

DESIGN OF MACHINE ELEMENTS II
B.E, VI Semester, Mechanical Engineering
[As per Choice Based Credit System (CBCS) scheme]

Course Code	17ME64	CIE Marks	40
Number of Lecture Hours/Week	04	SEE Marks	60
Total Number of Lecture Hours	50(10 Hours per Module)	Exam Hours	03

Credits – 04

Course Objectives:

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

Module - 1

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.

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.

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.

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, self-locking of brakes, and heat generation in brakes.

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 groove ball bearings from the manufacturers' catalogue; selection of bearings subjected to cyclic loads and speeds; probability of survival.

Course outcomes:

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

TEXT BOOKS:

[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.

REFERENCE BOOKS

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


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