R09

Code No: 55019

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, November - 2015

DESIGN OF MECHINE MEMBERS-I

(Mechanical Engineering)

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

Answer any five questions

All questions carry equal marks

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1.a) A rod made of aluminum alloy has length 500 mm and diameter 10 mm. What are its tensile stiffness and flexibility? Young's Modulus of aluminum is 70 GPa.

b) What should be the diameter of a power-transmitting shaft to transmit 150 kW at 500 rpm? The allowable shear stress is 80 MPa.

c) State maximum shear stress theory. Draw the safe boundary region for a given yield strength of a material. [5+5+5]

2.a) What is fatigue stress concentration factor? In what way, it is different from the theoretical stress concentration factor.

b) A steel rod is subjected to a tensile load which varies from 40 kN to 120 kN. Find the safe area of the bar. Take factor of safety = 2, Yield point of the material = 570 MPa and endurance limit of the material = 350 MPa. [7+8]

3. A welded connection as shown in figure 1 is subjected to an eccentric force of 60 kN in the plane of the welds. Determine the size of the welds, if the permissible shear stress for the weld is 100 MPa. All dimensions are in mm only. [15]

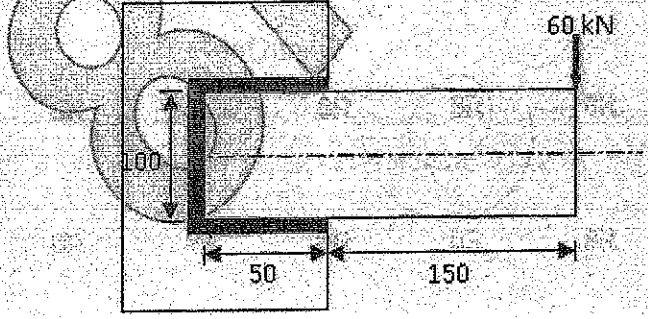


Figure 1

4.a) Discuss on bolts of uniform strength giving examples of practical applications of such bolts.

b) The cylinder head of a steam engine with 250 mm bore is fastened by eight stud bolts made of 30C8 steel. Maximum pressure inside the cylinder is 1 MPa. Determine the size of bolts and the approximate tightening stress and torque. Take 20% overload. Assume yield strength of 300 MPa for bolt. [7+8]

5.a) Can a knuckle joint be used for compressive loading?

b) Two mild steel rods are connected by a knuckle joint to transmit an axial force of 100 kN. Design the joint completely assuming the working stresses for both the pin and rod materials to be 100 MPa in tension, 65 MPa in shear and 150 MPa in crushing. [7+8]

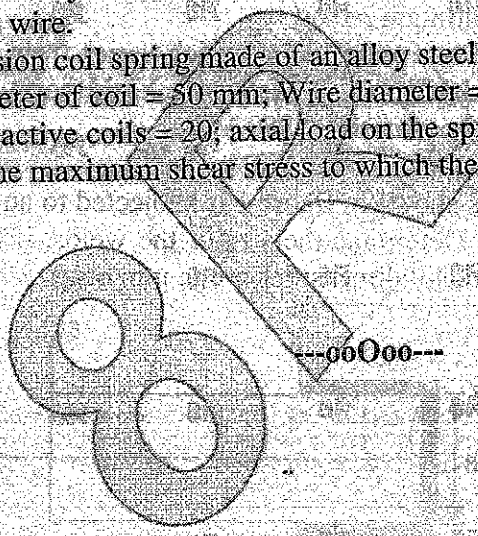
6. A shaft running at 200 rpm is used to transmit 15 kW of power. It carries two gears of 500 mm and 150 mm pitch circle diameters between two bearings 750 mm apart. Larger gear is keyed to the shaft at a distance of 150 mm from the left bearing and smaller gear at 100 mm from the right bearing. The power received at larger gear through a motor located vertically below it and it is delivered to another machine through smaller gear to another machine which is located at horizontally right position. Design the shaft using ASME code recommendation for design stresses. The pressure angle of gears is 20^0. [15]

7.a) Sketch a flange coupling and mention how strength of bolts and thickness of the flange can be calculated.

b) A clamp coupling is required to transmit 30 kW at 100 rpm. The allowable shear stress for the shaft is 40 MPa and the number of bolts connecting the two halves are six. The permissible tensile stress for the bolts is 70 MPa. The coefficient of friction between the muff and the shaft surface may be taken as 0.3. Determine the core diameter of the bolts. [8+7]

8.a) What are the major stresses in a helical spring? Indicate them graphically on the cross section of a wire.

b) A compression coil spring made of an alloy steel is having the following specifications:
Mean diameter of coil = 50 mm; Wire diameter = 5 mm;
Number of active coils = 20; axial load on the spring = 500 N;
Calculate the maximum shear stress to which the spring material is subjected to. [7+8]



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