

Code No.: ME503PC

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**CMR ENGINEERING COLLEGE: : HYDERABAD
UGC AUTONOMOUS**

**III-B.TECH-I-Semester End Examinations (Supply) – December 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 factors to be considered for the selection of materials for the design of machine elements. [2M]
- b) Recall the significance of theories of failure. [2M]
- c) Illustrate how the stress concentration in a component can be reduced. [2M]
- d) Define notch sensitivity. [2M]
- e) List the modes of failure of riveted joints. [2M]
- f) Differentiate between permanent fastenings and temporary fastenings. [2M]
- g) Define key. State its function. [2M]
- h) Define cotter and state the applications of a cotter joint. [2M]
- i) List the types of Flexible couplings. [2M]
- j) Why hollow shafts are preferred over solid shafts? [2M]

PART-B

(50 Marks)

2. Illustrate the most commonly used engineering materials. State the mechanical properties of metals and explain briefly. [10M]

OR

3. At a critical section in a shaft, the following stresses are induced: [10M]

Bending stress = 60 MPa

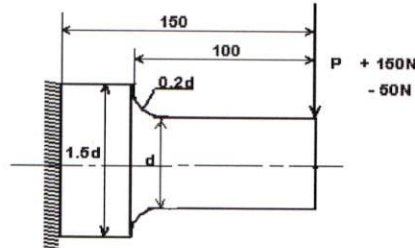
Torsional shear stress = 40 MPa

Determine the factor of safety, according to: (i) Maximum normal stress theory. (ii) Maximum shear stress theory. (iii) Maximum principal strain theory. The proportional limit in a simple tension test is found to be 300 MPa. Take Poisson's ratio as 0.3.

4. A machine component is subjected to a fluctuating stress that varies from 40 to 100 N/mm^2 . The corrected endurance limit of the machine component is 270 N/mm^2 . The ultimate stress and yield point stress of the material are 600 and 400 N/mm^2 respectively. Determine the factor of safety using: (i) Gerber formula. (ii) Solderberg line. [10M]

OR

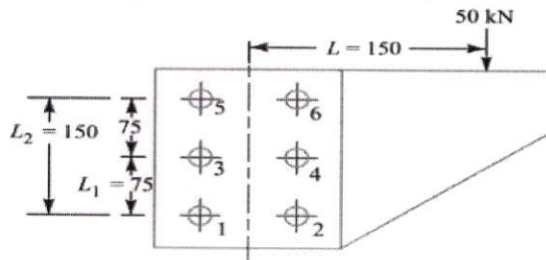
5. A cantilever beam made of cold drawn steel 40C8 ($\sigma_{\text{ulti}} = 600 \text{ MPa}$ and $\sigma_y = 380 \text{ MPa}$) shown in the figure. The force p acting at the free end varies from -50 N to $+150 \text{ N}$. The expected reliability is 90% and the factor of safety is 2. The notch sensitivity factor at the fillet is 0.9. Determine the diameter of the beam at the fillet cross section. (Assume $K_a = 0.77$; $K_b = 0.85$ and $K_c = 0.897$) [10M]



6. A double riveted lap joint with chain riveting is made for joining two plates having thickness of 12 mm. If the allowable tensile stress, allowable shear stress, and allowable compressive stress are 65 MPa, 55 MPa and 80 MPa respectively, evaluate the rivet diameter, pitch of rivets, distance between the rows of rivets, and efficiency of the joint. [10M]

OR

7. A bracket is bolted to a column by 6 bolts of equal size as shown in figure. It carries a load of 50 kN at a distance of 150 mm from the centre of column. If the maximum stress in the bolts is to be limited to 150 MPa, determine the diameter of bolt. [10M]



8. It is required to design a square key for fixing a gear on a shaft of 30 mm diameter. 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. [10M]

OR

9. Explain the design procedure of sleeve and cotter joint with neat sketches. [10M]
10. Discuss briefly about: (i) Flange coupling. (ii) Muff coupling with neat sketches. [10M]

OR

11. A hollow shaft is required to transmit 600 kW at 110 rpm, the maximum torque being 20% greater than the mean. The shear stress is not to exceed 63 MPa and twist in a length of 3 meters not to exceed 1.4 degrees. Find the external diameter of the shaft, if the internal diameter to the external diameter is $3/8$. Take modulus of rigidity as 84 GPa. [10M]
