

II Year II Semester

L T P C

Code:20ME4006

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DESIGN OF MACHINE MEMBERS-I

Course Objectives:

1. The student shall gain appreciation and understanding of the design function in mechanical engineering, the steps involved in designing and the relation of design activity with manufacturing activity, select proper materials to different machine elements based on their physical and mechanical properties.
2. The student shall learn and understand of the different types of failure modes and criteria, Procedure for designing the different machine elements and understand the standards of design.

UNIT – I

Introduction: Stages in design, Standardization, Interchangeability, Preferred numbers, Engineering materials, Ferrous, Non-ferrous, Non-metals, Indian standard specifications for ferrous materials

Design for static strength:

Fundamentals of Machine Design, Allowable stress, Factor of safety, Static loads – Types of loads, Members under combined loads, theories of failure.

UNIT – II

Stress concentration – explanation and examples, Reduction of stress concentration, Determination of stress concentration factor, combined stress concentration factor, Problems.

Design for fatigue strength: S-N diagram, low cycle fatigue, high cycle fatigue, Endurance limit. Modifying factors– size effect, surface effect, stress concentration effects; Fluctuating stresses, Fatigue strength under fluctuating stresses, goodman's line – soderberg's line, modified goodman's line, Gerber's parabola.

UNIT – III

Mechanical joints: Riveted Joints – Types, rivet materials, Failures of Riveted joints, Efficiency, Boiler Joints, Tank and Structural Joints, riveted brackets.

Welded joints – Types, strength of butt and fillet welds, Eccentrically loaded welds.

Fasteners - Design of keys-stresses in keys-cotter joints-socket and spigot, sleeve and cotter, Gib and cotter joint- knuckle joint.

UNIT – IV

Design of Shafts- Torsion of shafts, design for strength and rigidity, with steady loading, ASME and BIS codes for design of transmission shafting, shafts under fluctuating and combined loads.

Shaft Coupling: Rigid couplings – muff, split muff and flanged coupling, protected flanged coupling, bushed pin type flexible coupling.

UNIT – V

Springs: Types of springs - stresses in Helical coil springs of circular and non-circular cross sections. Tension and compression springs, springs under fluctuating loads, Leaf Springs: Stresses in leaf springs. Equalized stresses, – Energy stored in springs.

Note: Design data book is NOT Permitted for examination

Text Books:

1. Machine Design/ Shigley, J.E/McGraw Hill
2. Machine Design/V.B.Bhandari/ McGrawHill Education

References:

1. Machine design / Schaum Series/McGrawHill Professional
2. Machine Design / Norton/ Pearson publishers
3. Machine design / NC Pandya & CS Shah/Charotar Publishing House Pvt. Limited

Weblinks/ Online Resources:

- <https://nptel.ac.in/courses/112/105/112105125/>
- <http://creativestellars.blogspot.com/p/design.html>
- <https://www.jntumaterials.co.in/2015/04/jntujntuk-design-of-machine-members-i.html>

Course Outcomes:

On the completion of the course the students must be able to

1. Calculate different stresses in the machine components subjected to various static loads, failures and suitability of a material for an engineering application.
2. Calculate dynamic stresses in the machine components subjected to variable loads.
3. Design riveted, welded, bolted joints, keys, cotters and knuckle joints subjected to static loads and their failure modes
4. Design the machine shafts and suggest suitable coupling for a given application.
5. Calculate stresses in different types of springs subjected to static loads and dynamic loads