DESIGN OF MACHINE ELEMENTS II

Course	Code	Credits	L-T-P	Assessment		Exam Duration
				SEE	CIA	
Design of Machine Elements II	15ME64	04	3-2-0	80	20	3Hrs

Course Objectives:

CLO1	To understand various elements involved in a mechanical system.
CLO2	To analyze various forces acting on the elements of a mechanical system and design them using appropriate techniques, codes, and standards.
CLO3	To select transmission elements like gears, belts, pulleys,bearings from the manufacturers' catalogue.
CLO4	To design completely a mechanical system integrating machine elements.
CLO5	To produce assembly and working drawings of various mechanical systems involving machine elements like belts, pulleys, gears, springs, bearings, clutches and brakes.

MODULE I

Curved Beams: Stresses in curved beams of standard cross sections used in crane hook, punching presses & clamps, closed rings and links.

Cylinders & Cylinder Heads: Review of Lame's equations; compound cylinders, stresses due to different types of fit on cylinders; cylinder heads and flats. **08 Hours**

MODULE 2

Belts: Materials of construction of flat and V belts, power rating of belts,concept of slip and creep, initial tension, effect of centrifugal tension, maximum power condition.

Selection of flat and V belts-length & cross section from manufacturers' catalogues.

Construction and application of timing belts.

Wire ropes: Construction of wire ropes, stresses in wire ropes, and selection of wire ropes.

(Only theoretical treatment)

Chain drive: Types of power transmission chains, modes of failure for chain, and lubrication of chains.(Only theoretical treatment)

Springs: Types of springs, spring materials, stresses in helical coil springs of circular and non-circular cross sections. Tension and compression springs, concentric springs;springs under fluctuating loads.

Leaf Springs: Stresses in leaf springs,equalized stresses, and nipping of leaf springs.

Introduction to torsion and Belleville springs. **10 Hours**

MODULE 3

Gear drives: Classification of gears, materials for gears, standard systems of gear tooth, gear tooth failure modes and lubrication of gears.

Spur Gears: Definitions, stresses in gear tooth: Lewis equation and form factor, design for strength, dynamic load and wear.

Helical Gears: Definitions, transverse and normal module, formative number of teeth, design based on strength, dynamic load and wear.

Bevel Gears: Definitions, formative number of teeth, design based on strength, dynamic load and wear **12 Hours**

MODULE 4

Worm Gears: Definitions, types of worm and worm gears, and materials for worm and worm wheel. Design based on strength, dynamic, wear loads and efficiency of worm gear drives.

Design of Clutches: Types of clutches and their applications, single plate and multi-plate clutches. (Numerical examples only on single and multi-plate clutches)

Design of Brakes:Types of Brakes, Block and Band brakes,selflocking of brakes, and heat generation in brakes. **10 Hours**

MODULE 5 Lubrication and Bearings: Lubricants and their properties, bearing materials and properties; mechanisms of lubrication, hydrodynamic lubrication, pressure development in oil film, bearing modulus, coefficient of friction, minimum oil film thickness, heat generated, and heat dissipated.

Numerical examples on hydrodynamic journal and thrust bearing design.

Anti friction bearings: Types of rolling contact bearings and their applications, static and dynamic load carrying capacities, equivalent bearing load, load life relationship; selection of deep grove ball bearings from the manufacturers' catalogue; selection of bearings subjected to cyclic loads and speeds; probability of survival. **10 Hours**

Course Outcomes:

After learning the course the students should be able to:

CO1	Apply engineering design tools to product design.
CO2	Design mechanical systems involving springs,belts and pulleys.
CO3	Design different types of gears and simple gear boxes for different applications.
CO4	Design brakes and clutches.
CO5	Design hydrodynamic bearings for different applications.
CO6	Select Anti friction bearings for different applications using the manufacturers, catalogue.
C07	Develop proficiency to generate production drawings using CAD software.
C08	Become good design engineers through learning the art of working in a team with morality and ethics.

Scheme of Examination:

Two questions to be set from each module. Students have to answer five full questions, choosing one full question from each module.

Assignment:

Course work includes a Design project. Design project should enable the students to design a mechanical system (like single stage reduction gear box with spur gears, single stage worm reduction gear box, V-belt and pulley drive system, machine tool spindle with bearing mounting, C-clamp, screw jack, single plate clutch, etc.)A group of students (maximum number in a group should be 4) should submit assembly drawing and part drawings, completely dimensioned, indicating the necessary manufacturing tolerances, surface finish symbols and geometric tolerances wherever necessary. Design project must be completed using appropriate solid modeling software. Computer generated drawings must be submitted. Design calculations must be hand written and should be included in the report.

Design project should be given due credit (5 marks) in internal assessment.

Textbooks:

[1] Richard G. Budynas,and J. Keith Nisbett,"Shigley's Mechanical Engineering Design", McGraw-Hill Education, 10th Edition, 2015.
[2] Juvinall R.C, and Marshek K.M, "Fundamentals of Machine Component Design", John Wiley & Sons, Third Edition, Wiley student edition, 2007.
[3] V. B. Bhandari, "Design of Machine Elements",4th Ed., Tata Mcgraw Hill, 2016.

References:

[1] Robert L. Norton "Machine Design- an integrated approach", Pearson Education, 2nd edition.
[2] Spotts M.F., Shoup T.E "Design and Machine Elements", Pearson Education, 8th edition,2006.
[3] Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
[4] Hall, Holowenko, Laughlin (Schaum's Outline Series), "Machine design" adapted by S.K.Somani, Tata McGrawHill Publishing Company Ltd., Special Indian Edition, 2008.
[5] G. M. Maithra and L.V.Prasad, "Hand book of Mechanical Design", Tata McGraw Hill, 2nd edition,2004.

Design Data Hand Book:

[1] Design Data Hand Book, K.Lingaiah, McGraw Hill, 2nd edition, 2003.
[2] Design Data Hand Book, K.Mahadevan and Balaveera Reddy, CBS publication.
[3] Design Data Hand Book, H.G.Patil, I.K.International Publisher, 2010
[4]PSG Design Data Hand Book, PSG College of technology, Coimbatore.