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CMR ENGINEERING COLLEGE : HYDERABAD
UGC AUTONOMOUS
III-B.TECH-I-Semester End Examinations (Regular) - January- 2024
DESIGN OF MACHINE MEMBERS-I
(MECH)

[Time: 3 Hours]

[Max. Marks: 70]

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 20 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks.

PART-A

(20 Marks)

1. a) State the importance of fits and tolerances in design. [2M]
- b) Define the terms torsion and bending stress. [2M]
- c) List the methods of reducing stress concentration. [2M]
- d) State the factors affecting endurance strength of the components. [2M]
- e) List the modes of failure of riveted joints. [2M]
- f) Differentiate between permanent fastenings and temporary fastenings. [2M]
- g) Define key. List the types of keys. [2M]
- h) Write down the advantages and applications of cotter joint. [2M]
- i) Define shaft. List out the materials used for shaft. [2M]
- j) Give at least three practical applications of couplings. [2M]

PART-B

(50 Marks)

2. Enumerate the most commonly used engineering materials. State the mechanical properties of metals and explain briefly. [10M]
- OR**
3. A bolt is subjected to a tensile load of 25 kN and shear load of 10 kN. Determine the diameter of the bolt according to: (i) Maximum principle stress theory. (ii) Maximum shear stress theory. Assume factor of safety as 2.5, yield point stress in simple tension = 300 N/mm², Poisson ratio = 0.25. [10M]
- 4.a) Write down Goodman's equation for combination stresses. [5M]
- b) Mention the methods of reducing stress concentration. [5M]
- OR**
5. A machine component is subjected to a fluctuating stress that varies from 40 to 100 N/mm². The corrected endurance limit of the machine component is 270 N/mm². The ultimate stress and yield point stress of the material are 600 and 400 N/mm² respectively. Determine the factor of safety using: (i) Gerber formula. (ii) Solderberg line. [10M]
6. A steam engine of effective diameter 300 mm is subjected to a steam pressure of 1.5 N/mm². The cylinder head is connected by 8 bolts having yield point 330 MPa and endurance limit at 240 MPa. The bolts are tightened with an initial preload of 1.5 times the steam load. A soft copper gasket is used to make the joint leak-proof. Assuming a factor of safety 2, find the size of bolt required. The stiffness factor for copper gasket may be taken as 0.5. [10M]
- OR**
7. Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5 m in diameter subjected to a steam pressure of 0.95 N/mm². Assume joint efficiency as 75%, allowable tensile stress in the plate 90MPa; compressive stress 140MPa; and shear stress in the rivet 56MPa. [10M]

8. Two steel rods are to be connected by means of a steel sleeve and two steel cotters. [10M]
The rods are subjected to a tensile load of 40KN. Design the joint, using the permissible stress in tension as 60MPa, in shear as 50MPa, and in crushing as 90MPa.

OR

9. It is required to design a square key for fixing a gear on a shaft of 30 mm diameter. [10M]
The shaft is transmitting 20 kW power at 600 rpm to the gear. The key is made of steel 50C4 ($S_{yt} = 460 \text{ N/mm}^2$) and the factor of safety is 4. For key material, the yield strength in compression can be assumed to be equal to the yield strength in tension. Determine the dimensions of the key.

10. A Solid circular shaft is subjected to a bending moment of 3000Nm and a torque of [10M]
10000 Nm. The shaft is made of 45C8 steel having ultimate tensile stress of 700MPa and a ultimate shear stress of 500Mpa. Assume a factor of safety 6. Determine the diameter of the shaft.

OR

11. Discuss briefly about: (i) Flange coupling. (ii) Muff coupling with neat sketches. [10M]
