Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER – VI (OLD).EXAMINATION – WINTER 2016

Subject Code: 162001 **Date: 26/10/2016**

Subject Name: Design of Mechanisms - I

Time: 10:30 AM to 01:00 PM **Total Marks: 70**

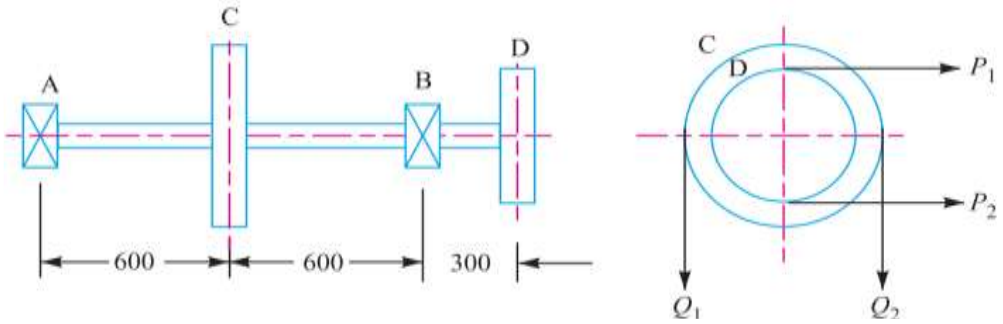
Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Design a knuckle joint to connect two mild steel bars under a tensile load of 25 KN. The allowable stresses are 65 MPa in tension,50 MPa in shear and 83 MPa in crushing.The standard diameter of solid rods are 20,22,24,26,28,30,32,34,36,38,40 mm.Give neat sketches of the joint , resisting areas and failures for knuckle pin. **10**

(b) On what parameters does the factor of safety depend ? Explain. **04**

Q.2 **(a)** A horizontal shaft AD supported in bearings at A and B and carrying pulleys at C and D is to transmit 75 kW at 500 r.p.m. from drive pulley D to off-take pulley C, as shown in following figure . Calculate the diameter of shaft. The data given is : P1 = 2 P2 (both horizontal), Q1 = 2 Q2 (both vertical), radius of pulley C = 220 mm, radius of pulley D = 160 mm, allowable shear stress = 45 MPa. **10**



(b) Explain ‘principal stresses’ with example. **04**

OR

(b) State any one theory of failure and explain giving example. **04**

Q.3 **(a)** A C-clamp, as shown in Fig 1, has trapezoidal threads of 12 mm outside diameter and 2 mm pitch. The coefficient of friction for screw threads is 0.12 and for the collar is 0.25. The mean radius of the collar is 6 mm. If the force exerted by the operator at the end of the handle is 80 N, find: 1. The length of handle; 2. The maximum shear stress in the body of the screw and where does this exist; and 3. The bearing pressure on the threads. **10**

(b) What is self locking and overhauling of power screw ? Explain. **04**

OR

Q.3 **(a)** Design a bell crank lever to apply a load of 5 kN (vertical) at the end A of an horizontal arm of length 400 mm. The end of the vertical arm C and the fulcrum B are to be fixed with the help of pins inside forked shaped supports. The end A **10**

is itself forked. Determine the cross-section of the arms and the dimensions of the pins. The lever is to have mechanical advantage of 4 with a shorter vertical arm BC. The ultimate stresses in shear and tension for the lever and pins are 400 MPa and 500 MPa respectively. The allowable bearing pressure for the pins is 12 N/mm2. Assume a factor of safety as 4 and the cross-section of the lever as rectangular with depth (b) as three times the thickness (t).

(b) What are the different types of levers used in machines ? Explain with neat sketches and application. **04**

Q.4 **(a)** Explain the generalized procedure of mechanical design with flow chart. **07**

(b) A long straight tube 76 mm internal diameter and 2.5 mm thick is subjected to an internal pressure of 5.6 MPa.Consider it as a thin cylinder.If the tube is subjected to a twisting moment of 70 Nm and elastic limit stress is 282 MPa,calculate the factor of safety using maximum principal stress theory and maximum shear stress theory. **07**

OR

Q.4 **(a)** How a material selection is followed for designing a product ? State the basis on which material is selected giving suitable example. **07**

(b) Design a helical compression spring which is to support a load of 550N at 160mm length and a load of 1050 N at 125mm length. The ends are to be close and ground. Take allowable shear stress of 500 MPa, factor of safety as 1.5 and D/d ratio of 7.5.Take G=8 x 104 MPa. **07**

Q.5 **(a)** Explain about stress concentration giving example and related sketches.Show the remedies also. **07**

(b) A wall bracket carries an inclined load P=10 KN at an angle of 300 with vertical as shown in Fig.2. The bracket is fixed to the vertical structure by 6 bolts spaced as shown.Calculate the diameter of the bolts if permissible tensile stress is 40 MPa. **07**

OR

Q.5 **(a)** What is meant by end fixity constants in case of Column design ? Explain giving related sketches and equations. **07**

(b) With neat sketch show how a turn buckle is designed for a given load and stresses.Show the sketches for failures. **07**

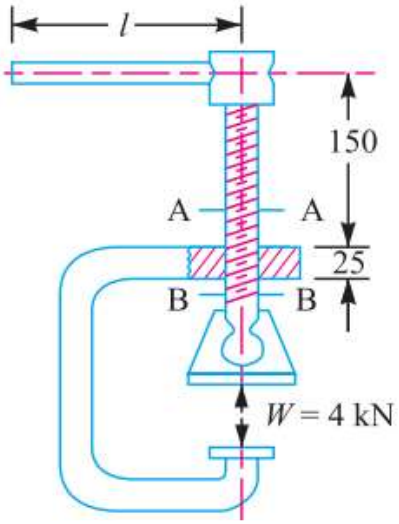


Fig.1,Q.3(a)

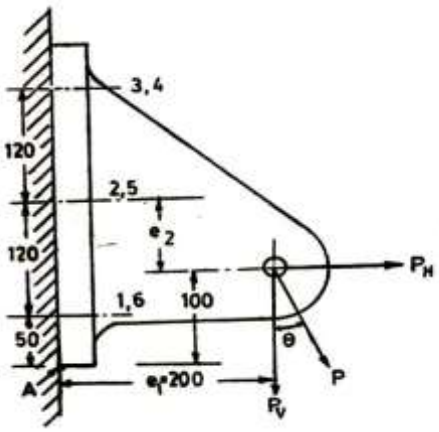


Fig.2. Q.5(b)

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