

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV (NEW) EXAMINATION – WINTER 2021****Subject Code:2141907****Date:04/01/2022****Subject Name:Machine Design & Industrial Drafting****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.
4. Simple and non-programmable scientific calculators are allowed.

- | | MARKS |
|---|-----------|
| Q.1 (a) Define factor of safety. Why it is required? | 03 |
| (b) What is meant by a coupling? Differentiate between flexible coupling and rigid coupling. | 04 |
| (c) Discuss design procedure of Knuckle joint | 07 |
| Q.2 (a) How are the hollow shafts are beneficial over the solid shafts? | 03 |
| (b) Explain with neat sketch three basic types of lever stating their practical examples | 04 |
| (c) Derive Rankine's formula for buckling of column. | 07 |
| OR | |
| (c) A plate 75 mm wide and 10mm thick is joined with another steel plate by means of single transverse and double parallel fillet welds as shown in Figure 1. The joint is subjected to a maximum tensile force of 55kN. The permissible tensile and shear stress in the weld material are 70 and 50N/mm ² respectively. Determine the required length of each parallel fillet weld. | 07 |

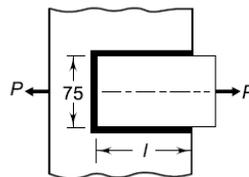


Figure 1

- | | |
|---|-----------|
| Q.3 (a) Differentiate between beam and column | 03 |
| (b) Define Pitch, Lead, Nominal diameter and Core diameter for power screw. | 04 |
| (c) Figure 2 shows a hollow transmission shaft having inside diameter 0.6 times the outside diameter is made of plain carbon steel 40C8 ($S_{yt} = 380/\text{mm}^2$) and factor of safety is 3. A belt pulley, 1000 mm in diameter, is mounted on the shaft, which overhangs the left hand bearing by 250mm. The belts are vertical and transmits power to the machine shaft below the pulley. The tension on the tight and slack side of the belt are 3kN and 1kN respectively and the weight of the pulley is 500N. The angle of wrap of the belt on pulley is 180°. Calculate the inside and outside diameters of the shaft. | 07 |

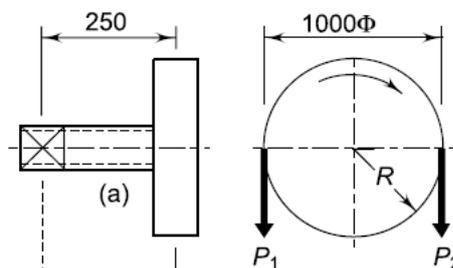


Figure 2

OR

- Q.3** (a) What is fit? Explain various types of fit with neat sketches **03**
(b) Derive the design equation for shaft subjected to twisting moment only **04**
(c) A brake band attached to the hinge by means of a riveted joint is shown in Figure 3. Determine the size of the rivet needed for a load of 10kN. Also determine the width of the band. The permissible stresses for the band and the rivets in tension, shear and compression are 80, 60 and 120 N/mm² respectively. Assume margin (m) = 1.5d, transverse pitch 'p_t' = p. **07**

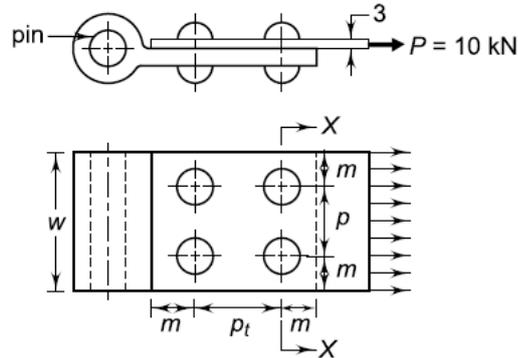


Figure 3

- Q.4** (a) Explain terminology of power screw with neat sketch. **03**
(b) Explain different types of keys used in shaft coupling **04**
(c) Derive the expression for torque required to lift a load 'W' using screw jack with a neat sketch **07**

OR

- Q.4** (a) What is Caulking and Fullering as related to riveted joints? **03**
(b) State and explain the Castigliano's theorem. Write its application **04**
(c) It is required to design a knuckle joint to connect two circular rods subjected to an axial tensile force of 50kN. Design the joint and specify the dimensions. The material for both the rods and pin is 30C8 steel with S_{yt} = 400 N/mm². Consider that yield strength in compression is same as yield strength in tension. Assume a factor of safety of '5'. **07**
- Q.5** (a) Give symbols for flatness, cylindricity, symmetry and straightness **03**
(b) What is self-locking of power screw? Explain **04**
(c) Explain three basic types of levers with practical examples **07**

OR

- Q.5** (a) Differentiate between shaft, spindle and axle **03**
(b) What is stress concentration and discuss the method to relieve the stress concentration with neat sketches. **04**
(c) A machine vice shown in Figure 4 has single start square thread with 22 mm nominal diameter with 5mm pitch. The outer and inner diameters of the friction collar are 55mm and 45mm respectively. The coefficient of friction for thread and collar are 0.15 and 0.17 respectively. The machinist can comfortably exert a force of 125N on the handle at a mean radius of 150 mm. Assuming uniform wear for the collar. Calculate. **07**
i) The clamping force developed between the jaws
ii) The overall efficiency of the clamp

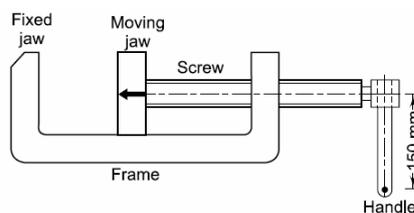


Figure 4
