PVP 14

Code: ME5T5

III B.Tech - I Semester – Regular/Supplementary Examinations
March - 2021

DESIGN OF MACHINE MEMBERS-I
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

PART – A

Answer ***all*** the questions. All questions carry equal marks

11x 2 = 22 M

1.

a) Explain Preferred Numbers.
b) Explain Design Process.
c) What is Endurance limit?
d) What is Notch sensitivity?
e) Illustrate different types of riveted joints and rivets.
f) What do you understand by the term welded joint? How it differs from riveted joint?
g) Explain advantages of bolted joints.
h) Distinguish between cotter joint and knuckle joint.
i) What is the function of a spring?
j) Discuss the materials and practical applications for the various types of springs.
k) What do you understand by full length and graduated leaves of a leaf spring?

PART – B

Answer any ***THREE*** questions. All questions carry equal marks. 3 x 16 = 48 M

2. a) The shaft of an overhang crank subjected to a force P of 1kN is shown in Figure-1. The shaft is made of plain carbon steel 45C8 and the tensile yield strength is 380N/mm^2. The factor of safety is 2. Determine the diameter of the shaft using the maximum shear stress theory. 8 M

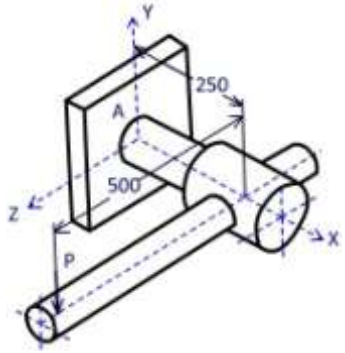

Figure-1

b) A C-frame subjected to a force of 15kN is shown in Figure-2. It is made of grey cast Iron FG 300 and the factor of safety is 2.5. Determine the dimensions of the cross section of the frame. 8 M

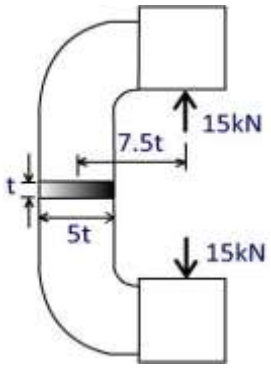

Figure-2

3. a) A plate made of steel 20CB (S_{ut}=440N/mm^2) in hot rolled and normalized condition is shown in Figure-3. It is subjected to a completely reversed axial load of 30kN. The notch sensitivity factor q can be taken as 0.8 and the expected reliability is 90%. The size factor is 0.85. The factor of safety is 2. Determine the plate thickness for infinite life. 8 M

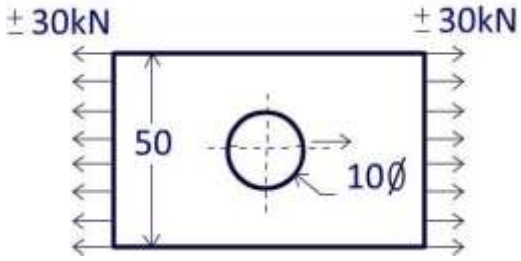

Figure-3

b) A rotating bar made of steel 45C8 (S_{ut}=630N/mm^2) is subjected to a completely reversed bending stress. The corrected endurance limit of the bar is 315N/mm^2. Find the fatigue strength of the bar for a life of 90,000 cycles. 8 M

4. a) The structural connection shown in Figure-4 is subjected to an eccentric force P of 10kN with an eccentricity of 500mm from the C.G of the rivets. The centre distance between the rivets 1 and 2 is 200mm, and the centre distance between the rivets 1 and 3 is 150mm. All rivets are identical. The rivets are made from plain carbon steel 30C8 (S_{ut}=400N/mm^2) and the factor of safety is 2.5. Determine the size of rivets. 8 M

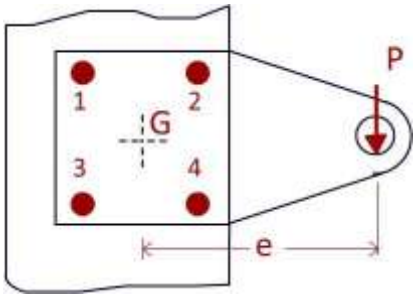

Figure-4

b) A steel plate, 80 mm wide and 10mm thick, is joined to another steel plate by means of a single transverse and double parallel fillet welds, as shown in Figure-5. The strength of the welded joint should be equal to the strength of the plates to be joined. The permissible tensile and shear stresses for the weld material and the plates are 100 and 70 N/mm^2 respectively. Find the length of each parallel fillet weld. Assume that the tensile force passes through the centre of gravity of three welds. 8 M

