Code No: **20ME4T04** **R20**

II B. TECH II SEMESTER REGULAR EXAMINATIONS, JUNE - 2022
DESIGN OF MACHINE MEMBERS-I
(MECHANICAL ENGINEERING)

Time: 3 hours Max. Marks: 70

Note: Answer **ONE** question from each unit **(5 × 14 = 70 Marks)**

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UNIT-I

1. a) Define the term ‘factor of safety’. What factors should be considered while selecting factor of safety. [6M]

   b) A cylindrical shaft made of steel of yield strength 700 MPa is subjected to static loads consisting of bending moment 10 kN-m and a torsional moment 30 kN-m. Determine the diameter of the shaft using two different theories of failure, and assuming a factor of safety of 2. Take E = 210 GPa and poisson's ratio = 0.25. [8M]

(OR)

2. a) Explain the different phases in Machine design? [6M]

   b) A shaft is designed based on maximum distortion energy theory with a factor of safety of 2.0. The material used is 30C8 steel with a yield stress of 310MPa. It is subjected to an axial load of 40kN. Determine the maximum torque capacity. Diameter of the shaft is 20 mm. [8M]

UNIT-II

3. a) A machine member is made of plain carbon steel of ultimate strength 650 N/mm^2 and endurance limit of 300 N/mm^2. If the member is subjected to a fluctuating torsional moment which varies from -200 N-m to 400 N-m. Design the member using (i) modified Goodman’s equation and (ii) Soderberg equation [8M]

   b) What is meant by stress concentration? Explain the causes of stress concentration. [6M]

(OR)

4. a) A machine component is subjected to a flexural stress which fluctuates between + 300 MN/m^2 and – 150 MN/m^2. Determine the value of minimum ultimate strength according to 1. Gerber relation; 2.Modified Goodman relation; and 3. Soderberg relation. Take yield strength = 0.55 Ultimate strength; Endurance strength = 0.5 Ultimate strength; and factor of safety = 2. [8M]

   b) Write a short note on cumulative damage in fatigue. [6M]

UNIT-III

5. a) Explain the different types of failures in riveted joints with expressions. [6M]
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	b)	Two plates 16 mm thick are joined by a double riveted lap joint. The pitch of each row of rivets is 90 mm. The rivets are 25 mm in diameter. The permissible stresses are 140 MPa in tension, 80 MPa in shear and 160 MPa in crushing. Find the efficiency of the joint.	[8M]
		(OR)	
6.	a)	What are the advantages of welded joints compared with riveted joints?	[6M]
	b)	What is an eccentric loaded welded joint? Discuss the procedure for designing such a joint.	[8M]
		UNIT-IV	
7.	a)	Explain the concept of equivalent twisting moment and equivalent bending moment is shafts.	[6M]
	b)	Design and make a neat dimensioned sketch of a muff coupling which is used to connect two steel shafts transmitting 40 kW at 350 r.p.m. The material for the shafts and key is plain carbon steel for which allowable shear and crushing stresses may be taken as 40 MPa and 80 MPa respectively. The material for the muff is cast iron for which the allowable shear stress may be assumed as 15 MPa.	[8M]
		(OR)	
8.	a)	What is a key? State its function. Explain different keys with their applications.	[6M]
	b)	Design a clamp coupling to transmit 30 kW at 100 r.p.m. The allowable shear stress for the shaft and key are 40 MPa and the number of bolts connecting the two halves are six. The permissible tensile stress for the bolts is 70 MPa. The coefficient of friction between the muff and the shaft surface may be taken as 0.3	[8M]
		UNIT-V	
9.	a)	Design a sleeve and cotter joint to resist a tensile load of 60 kN. All parts of the joint are made of the same material with the following allowable stresses : σ_t = 60 MPa ; τ = 70 MPa ; and σ_c = 125 MPa.	[8M]
	b)	Classify springs according to their shapes. Draw neat sketches indicating in each case whether stresses are induced by bending or by torsion.	[6M]
		(OR)	
10.	a)	What is a cotter joint? Explain with the help of a neat sketch. What are the applications of a cottered joint?	[6M]
	b)	Design a close coiled helical compression spring for a service load ranging from 2250 N to 2750 N. The axial deflection of the spring for the load range is 6 mm. Assume a spring index of 5. The permissible shear stress intensity is 420 MPa and modulus of rigidity, G = 84 kN/mm^2.	[8M]

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