

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-IV (NEW) EXAMINATION – SUMMER 2021****Subject Code:3141907****Date:06/09/2021****Subject Name:Fundamentals of Machine Design****Time:02:30 PM TO 05:00 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.

- Q.1** (a) Define strain and explain different types of strain **03**  
 (b) List the different types of stresses considered in machine design. And explain tensile and shear stress. **04**  
 (c) Give the different theories of failures and explain maximum principal stress theory in detail with its region of safety. **07**
- Q.2** (a) Explain limits, fits and tolerance. **03**  
 (b) Explain the parallel axis theorems for moment of inertia. **04**  
 (c) Write a short note on Knuckle joint with its design procedure. **07**
- OR**
- (c) An offset link subjected to a force of 25 kN is shown in fig.1. It is made of grey cast iron FG300 ( $S_{ut}=300$  MPa) and FOS is 3. Determine the dimensions of cross-section of the link. **07**

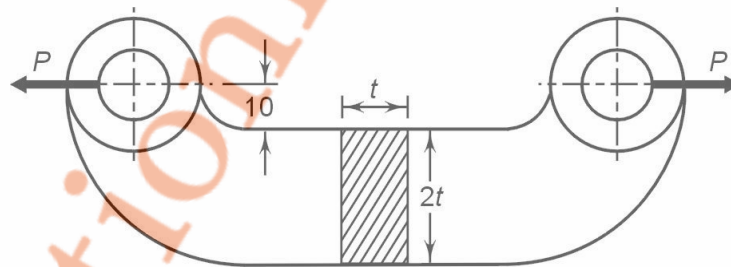


Fig.1

- Q.3** (a) How the hollow shafts are beneficial over the solid shaft? **03**  
 (b) List the different types of shafts and write the material properties required for a shaft. **04**  
 (c) What is modulus of elasticity, modulus of rigidity, Poisson's ratio. Give relation between them. **07**

**OR**

- Q.3** (a) Explain Aesthetic look and Ergonomics consideration in machine design. **03**  
 (b) Write a difference between shaft, spindle and axle. **04**  
 (c) Design a shaft to transmit power from an electric motor to a lathe head stock through a pulley by means of a belt drive. The pulley weighs 200 N and is located at 300 mm from the centre of the bearing. The diameter of the pulley is 200 mm and the maximum power transmitted is 1 kW at 120 r.p.m. The angle of lap of the belt is  $180^\circ$  and coefficient of friction between the belt and the pulley is 0.3. The shock and fatigue factors for bending and twisting are 1.5 and 2.0 respectively. The allowable shear stress in the shaft may be taken as 35 MPa. **07**

- Q.4** (a) Discuss torsion in solid shaft and hollow shaft. **03**  
(b) A hollow circular column is having external diameter 85 mm and internal diameter 65 mm. The effective length of column is 3m. Calculate slenderness ratio of column. **04**  
(c) Explain in detail Rankine's formula for the column. **07**

**OR**

- Q.4** (a) Derive the equation of efficiency of square threaded screws. **03**  
(b) What is a key ? Discuss the different types of keys. **04**  
(c) Give the detail design procedure of Screw Jack . **07**

- Q.5** (a) Explain different types of welded joints with neat sketches. **03**  
(b) What are the advantages and disadvantages of threaded joints. **04**  
(c) A power screw having double start square threads of 25 mm nominal diameter and 5 mm pitch is acted upon by an axial load of 10 KN. The outer and inner diameters of screw collar are 50 mm and 20 mm respectively. The coefficient of thread friction and collar friction may be assumed as 0.2 and 0.15 respectively. The screw rotates at 12 r.p.m. Assuming uniform wear condition at the collar and allowable thread bearing pressure of 5.8 N/mm<sup>2</sup>, find: 1. the torque required to rotate the screw; 2. the stress in the screw; and 3. the number of threads of nut in engagement with screw. **07**

**OR**

- Q.5** (a) What is overhauling and self locking of screws? **03**  
(b) What is stress concentration? Discuss the methods to reduce stress concentration **04**  
(c) Derive the equation for torque required to lower the load by square threaded screw. **07**

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