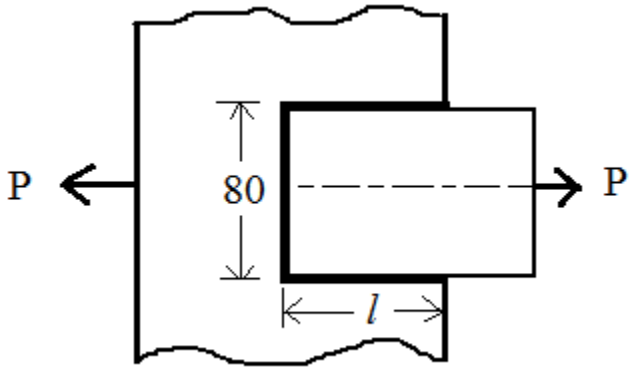

Figure-5

5. a) Determine the size of the bolts and the thickness of the arm for the bracket as shown in Figure-6, if it carries a load of 40 kN at an angle of 60° to the vertical. 8 M

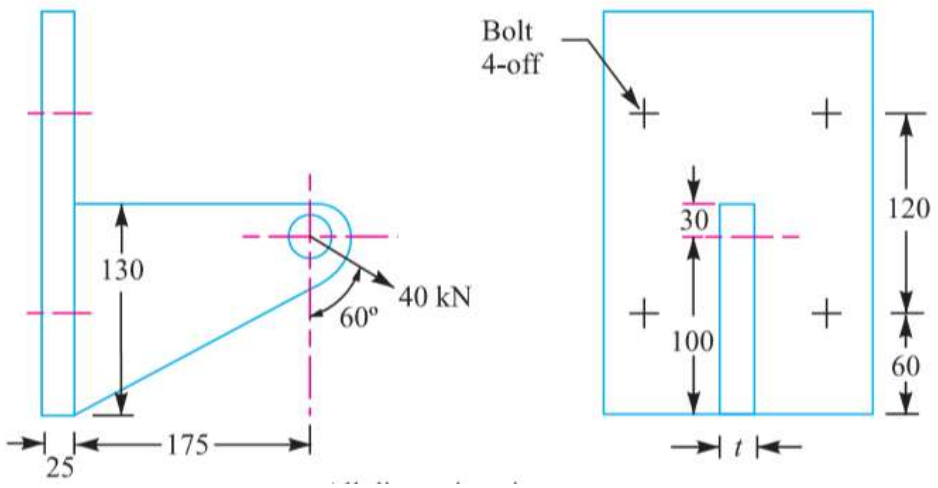

Figure-6

b) Design a knuckle joint for a tie rod of a circular section to sustain a maximum pull of 70 kN. The ultimate strength of the material of the rod against tearing is 420 MPa. The ultimate tensile and shearing strength of the pin material are 510 MPa and 396 MPa respectively. Determine the tie rod section and pin section. Take factor of safety = 6. 8 M

6. a) A safety valve of 60 mm diameter is to blow off at a pressure of 1.2 N/mm^2. It is held on its seat by a close coiled helical spring. The maximum lift of the valve is 10 mm. Design a suitable compression spring of spring index 5 and providing an initial compression of 35 mm. The maximum shear stress in the material of the wire is limited to 500 MPa. The modulus of rigidity for the spring material is 80 kN/mm^2. Find :

i) Diameter of the spring wire, ii) Mean coil diameter, iii) Number of active turns, and iv) Pitch of the coil. 8 M

b) Design a leaf spring for the following specifications : Total load = 140 kN ; Number of springs supporting the load =4; Maximum number of leaves = 10;
Span of the spring = 1000 mm ;
Permissible deflection = 80 mm. Take Young's modulus, E = 200 kN/mm^2 and allowable stress in spring material as 600 MPa. 8 M