

Code No: 155AX

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, September - 2021

DESIGN OF MACHINE MEMBERS - I

(Mechanical Engineering)

Time: 3 Hours

Max. Marks: 75

Answer any five questions

All questions carry equal marks

- 1.a) Explain the influence of preferred number and design of components.
 b) State and illustrate two principal design rules for casting design. [8+7]
2. It is required to design a cotter joint to connect two steel rods of equal diameter. Each rod is subjected to an axial tensile force of 50 kN. Design the joint and specify its main dimensions. [15]
3. A cantilever beam made of cold drawn steel 4⁰C8 ($S_{ut} = 600 \text{ N/mm}^2$ and $S_{yt} = 380 \text{ N/mm}^2$) is shown in Figure. 1. 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 d of the beam at the fillet cross-section using Gerber curve as failure criterion. [15]

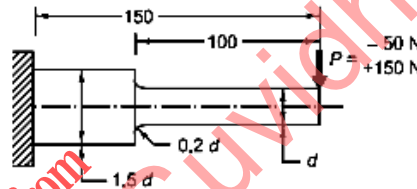


Figure 1

4. A bar of circular cross-section is subjected to alternating tensile forces varying from a minimum of 200 kN to a maximum of 500 kN. It is to be manufactured of a material with an ultimate tensile strength of 900 MPa and an endurance limit of 700 MPa. Determine the diameter of bar using safety factors of 3.5 related to ultimate tensile strength and 4 related to endurance limit and a stress concentration factor of 1.65 for fatigue load. Use Goodman straight line as basis for design. [15]
5. Two circular plates with $(2d)$ and (d) as outer and inner diameters respectively, are clamped together by means of a bolt as shown in Figure. 2. The bolt is made of plain carbon steel 45C8 ($S_t = 380 \text{ N/mm}^2$ and $E = 207000 \text{ N/mm}^2$), while the plates are made of aluminium ($E = 71000 \text{ N/mm}^2$). The initial pre-load in the bolt is 5 kN and the external force acting on the bolted joint is 10 kN. Determine the size of the bolt, if the factor of safety is 2.5. [15]

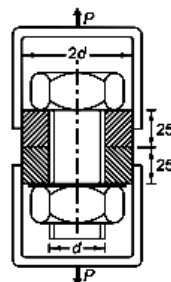


Figure 2

6. A welded connection of steel plates is shown in Figure. 3. It is subjected to an eccentric force of 50 kN. Determine the size of the weld, if the permissible shear stress in the weld is not to exceed 70 N/mm^2 . [15]

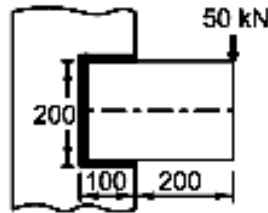


Figure 3

7. The cross-section of a flat key for a 40 mm diameter shaft is $22 \text{ mm} \times 14 \text{ mm}$. The power transmitted by the shaft to the hub is 25 kW at 300 rpm. The key is made of steel ($S_{yc} = S_{yt} = 300 \text{ N/mm}^2$) and the factor of safety is 2.8. Determine the length of the key. Assume ($S_{sy} = 0.577 S_{yt}$). [15]
8. A steel solid shaft transmitting 15 kW at 200 r.p.m. is supported on two bearings 750 mm apart and has two gears keyed to it. The pinion having 30 teeth of 5 mm module is located 100 mm to the left of the right hand bearing and delivers power horizontally to the right. The gear having 100 teeth of 5 mm module is located 150 mm to the right of the left hand bearing and receives power in a vertical direction from below. Using an allowable stress of 54 MPa in shear, determine the diameter of the shaft. [15]

---ooOoo---