

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-III • EXAMINATION – WINTER • 2014****Subject Code: 130103****Date: 18-12-2014****Subject Name: Analysis of Mechanisms and Machine Elements****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)** Define following terms **07**
- | | |
|----------------------------|----------------------|
| (i) Element | (ii) Kinematic joint |
| (iii) Kinematic Chain | (iv) Mechanism |
| (v) Inversion of mechanism | (vi) Machine |
| (vii) Degree of freedom | |
- (b)** Explain stress-strain diagram for ductile material. **07**
- Q.2 (a)** Define following stresses **07**
- | | |
|--------------------------|-----------------------|
| (i) Tensile stress | (ii) Shear stress |
| (iii) Compressive stress | (iv) Bearing stress |
| (v) Crushing stress | (vi) Principle stress |
| (vii) Ultimate stress | |
- (b)** A hydraulic press exerts a load of 3000 kN. This load is carried by two steel rods, supporting the upper head of press. If the safe stress is 80 MPa and $E=200 \times 10^3 \text{ N/mm}^2$, find 1. Diameter of the rods and 2. Extension in each rod in a length of 3 m **07**
- OR**
- (b)** The piston rod of a steam engine is 60 mm in diameter and 650 mm long. The diameter of piston is 420 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 piston is $215 \times 10^3 \text{ MPa}$. **07**
- Q.3 (a)** A hollow shaft of 50 mm outer diameter and 30 mm inner diameter is subjected to a twisting moment of 125 N-m, simultaneously, it is subjected to an axial thrust of 12 kN and bending moment of 80 N-m. Calculate the maximum compressive and shear stresses. **07**
- (b)** A shaft is transmitting 100 kW at 200 rpm. If the allowable shear stress in the material is 75 MPa, find the suitable diameter of the shaft. The shaft is not to twist more than 1° in a length of 3 m. take $C = 85 \text{ GPa}$. **07**
- OR**
- Q.3 (a)** A shaft is subjected to a bending load of 5 kN, pure torque of 1200 N-m and axial pulling load of 17 kN. Calculate stresses at point A and B (Fig. 1). **07**
- (b)** A steel shaft 40 mm in diameter and 1.5 m length held rigidly at one end has a hand wheel 500 mm in diameter keyed to other end. The modulus of rigidity of steel is 80 GPa. Calculate (i) required tangential load to the rim of the wheel to produce torsional shear of 60 MPa, and (ii) angle of twist when this load is applied. **07**
- Q.4 (a)** For the given configuration of four bar chain mechanism as shown in Fig. 2, find out instantaneous velocity of Point C and point M. **07**
- (b)** For the given configuration of four bar chain mechanism as shown in Fig. 2, find out instantaneous acceleration of Point C. **07**
- OR**

- Q.4 (a) For the given configuration of slider-crank mechanism as shown in Fig. 3, find out instantaneous velocity of Slider S and point P of connecting rod. 07
- (b) For the given configuration of slider-crank mechanism as shown in Fig. 3, find out instantaneous acceleration of Slider S. 07
- Q.5 (a) Classify different types of riveted joints. And explain why butt joint with single cover is stronger than lap joint for the same plate thickness and riveting configuration. 07
- (b) A double riveted double cover butt joint in plates 22 mm thick is made with 28 mm diameter rivets at 120 mm pitch. Permissible stresses are: tensile stress = 120 MPa, shear stress = 100 MPa and crushing stress = 150 MPa. Find the efficiency of joint, taking the strength of the rivet in double shear as twice than that of single shear. 07
- OR
- Q.5 (a) Define following terms: 07
- (i) spindle (ii) axle (iii) shaft (iv) thin shell pressure vessel (v) thick shell pressure vessel (vi) double riveted joint (vii) caulking and fullering
- (b) A double riveted lap joint with zig-zag riveting is to be designed for 15 mm thick plates. Assume tensile stress = 80 MPa, shear stress = 60 MPa and crushing stress = 120 MPa. State how the joint will fail and find efficiency of the joint. Take back-pitch = $0.33p + 0.67d$. 07


