Code No: 55019 **R09**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD**
**B. Tech III Year I Semester Examinations, December - 2014**
**DESIGN OF MACHINE 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) Explain why we require Theories of failure. List different theories of failure for ductile materials.

b) A shaft is subjected to twisting and bending moments of 1500N-m and 1000 N-m respectively. If the permissible stresses are 65MPa in tension or compression and 45 MPa in shear. Determine the diameter of the shaft.

2. A hot rolled steel shaft is subjected to a torsional load that varies from – 98100 N-mm to 431640 N-mm. It is also subjected to a bending moment that varies from -5000N-mm to 15000N-mm. Determine the diameter of the shaft using factor of safety 1.6. Take $\sigma_{ulti}$ = 490.5 MPa and $\sigma_y$ = 314 MPa.

3.a) Classify the welded joints with neat sketches.

b) A welded connection as shown in the figure 1 is subjected to an eccentric force of 7.5kN. Determine the size of welds if the permissible shear stress for the weld is 100N/mm$^2$. Assume static conditions.

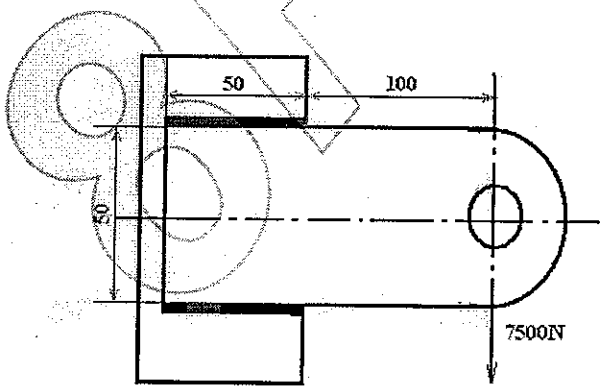


**Figure: 1**

4. A cast iron bracket fixed to the steel structure is shown in the figure 2 below. It supports a load P of 25kN. There are two bolts at A and two bolts at B. the distances are as follows $l_1$ = 50mm; $l_2$ = 50mm; $l$ = 400mm; determine the size of the bolts, if maximum permissible tensile stress in the bolt is 50N/mm$^2$.

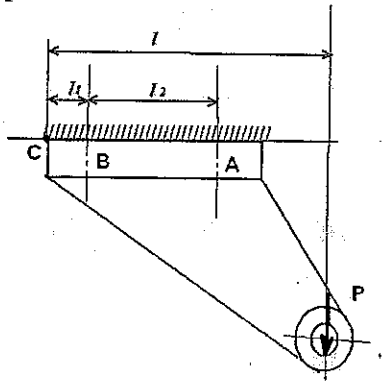


**Figure: 2**

5. Design a cotter joint to support a load varying from 20kN in tension to 30kN in compression. The following allowable stresses may be used for the material of the joint used. Tensile stress is equal to compression stress and is equal to 50MPa; shear stress 35MPa and crushing stress 90MPa.

6. A 225 pulley is keyed to a shaft and the center plane of the pulley overhangs the nearer bearing by 250mm, as shown below figure 3. An open belt arrangement is used. The pulley is driven by an 1800 rev/min motor through a flat belt with a 1 to1 velocity ratio of the pulleys. The belt is 9.5x150mm and weighs 970 kg/m$^3$. The coefficient of friction between the belt and pulleys is 0.3. The belt runs at its maximum capacity with maximum belt stress of 2 MPa. It is decided that the power capacity is to be doubled and if the several possibilities, this problem will concern itself with the effect of increasing the belt width. Assume that the belt width is to be increased. With all other conditions remaining the same, how much should belt width be increased to double the power capacity?

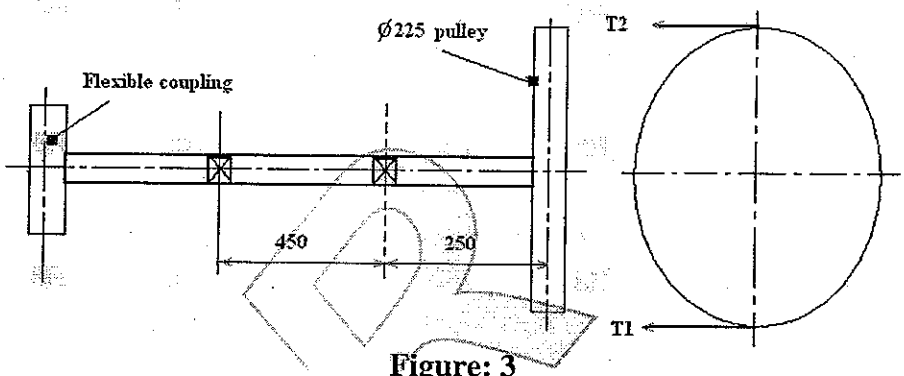


**Figure: 3**

7.a) Classify Keys and state their applications.

b) Design a rigid sleeve coupling of cast iron to connect two shafts; transmitting 20kW at 1400 rpm and capable of resisting 20% overload. The shaft and key materials are the same with 50MPa as permissible shear stress. Take the permissible shear stress for sleeve material as 15MPa.

8.a) Discuss the materials and practical applications for the various types of springs.

b) Design a close coiled helical compression spring for a service load ranging from 2250 N to 2750 N. The axial deflection of the spring for the load range is 6 mm. Assume a spring index of 5. The permissible shear stress intensity is 420 MPa and modulus of rigidity, G = 84 kN/mm$^2$.Neglect the effect of stress concentration. Draw a fully dimensioned sketch of the spring, showing details of the finish of the end coils.

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