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Total No. of Pages : 03

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B.Tech.(Automation & Robotics) (2011 & Onward) (Sem.–4)

DESIGN OF MACHINE ELEMENTS

Subject Code : BTPE-401

M.Code : 63017

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

1. Answer briefly :

a) What do you mean by term factor of safety?

b) What is 'Design for Assembly'?

c) What is the purpose of the rubber bush in bushed-pin flexible coupling?

d) What is the effect of keyway cut into the shaft?

e) What are the applications of a knuckle joint?

f) What is leverage?

g) What is the difference between shearing and crushing?

h) What is 'throat' of fillet weld?

i) What is the difference between caulking and fullering?

j) What is a bell-crank lever?

SECTION-B

2. A bracket is welded to the vertical plate by means of two fillet welds as shown in figure below. Determine the size of the welds if the permissible shear stress is limited to 70 MPa.

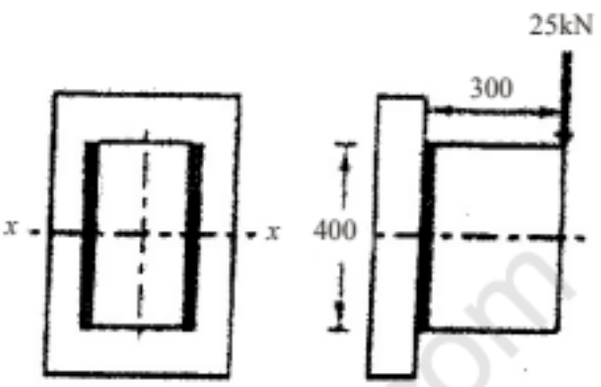

FIG.1

3. Design and sketch a cotter joint to connect two mild steel rods for a pull of 60 kN. The maximum permissible stresses are 75 MPa in tension; 55 MPa in shear and 85 MPa in crushing.

4. Design a cast iron protective flange coupling to connect two shafts in order to transmit 8.0 kW at 800 rpm. The following permissible stresses may be used :

   Permissible shear stress for shaft, bolt and key material = 45 MPa

   Permissible crushing stress for bolt and key material = 75 MPa

   Permissible shear stress for the cast iron = 25 MPa

5. A propeller shaft is required to transmit 50 kW power at 600 rpm. It is a hollow shaft, having inside diameter 0.8 times of the outside diameter. It is made of steel (S_{yt} = 390 N/mm^2) and the factor of safety is 4. Calculate the inside and outside diameters of the shaft.

6. A single plate clutch, effective on both sides, is required to transmit 30 kW at 3500 rpm. Determine the outer and inner diameters of frictional surface if the coefficient of friction is 0.255, ratio of diameters is 1.3 and the maximum pressure is not to exceed 0.1 N/mm^2. Also, determine the axial thrust to be provided by springs. Assume the theory of uniform wear.

SECTION-C

7. Design the longitudinal and circumferential joint for a boiler whose diameter is 2.4 meters and is subjected to a pressure of 1 N/mm^2. The longitudinal joint is a triple riveted butt joint with an efficiency of about 85% and the circumferential joint is a double riveted lap joint with an efficiency of about 70%. The pitch in the outer rows of the rivets is to be double than in the inner rows and the width of the cover plates is unequal. The allowable stresses are :

   σ_t = 75 MP*a* ; τ = 55 MP*a* ; σ_c = 120 MP*a*
   Assume that the resistance of rivets in double shear is 1.875 times that of single shear.
   Draw the complete joint.

8. Design a cranked lever for the following dimensions :

   Length of the handle : 300 mm

   Length of the lever arm : 400 mm

   Overhang of the journal : 100 mm

   The lever is operated by a single person exerting a maximum force of 350 N at a distance of l/3rd length of the handle from its free end. The permissible stresses may be taken as 60 MPa for lever material and 45 MPa for shaft material.

9. For supporting the travelling crane in a workshop, the brackets are fixed on steel columns as shown in figure below. The vertical face of the bracket is secured to a column by four bolts, in two rows (two in each row) at a distance of 50 mm from the lower edge of the bracket. Determine the size of the bolts if the permissible value of the tensile stress for the bolt material is 85 MPa.

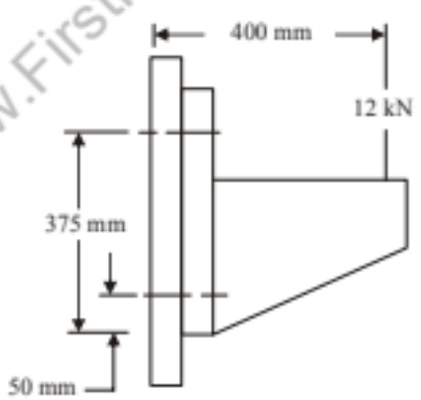

FIG.2

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.