.

List of Open Source 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.