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10AU52

Fifth Semester B.E. Degree Examination, June/July 2019
Design of Machine Elements – I

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, selecting at least TWO full questions from each part.*
2. Use of data-hand book is permitted.

PART – A

1 a. Briefly discuss factors influencing the selection of suitable material for machine element. **(08 Marks)**

b. Define codes and standards. **(04 Marks)**

c. A 50mm diameter steel rod supports a 9kN load and in addition is subjected to a torsional moment of 100N-m as shown in Fig.Q.1(c). Determine the maximum tensile and the maximum shear stress. **(08 Marks)**

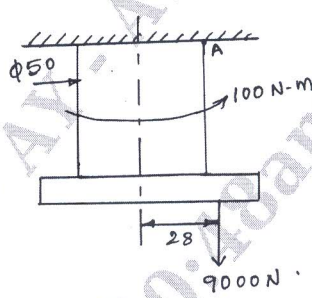

Fig.Q.1(c)

2 a. A shaft of 50mm diameter is stepped down to 40mm with a fillet radius of 5mm. If the allowable shear stress is 50N/mm^2. Determine the power that can be transmitted at 1200rpm. **(10 Marks)**

b. A cantilever beam of span 800mm has a rectangular cross-section of depth 200mm. The free end of the beam is subjected to a transverse load of 1kN that drops on to it from a height of 40mm. Selecting C40 steel (σ_y = 328.6MPa) and factor of safety = 3. Determine the width of rectangular cross-section. **(10 Marks)**

3 A steel shaft is subjected to a bending moment varies from 100Nm to 200Nm and transmits 10kW at 150 rpm. The torque varies over a range of ±40%. The shaft is made of steel whose yield. Stress = 400N/mm^2 and endurance stress = 300N/mm^2, surface coefficient factor = 0.9, size factor = 1.2 fos = 5. Stress concentration factor = 1.94. Determine the diameter of shaft for infinite life. **(20 Marks)**

4 a. Design a Knuckle joint to connect two mild. Steel rods subjected to an axial pull of 100kN. The allowable stresses for rods and pin are 100MPa, 130MPa and 60MPa in tension, crushing and shear respectively. The bending of the pin is prevented by selection of proper fit. **(10Marks)**

b. Design a pin type flexible coupling to transmit 10kW at 500rpm. Assume C40 steel as shaft, bolt (pin) and key material (σ_y = 328.6MPa) and cast iron as flange and hub material (σ_{ut} = 124.5MPa). **(10 Marks)**

PART – B

5 A horizontal piece of commercial shafting is supported by two bearings 1.5m apart. A keyed gear 20° involute and 175mm in diameter is located 400mm to the left of the right bearing and is driven by a gear directly behind it. A 600mm diameter pulley is keyed to the shaft 600mm to the right of the left bearing and drives a pulley with a horizontal belt directly behind it. The tension ratio of the belt is 3 to 1 with the slack side on top. The drive transmits 45kW at 330rpm. Take $K_b = K_t = 1.5$. Calculate the necessary diameter of the shaft and angular deflection in degrees. Use allowable shear stress 40MPa and $G = 80 \times 10^9$ N/mm^2. **(20 Marks)**

6 a. The structural connection shown in Fig.Q.6(a) is subjected to an eccentric load P to 10kN with an eccentricity of 500mm. The centre distance between bolts at 1 and 3 is 150mm and the centre distance between bolts at 1 and 2 is 200mm. All bolts are identical. The bolts are made of plain carbon steel having yield. Strength in tension of 400MPa and fos = 2.5. Determine the size of bolts. **(12 Marks)**

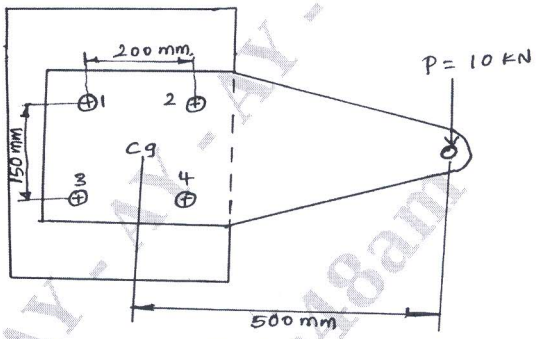

Fig.Q.6(a)

b. Explain the effect of fatigue loading on threaded fastners. **(08 Marks)**

7 a. Design a double Riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5m in diameter subjected to a steam pressure of 0.95 N/mm^2. Assume an efficiency of 75%. Allowable tensile stress in the plate of 90N/mm^2, allowable crushing stress of 140N/mm^2 and an allowable shear stress in the rivet of 56N/mm^2. **(10 Marks)**

b. A double riveted lap joint is to be made between 9mm plates. If the safe working stresses in tension, crushing and shear are 80N/mm^2, 120 N/mm^2 and 60N/mm^2 respectively. Design the riveted joint. **(10 Marks)**

8 a. Determine the size of weld required for an eccentrically loaded weld as shown in Fig.Q.8(a). The allowable stress in the weld is 75 N/mm^2. **(12 Marks)**

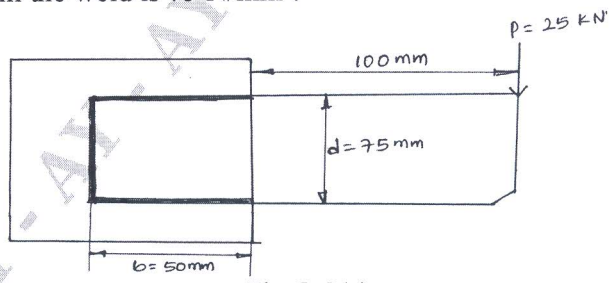

Fig.Q.8(a)

b. Explain self locking and overhauling in power screws. **(08 Marks)**

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