Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–III • EXAMINATION – SUMMER • 2014

Subject Code: 131902   **Date: 26-05-2014**

Subject Name: Machine Design and Industrial Drafting

Time: 02.30 pm - 05.30 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)** i. What is stress concentration? Explain methods to relieve stress concentration? **05**

ii. Explain any two stresses with simple sketches. **02**

(b) i. Explain hole-based and shaft based limit system with neat sketch. **04**

ii. Define limits, fits & upper deviation. **03**

Q.2 **(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. Standard diameter of solid bars are 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40 mm. Check failure of knuckle pin in shear, failure of rod end & forked end in tension, shearing and crushing. **10**

(b) Define factor of safety and state the important factors affecting the factor of safety. **04**

OR

(b) Explain caulking & fullering in terms of riveted joint. **04**

Q.3 **(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 Fig 1. 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 critical speed of shaft. **04**

OR

Q.3 **(a)** Design a cast iron protective type flange coupling to transmit 15 kW at 900 r.p.m. from an electric motor to a compressor. The service factor may be assumed as 1.70. The following permissible stresses may be used : **10**

Shear stress for shaft, bolt and key material = 40 MPa

Crushing stress for bolt and key = 80 MPa

Shear stress for cast iron = 8 MPa

Standard shaft diameter: 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40 mm.

Take number of bolts are 3.

(b) Explain different types of keys with its applications **04**

Q.4 **(a)** A C-clamp, as shown in Fig 2, 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. **08**

(b) What is self-locking and over-hauling of power screw? Why the efficiency of self-locking square threaded screw is less than 50%? **06**

OR

Q.4 (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 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/mm^2. 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). **10**

(b) Explain the basic types of levers with the help of neat sketches & examples. **04**

Q.5 (a) A bracket is welded to the side of a column and carries a vertical load P, as shown in Fig 3. Evaluate P so that the maximum shear stress in the 10 mm fillet welds is 80 MPa. **10**

(b) i. Why is a boss generally needed at the fulcrum of the levers. **02**
ii. Why is a separate nut preferable to an integral nut with body of a screw jack? **02**

OR

Q.5 (a) Explain circle, arc, rectangle, ellipse, polygon, offset and chamfer commands for Auto CAD drawing. **07**

(b) i. State the difference between shaft, axle and spindle. **03**
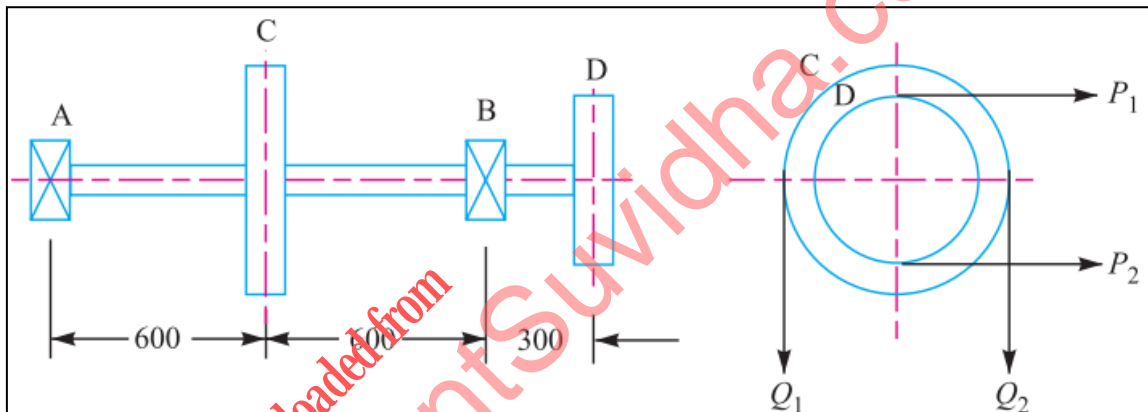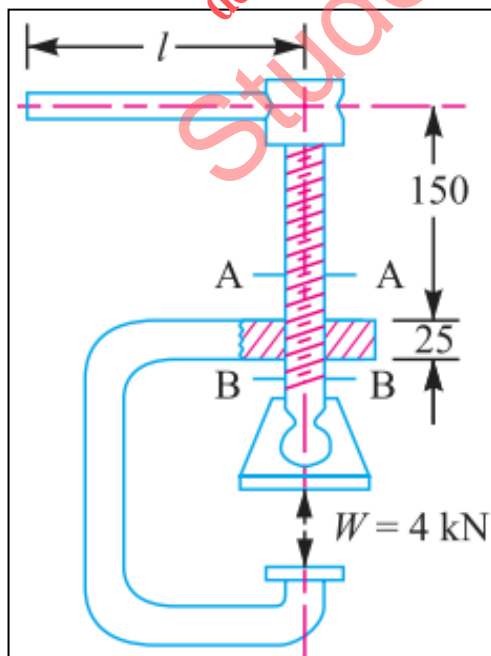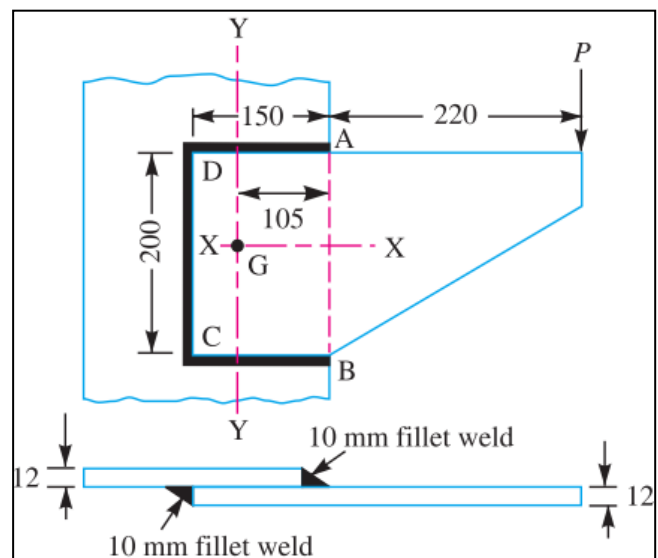ii. What are the advantages of welded joint over riveted joint? **04**

Fig. 1 (Que. 3 (a))

Fig. 2 (Que. 4 (a))

Fig. 3 (Que. 5 (a))

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