USN | | | | | | | | | | |

10ME52

Fifth Semester B.E. Degree Examination, June/July 2016
Design of Machine Elements – I

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Use of design data handbook is permitted.***
3. ***Assume missing data if any suitably.***

PART – A

1 a. Explain the phase of Design with neat flow Diagram. **(06 Marks)**

b. What are the codes and standards? **(04 Marks)**

c. Stresses in a two dimensional stressed body as in the Fig Q1(c), Determine :
i) Principal stresses and their direction
ii) Maximum shear stress and their planes. **(10 Marks)**

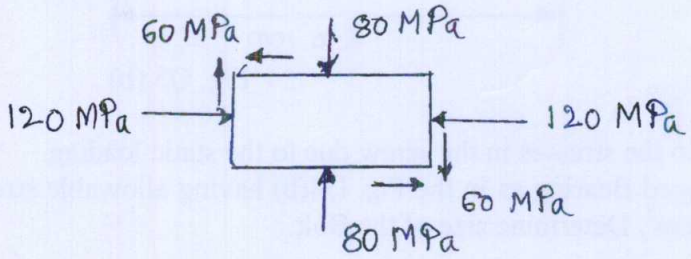

Fig. Q1(c)

2 a. What is the stress concentration factor? What are the methods to determine stress concentration factor? **(06 Marks)**

b. A Load of 4000N on a simply supported shaft as in the Fig. Q2(b). Find the radius of the fillet at left side of the shaft, if maximum stress at left fillet is same as that of right. Take q = 0.95. **(14 Marks)**

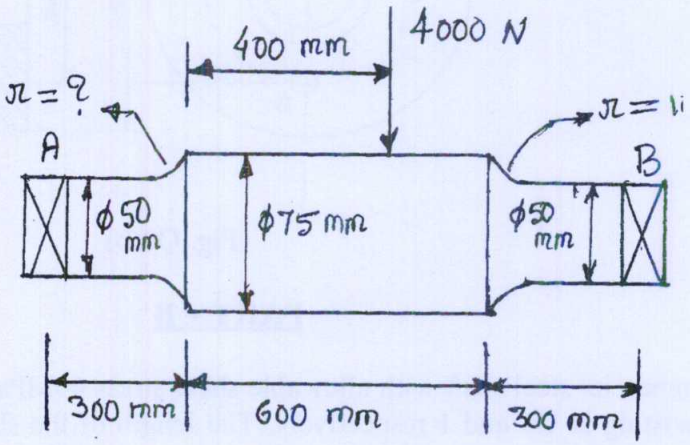

Fig. Q2(b)

3 a. List the factors effecting the endurance limit. **(06 Marks)**

b. Determine the Diameter "d" based on soderberg criterion for a machine member as shown in the Fig. Q3(b). The properties of the material used are, ultimate stress σ_u = 600MPa, yield stress σ_y = 400MPa, endurance stress σ_{en} = 300MPa, and yield shear stress τ_y = 200MPa. The size factor, surface factor are 0.9 and 0.85 respectively. The notch sensitivity factor is 0.92, and load factor for axial can be as 0.6 and factor of safety as 3. **(14 Marks)**

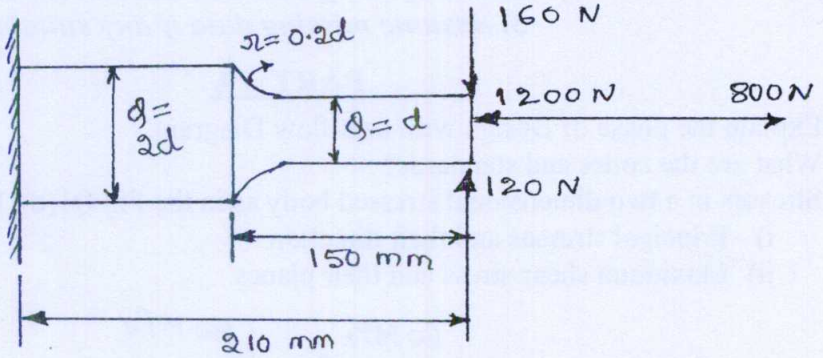

Fig. Q3 (b)

