Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III • EXAMINATION – WINTER 2013

Subject Code: 130103 Date: 26-11-2013

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)** The load on a bolt consists of an axial pull of 10 kN together with a transverse shear force of 5kN. Find the diameter of bolt required according to (1) Maximum principle stress theory (2) Maximum shear stress theory. **07**

(b) Define the following terms: **07**

(i) Kinematic link (ii) Kinematic pair (iii) Degree of freedom (iv) Kinematic chain (v) Inversion (vi) Kinematics (vii) Rigid body.

Q.2 **(a)** Give the classification of kinematic pairs with neat sketches. **07**

(b) With help of neat sketches explain inversions of four-bar chain. **07**

OR

(b) Define the following terms: **07**

(a) Impact stress (b) Volumetric strain (c) Bulk modulus (d) Poission's ratio (e) Principle stress (f) Factor of safety (g) Bearing stress.

Q.3 **(a)** Explain the following terms: **06**

(a) Keneddy's theorem (b) Velocity of rubbing (c) Corioli's component of acceleration.

(b) In the mechanism shown in figure 1, the crank O_1A rotates at a uniform speed of 650 rpm. Determine the linear velocity of the slider C and the angular speed of the link BC. O_1A = 30 mm, AB= 45 mm, BC = 50 mm, O_2B= 65 mm and O_1O_2=70 mm. **08**

OR

Q.3 **(a)** In a pin jointed four bar mechanism as shown in figure 2, AB= 300 mm, BC = CD = 360 mm, and AD= 600 mm. The angle BAD = 60^0. The crank AB rotates uniformly at 1000 rpm in clockwise direction. Locate all the instantaneous centers and find the angular velocity of the link BC. **08**

(b) Explain the Klein's construction method with diagram for finding velocity and acceleration of the reciprocating parts in engines. **06**

Q.4 **(a)** Explain different modes of failures of a riveted joint with neat sketches. **07**

(b) A double riveted, double cover butt joint is used to connect two plates of thickness 15 mm each, with the help of rivets with 25 mm diameter. If the strength of the rivets in shear or bearing whichever is less is equal to the tearing strength of the plate, then determine the pitch for the rivets. What is the efficiency of the joint? What is thickness of the cover plates? Take allowable tearing strength, bearing strength and shear stress for rivet material are 100 MPa, 120 MPa and 80 MPa respectively. **07**

OR

Q.4 **(a)** The piston rod of a hydraulic cylinder exerts an operating force of 10 kN. The friction due to piston packing and stuffing box is equivalent to 10% of the operating force. The pressure in the cylinder is 10 MPa. The cylinder is made of cast iron FG 200 and the factor of safety is 5. Determine the diameter and the thickness of the cylinder. **07**

(b) Draw the stress distribution diagrams for thick cylindrical shell subjected to an internal pressure. Write down the different equations used for designing thick cylindrical shell. **07**

Q.5 **(a)** A welded connection as shown in figure 3 is subjected to an eccentric force of 7.5 kN. Determine the size of weld if the permissible shear stress in weld is 100 MPa. **07**

(b) A solid steel shaft is used to transmit 18 kW at 180 rpm. The ultimate shear stress for the steel may be taken as 350 MPa and a factor of safety as 7. Find the diameter of solid shaft. If a hollow shaft is used in place of the solid shaft, Find the inside and outside diameter when the ratio of inside to outside diameter is 0.5. **07**

OR

Q.5 **(a)** A horizontal gas engine running at 210 rpm has a bore of 220 mm and stroke of 440 mm. The connecting rod is 924 mm long and reciprocating parts weight 20 kg. When the crank has turned through angle of 30^0 from IDC, the gas pressure on the cover and the crank sides are 500 kN /m^2 and 60 kN /m^2 respectively. Diameter of piston rod is 40 mm. Determine: (a) Turning moment on the crankshaft (b) thrust on the bearing (3) acceleration of the flywheel which has a mass of 8 kg and radius of gyration of 600 mm while the power of engine is 22 kW. **07**

(b) Explain in detail: (i) D'Almbert's principle (ii) Principle of virtual work. **07**

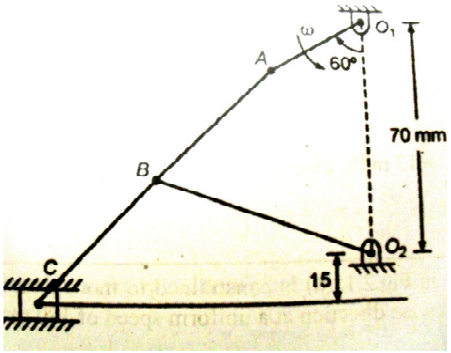

Figure -1

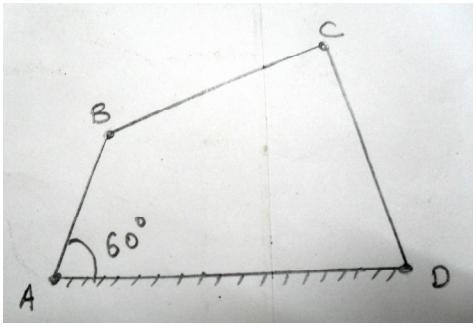

Figure -2

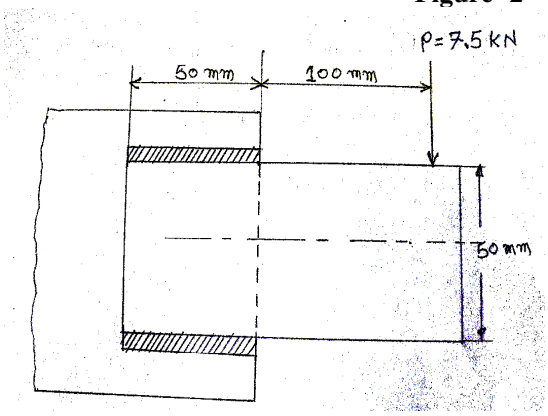

Figure -3

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