

Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

## GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. Sem-III Remedial Examination March 2010

Subject code: 131902

Subject Name: Machine Design and Industrial Drafting

Date: 10 / 03 / 2010

Time: 03.00 pm – 06.00 pm

Total Marks: 70

### Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Use drawing sheet for drawing work.

- Q.1 (a)** Answer the following. 06
- (i) Differentiate between rigid and flexible coupling.
- (ii) What is critical speed of shaft?
- (iii) Write types of failure in riveted joint.
- (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
- (c)** What is factor of safety? List the factors to be considered for deciding the magnitude of factor of safety? 02
- Q.2 (a)** A wall bracket with rectangular cross section is shown in **Fig.-1**. The depth of the cross-section is twice of the width. The force P acting on the bracket at  $30^\circ$  to the horizontal is 5 KN. The bracket is made gray cast iron FG 200 ( $S_{ut} = 200 \text{ N/mm}^2$ ) and factor of safety = 3.5 Determine the dimensions of the cross section of the bracket. 07
- (b)** A shaft of rectangular cross-section is welded to a support by means of fillet welds, as shown in **Fig.-2**. Determine the size of the welds, if the permissible shear stress in the weld is limited to  $75 \text{ N/mm}^2$ . 07
- OR**
- (b)** Design a knuckle joint to connect two rods subjected to tensile force of 50 KN. The rods and pin are made of plain carbon steel 30C8. The permissible stresses are  $\sigma_t = \sigma_c = 80 \text{ MPa}$  and  $\tau = 40 \text{ MPa}$ . 07
- Q.3 (a)** The lay shaft driven by pulley 'D' from an electric motor is shown in **Fig.-3**. Another belt drive from pulley 'C' is running a compressor. The permissible shear stress of the shaft material is  $85.5 \text{ N/mm}^2$ . The belt tensions for pulley C are  $T_3 = 1500 \text{ N}$ ,  $T_4 = 600 \text{ N}$ . The shock and fatigue factors are:  $K_b = 1.75$  and  $K_f = 1.25$ . The ratio of belt tension for pulley 'D' = 3.5, Diameter of pulley C = 150mm, Diameter of pulley D = 480mm. Determine the diameter of the shaft. 10
- (b)** Show that square key is equally strong in shearing and crushing. 04
- OR**
- Q.3 (a)** Design a protective type cast iron flange coupling for a shaft transmitting 15 KW power at a speed of 720 rpm. The permissible stresses are:  
For the shafts, keys, and bolts material,  
Permissible tensile stress ( $\sigma_t$ ) = 133.33 MPa 10

Permissible compressive stress ( $\sigma_c$ ) = 200 MPa

Permissible shear stress ( $\tau$ ) = 66.67 MPa

For flanges material,

Permissible shear stress ( $\tau$ ) = 16.67 MPa

The keys have square cross-section.

- (b)** What are the basic functions of the key? What is splined shaft? **04**
- Q.4 (a)** A triple threaded power screw, used in a screw jack, has a nominal diameter of 50 mm and a pitch of 8 mm. The threads are square and the length of nut is 48 mm. The screw jack is used to lift a load of 7.5 KN. The coefficient of friction at the threads is 0.12 and collar friction is negligible. Calculate: (i) the principal shear stress in the screw body, (ii) the transverse shear stresses in the screw and the nut, (iii) the unit bearing pressure. State whether the screw is self-locking or not. **10**
- (b)** What is stress concentration? How will you reduce the stress concentration in keyway shaft and in threaded parts? **04**

**OR**

- Q.4 (a)** A bell crank lever is to be designed to raise a load of 5KN at the short arm end. The arm lengths are 150 mm and 500 mm. The permissible stresses for lever and pin materials in shear and tension are 60 MPa and 90 MPa respectively. The bearing pressure on the pin is to be limited to 12 MPa. Assume the lever cross section as  $t \times 4t$  and fulcrum pin length as 1.25 times pin diameter **10**
- (b)** Why cotter is provided with taper? Write the advantages of cotter joint? **04**
- Q.5 (a)** Using proportionate dimensions draw a sectional front view of stuffing box. **07**
- (b)** What is tolerance and transition fit? **02**
- (c)** Write the use of the following commands **05**  
(1) Fillet (2) Explode (3) Scale (4) Array (5) Trim.

