Code No: 115DV

R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech III Year I Semester Examinations, February/March - 2016
DESIGN OF MACHINE MEMBERS – I
(Common to ME, AME)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 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 and may have a, b, c as sub questions.

Part- A

(25 Marks)

1.a) Define terms: Endurance Limit and Factor of safety. [2]
b) Write R20 series and R20/3 series for numbers between 10 and 100. [3]
c) Why is connecting rod bolts tightened with initial tension greater than external load? [2]
d) Define the efficiency of the riveted joint. According to Indian Boiler Regulations, what is the highest efficiency required of a riveted joint? [3]
e) What is the function of key and what types of stresses are introduced in a key? [2]
f) What is a cotter joint? Explain with the help of a neat sketch, how a cotter joint is made? [3]
g) What are flexible couplings and what are their applications? [2]
h) Differentiate between torsional rigidity and lateral rigidity in the case of shaft design. [3]
i) What should be the safe frequency of a helical spring? [2]
j) What are the various types of end conditions in case of the close coiled helical springs [3]

Part-B

(50 Marks)

2. The stresses induced at a critical point in a machine component made of steel 45C8 are as follows: σ_x = 100 MPa, σ_y = 40 MPa and τ_{xy} = 80 MPa. Calculate the factor of safety by (a) the maximum normal stress theory, (b) the maximum shear stress theory and (c) the Distortion energy theory. Comment on the variation of factor safety with the method of failure theory. [10]

OR

3. The work cycle of a mechanical component subjected to completely reversed bending stresses consists of the following three elements: (a) ± 350 MPa for 85% of time, (b) ± 400 MPa for 12% of time and (c) ± 500 MPa for 3% of time. The material for the component is 50C4 and the corrected endurance limit of the component is 280 MPa. Determine the life of the component. [10]

4. Two lengths of mild steel tie rod having width 200 mm and thickness 12.5 mm are to be connected by means of a butt joint with double cover plates. Design the joint if the permissible stresses are 80 MPa in tension, 65 MPa in shear and 160 MPa in crushing. Make a sketch of the joint. [10]

OR

5.a) Explain the nature of the stresses induced in the welds shown in Figure 1.
b) A bracket as shown in figure 1 carries a load of 10 kN. Find the size of the weld if the allowable shear stress is not to exceed 80 MPa. [5+5]

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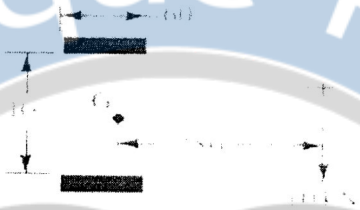

All dimensions in mm

Figure 1

6. 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. [10]

OR

7.a) If a bolt and cotter are made of the same material and if the depth of a cotter is equal to the bolt and the thickness 1/4th the diameter, prove that the cotter is weaker than the bolt.

b) Design the rectangular key for a shaft of 50 mm diameter. The shearing and crushing stresses for the key material are 42 MP and 70 MPa respectively. [5+5]

8.a) Discuss the role of combined shock and fatigue factor in the design of shaft.

b) A shaft, 2m long between bearings, carries a 900 N pulley at its mid-point through a belt drive. The shaft receives 25 kW of power at 180 rpm. The belt drive is horizontal, and the sum of the belt tensions is 7 kN. Determine the shaft diameter and angle of twist, the shaft undergoes. Take G = 80 GPa. [5+5]

OR

9. Design a bushed-pin type flexible coupling for connecting a motor shaft to a pump shaft for the following service conditions.
Power to be transmitted = 40 kW; speed of the motor shaft = 1000 rpm. ; Diameter of the motor shaft = 50 mm; diameter of the pump shaft = 45 mm.
The bearing pressure in the rubber bush and allowable stress in the pins are to be limited to 0.45 N/mm^2 and 25 MPa respectively. [10]

10. A helical spring is acted upon by a varying load of 300 N to 900 N. The spring deflection will be around 15 mm and outside diameter of the spring should be within 48-50 mm. Design the spring. [10]

OR

11. Design a concentric spring for an air craft engine valve to exert a maximum force of 5000 N under a deflection of 40 mm. Both the springs have same free length, solid length and are subjected to equal maximum shear stress of 850 MPa. The spring index for both the springs is 6. [10]

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