4 a. Explain the stresses in the screw due to the static loading. **(10 Marks)**

b. A flanged Bearing as in the Fig. Q4(b) having allowable stresses in shear in Bolt material is 50N/mm^2. Determine size of the Bolt. **(10 Marks)**

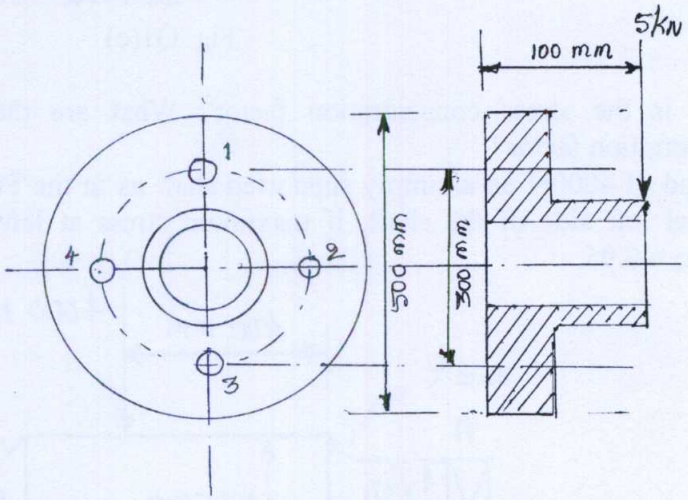

Fig. Q4(b)

PART – B

5 A commercial steel shaft with allowable shear stress 40MPa, with shock factors for Bending and twisting is 1.5 and 1 respectively. The length of the shaft between bearings is 600mm carries a pulley of 400mm diameter having weight 400N, mounted in middle of the shaft. Shaft receives 40kW at 600rpm by a flat belt drive. Power from shaft is transmitted through another pulley of diameter 600mm weighing 600N over hanging the right hand bearing by 200mm. The Belt drives on pulleys are right angles to each other. Take ratios of Belt tensions as 3, determine the diameter of the shaft. Use ASME code for shaft Design. **(20 Marks)**

6 a. Two rods made up of plain carbon steel having, tensile stress σ_{yt} = 380 N/mm^2 are to be connected by means of cottar joint. Diameter of each rod is 50mm and cotter is made up of steel of 15mm thickness. Calculate dimensions of the socket end, making following assumptions.

i) Yield strength in compression is twice of tensile yield strength.

ii) Yield strength in shear is 50% of tensile yield strength. Take factor of safety as 6.

(10 Marks)

b. A 19kW, 1440 rpm motor has a steel shaft, extension of the shaft is 75mm. Diameter of the shaft is 45 mm. Maximum torques is 3.5 times the average torque and yield shear stress is 54MPa, crushing stress is 108MPa for key material. Design the key and also determine effect of key way. Take factor of safety as 2.5. **(10 Marks)**

7 a. Design a Triple Riveted lap joint of zig-zag type for a pressure vessel of 1.5m diameter. The maximum pressure inside the vessel is 1.5MPa. Allowable stresses in tension, crushing and shear are 100MPa, 125MPa and 75MPa respectively. **(10 Marks)**

b. A plate of 80mm wide and 15mm thick is to be joined with another plate by a single transverse weld and a double parallel weld. Determine length of the parallel weld if joint is subjected to both static and fatigue loading. Take tensile stress σ_t = 90 MPa, Shear stress τ = 55 MPa as allowable stresses and stress concentration factor as 1.5 for transverse weld and 2.7 for parallel weld. **(10 Marks)**

8 a. Obtain the expression for Torque required to lift the load on a square threaded screw. **(08 Marks)**

b. A square threaded power screw has nominal diameter of 30mm and a pitch of 6mm with Double start. Load on screw is 6kN and mean diameter of thrust collar is 40mm. The co-efficient of friction for screw is 0.1 and for collar is 0.09. Determine a) torque required to rotate the screw against the load. b) Torque required to rotate the screw with the load c) overall efficiency d) Is the screw self locking? **(12 Marks)**

* * * * *