**OR**

- Q.5 (a)** Using proportionate dimensions draw a half-sectional front view of Plummer block. **07**
- (b)** Explain the machining symbol with all parameter. **02**
- (c)** Write the sequence of AutoCAD commands to be used to draw FV and TV of a hexagonal nut M20x2. **05**

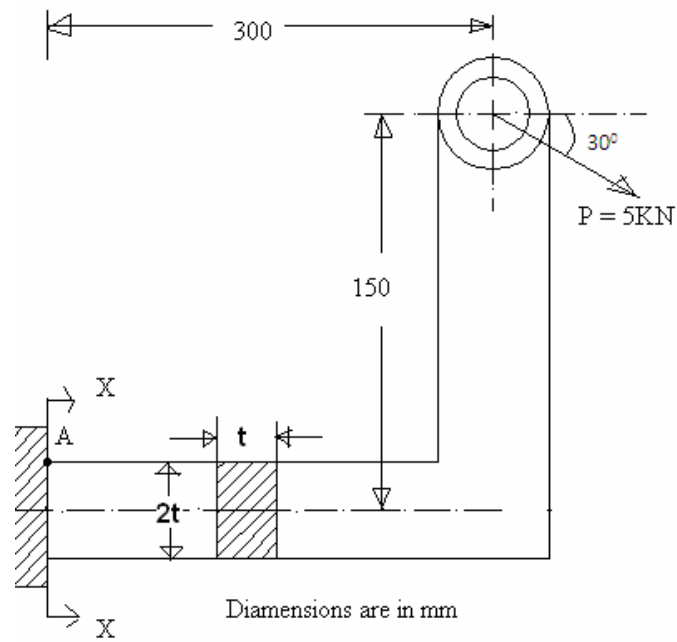


Fig-1 (Q.2 - a)

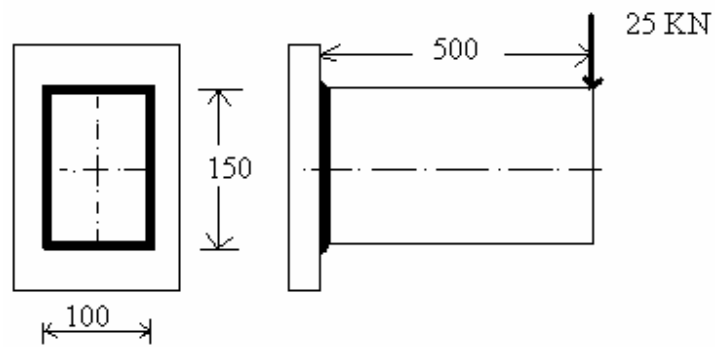


Fig-2 (Q.2 - b)

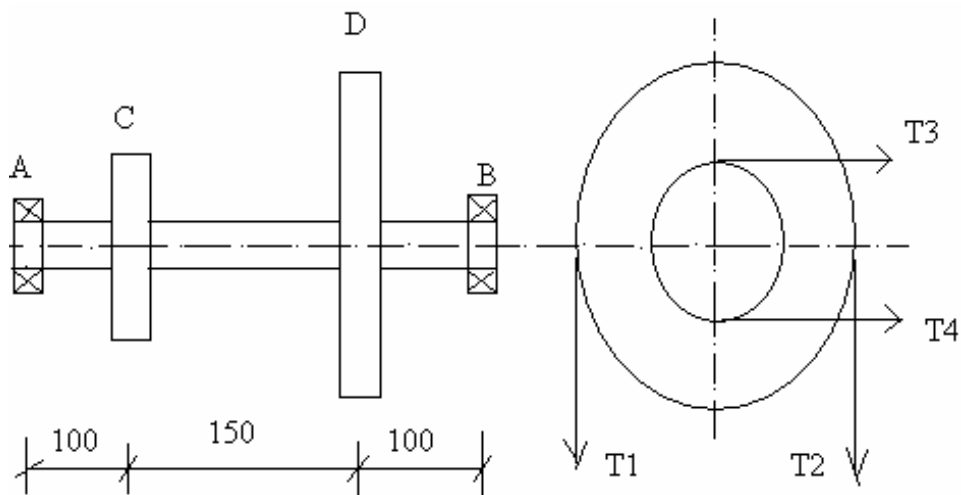


Fig-3 (Q.3 - a)