

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-VI • EXAMINATION – WINTER • 2014

Subject Code: 162001**Date: 26-11-2014****Subject Name: Design of Mechanism – I****Time: 02:30 pm - 05:00 pm****Total Marks: 70****Instructions:**

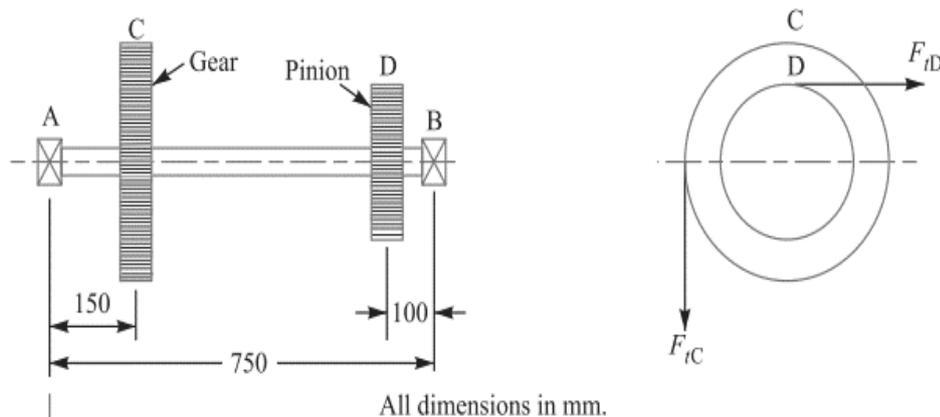
1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** What are the general considerations in machine design? **07**
(b) What do you understand by preferred numbers and standardization? Explain fully. **07**

- Q.2 (a)** Explain the bearing pressure with suitable examples. The piston rod of a steam engine is 50 mm in diameter and 600 mm long. The diameter of the piston is 400 mm and the maximum steam pressure is 0.9 N/mm^2 . Find the compression of the piston rod if the Young's modulus for the material of the piston rod is 210 kN/mm^2 . **07**
(b) A vertical two start square threaded screw of a 100 mm mean diameter and 20 mm pitch supports a vertical load of 18 kN. The axial thrust on the screw is taken by a collar bearing of 250 mm outside diameter and 100 mm inside diameter. Find the force required at the end of a lever which is 400 mm long in order to lift the load. Use uniform wear theory to calculate collar friction torque. The coefficient of friction for the vertical screw and nut is 0.15 and that for collar bearing is 0.20. **07**

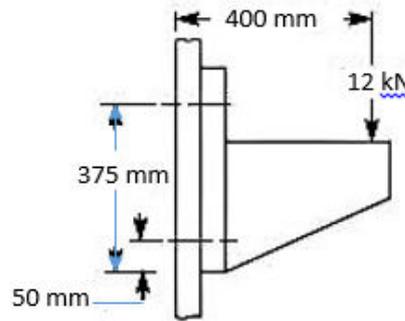
OR

- (b)** Why self-locking of power screw is required? Show that the efficiency of self-locking screws is less than 50 percent. **07**
- Q.3 (a)** Distinguish clearly, giving examples between pin, axle and shaft. A steel solid shaft transmitting 15 kW at 200 r.p.m. is supported on two bearings 750 mm apart and has two gears keyed to it. The pinion D having 150 mm diameter is located 100 mm to the left of the right hand bearing and delivers power horizontally to the right. The gear C having 500 mm diameter is located 150 mm to the right of the left hand bearing and receives power in a vertical direction from below. Using an allowable stress of 54 MPa in shear, determine the diameter of the shaft. **14**

**OR**

- Q.3 (a)** Define Factor of safety. Explain in detail how it differs for ductile materials and brittle materials. Mention various criteria for selection of factor of safety. **07**
(b) Explain the step wise procedure to design the turn buckle joint. **07**

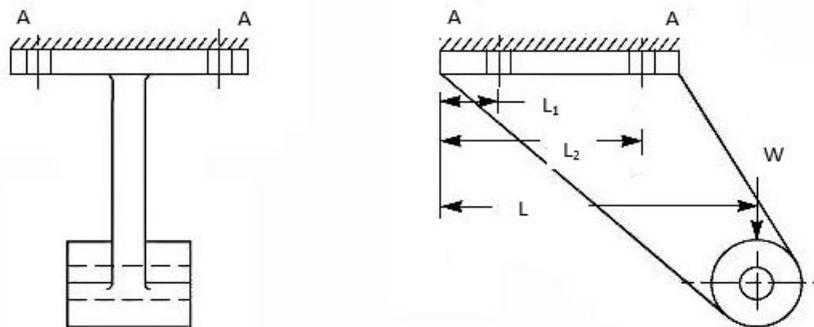
- Q.4 (a)** For supporting the travelling crane in a workshop, the brackets are fixed on steel columns as shown in Figure. The maximum load that comes on the bracket is 12 kN acting vertically at a distance of 400 mm from the face of the column. The vertical face of the bracket is secured to a column by four bolts, in two rows (two in each row) at a distance of 50 mm from the lower edge of the bracket. Determine the size of the bolts if the permissible value of the tensile stress for the bolt material is 84 MPa. 07



- (b)** What is principal stresses, explain in detail with examples. What do you mean by hoop stress and longitudinal stress 07

OR

- Q.4 (a)** A bracket, as shown in figure supports a load of 30 kN by four bolts. Determine the size of bolts, if the maximum allowable tensile stress in the bolt material is 60 MPa. The distance are: $L_1 = 80\text{mm}$, $L_2 = 250\text{mm}$, and $L = 500\text{mm}$. 07



- (b)** State the Euler's formula. What are the assumptions used to derive this formula? Mention the limitations of Euler's formula. 07

- Q.5 (a)** Explain mechanical advantage in context of lever. Mention the various types of levers by stating their applications. Explain the need of boss with suitable example. 07

- (b)** Design a helical compression spring for a maximum load of 1000 N for a deflection of 25 mm using the value of spring index as 5. The maximum permissible shear stress for spring wire is 420 MPa and modulus of rigidity is 84 kN/mm². 07

OR

- Q.5 (a)** A hollow shaft is required to transmit 600 kW at 110 r.p.m., the maximum torque being 20% greater than the mean. The shear stress is not to exceed 63 MPa and twist in a length of 3 metres not to exceed 1.4 degrees. Find the external diameter of the shaft, if the internal diameter to the external diameter is 3/8. Take modulus of rigidity as 84 GPa. 07

- (b)** A beam of uniform rectangular cross-section is fixed at one end and carries an electric motor weighing 400 N at a distance of 300 mm from the fixed end. The maximum bending stress in the beam is 40 MPa. Find the width and depth of the beam, if depth is twice that of width. 07
