II Year - II Semester

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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
2. Selection of proper materials to different machine elements based on their physical and mechanical properties.
3. Learn and understanding of the different types of failure modes and criteria.
4. Procedure for the different machine elements such as fasteners, shafts, couplings, keys, axially loaded joints etc.

UNIT – I

INTRODUCTION: General considerations in the design of Engineering Materials and their properties – selection –Manufacturing consideration in design, tolerances and fits –BIS codes of steels.

STRESSES IN MACHINE MEMBERS: Simple stresses – combined stresses – torsional and bending stresses – impact stresses – stress strain relation – various theories of failure – factor of safety – design for strength and rigidity – preferred numbers. the concept of stiffness in tension, bending, torsion and combined situations – static strength design based on fracture toughness.

UNIT – II

STRENGTH OF MACHINE ELEMENTS: Stress concentration – theoretical stress concentration factor – fatigue stress concentration factor notch sensitivity – design for fluctuating stresses – endurance limit – estimation of endurance strength – Goodman's line – Soderberg's line – modified Goodman's line.

UNIT – III

Riveted and welded joints – design of joints with initial stresses – eccentric loading.

Bolted joints – design of bolts with pre-stresses – design of joints under eccentric loading – locking devices – both of uniform strength, different seals.

UNIT – IV

KEYS, COTTERS AND KNUCKLE JOINTS: Design of keys-stresses in keys-cotter joints-spigot and socket, sleeve and cotter, jib and cotter joints- knuckle joints.

SHAFTS: Design of solid and hollow shafts for strength and rigidity – design of shafts for combined bending and axial loads – shaft sizes – BIS code. Use of internal and external circlips, gaskets and seals (stationary & rotary).

UNIT – V

SHAFT COUPLING: Rigid couplings – muff, split muff and flange couplings, flexible couplings – flange coupling (modified).

UNIT – VI

MECHANICAL SPRINGS:

Stresses and deflections of helical springs – extension -compression springs – springs for fatigue loading, energy storage capacity – helical torsion springs – co-axial springs, leaf springs.

Note: Design data book is NOT Permitted for examination

Text Books:

1. Machine Design/V.Bandari/ TMH Publishers
2. Machine design / NC Pandya & CS Shah/Charotar Publishing House Pvt. Limited
3. Design data book of Engineers-

References:

1. Design of Machine Elements / V.M. Faires/McMillan
2. Machine design / Schaum Series/McGrawHill Professional
3. Machine Design/ Shigley, J.E/McGraw Hill.
4. Design data handbook/ K.Mahadevan & K. Balaveera Reddy/ CBS publishers.
5. Design of machine elements-Spotts/Pearson Publications
6. Machine Design –Norton/ Pearson publishers

Course outcomes:

Upon successful completion of this course student should be able to:

1. Apply the design procedure to engineering problems, including the consideration of technical and manufacturing constraints.
2. Select suitable materials and significance of tolerances and fits in critical design applications.
3. Utilize design data hand book and design the elements for strength, stiffness and fatigue.
4. Identify the loads, the machine members subjected and calculate static and dynamic stresses to ensure safe design.

Code No: RT31033 **R16** SET - 1

III B. Tech I Semester Supplementary Examinations, May - 2018

DESIGN OF MACHINE MEMBERS – I

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**
(Data books may be allowed)

PART –A

1	a)	Write about preferred numbers?	**Remembering**	[3M]
	b)	How will you reduce stress concentration in shaft with keyway?	**Remembering**	[4M]
	c)	Write the advantages and limitations of bolted joints?	**Remembering**	[4M]
	d)	Write the applications of spigot and socket joint?	**Remembering**	[4M]
	e)	What is the importance of split muff couplings?	**Remembering**	[3M]
	f)	List the classification of springs?	**Remembering**	[4M]

PART -B

2	a)	Explain the manufacturing considerations in design?	**Understanding**	[8M]
	b)	How do you understand failure? Explain the various theories of failure?	**Understanding**	[8M]
3	a)	A torsion bar spring has a solid round 20 mm diameter section which blends smoothly at each end with a larger splined section. It is subjected to a completely reversed nominal torsional stress of 210 MN/m^2. Stress concentration is negligible, and the surfaces are machined. Estimate the fatigue life corresponding to each of the following materials : i) steel= 250 HB, ii) Cast iron Su= 350 MN/m^2.	**Evaluating**	[12M]
	b)	Describe the estimation of endurance strength?	**Remembering**	[4M]
4	a)	How is the allowable stress calculated for a riveted joint subjected to alternating type of load?	**Remembering**	[6M]
	b)	The end of a receiver, cylindrical in shape is closed by a lap joint using rivets. The maximum pressure in the receiver is 1 MPa. The axial length of the receiver is limited to 2 m while its storing capacity is 2 m^3. Design the suitable lap joint giving a neat sketch. The permissible stresses in shear and crushing of rivets may be taken as 30 MPa and 70 MPa. The permissible tensile stress for the plate material is 80 MPa.	**Creating**	[10M]

5 a) A machinery shaft supported on a bearing 2.4 metre apart is to transmit 187.5 kW at 200 rev/min. It is subjected to a bending load of 5000 N located at a distance of 0.66 metre from one bearing. Safe stress in shear is 42 MPa and in bending 84 MPa. i.) Determine the shaft diameter for steady loading ii.) Determine the shaft diameter if the transverse load is steady and the torsional load is suddenly applied. **Evaluating** [12M]

b) Write the importance and applications of jib and cotter joints? **Remembering** [4M]

6 A propeller shaft is made-up by joining together number of solid shafts. The joint is made by forging the ends of the shaft in the form of a flange, and bolting the flanges together by means of 8 bolts. If the shaft transmits 60kW at 120 rpm, determine the size of the shaft, the diameter and thickness of the flange and the diameter and pitch circle diameter of bolts. Permissible stresses are τ = 35MPa ; σc = 45MPa. **Evaluating** [16M]

7 A rail carriage weighing 200kN and running at 5 km/hour is brought to rest by four buffer springs of close coiled helical type during connection with another carriage which is already at rest. The mean coil diameter is 5 times the wire diameter. The deflection of each spring is 220 mm, to bring the carriage to rest. Safe shear stress for the spring material is 400 N/mm^2. Calculate the maximum load on the spring, diameter of wire and coil, number of turns and free length of spring. Assume the ends of spring are squared and ground. Take $G= 0.8\times10^4 N/mm^2$. **Applying** [16M]

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