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Question Paper Code : R 3769

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Third Semester

Mechanical Engineering

ME 232 — KINEMATICS OF MACHINES

(Common to Mechatronics Engineering)

(Regulation 2001)

Time : Three hours   Maximum : 100 marks

A3-Size drawing sheet is to be provided.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State atleast one similarity and one difference between a Helical pair and cylindrical pair.

2. Define Kinematics chain.

3. Briefly explain the types of instantaneous centres.

4. What is the condition for occurance of coriolis acceleration in kinematics chain?

5. Sketch any four types of follower with cam arrangement.

6. State the advantages of tangent cam and sketch it.

7. State any two advantages of involute gears.

8. Define the following terms in a super gear tooth
    (a) Module.
    (b) Pressure angle.

9. State the laws of dry or solid friction.

10. What is the condition for self-locking in screws?

PART B — (5 × 16 = 80 marks)

11. (a) Sketch slider crank chain and its various inversions stating actual machines in which these are used in practice. (16)

Or

(b) (i) Sketch and explain the inversion of a 4 bar mechanism, all the four pairs are turning pairs. (6)

(ii) Sketch and explain any two types of straight line motion generating mechanism. (10)

12. (a) The following date refer to the lengths of links of a six-link mechanism in which the rotary motion of the input link 2 is transformed to the horizontal linear motion of the output slider 6.

Fixed link 1, A_0B_0 = 60 mm

Input link 2, A_0A = 25mm

Coupler link 3, AB = 85 mm

Follower link 4, BB_0 = 55 mm

Connecting rod 5, CD = 60 mm.

The pin joint C is at the centre of link BB_0. The horizontal line of stroke of the slider passes through the fixed link pivots A_0 and B_0. < B_0A_0A is 60°. In this position,

(i) Sketches the mechanism and indicate the data. (3)

(ii) Draw the velocity diagram and determine the linear velocity of the slider, if the input link constant speed is 2 rad/ sec. clockwise. (5)

(iii) Draw the acceleration diagram and determine the linear acceleration of the slider, which is connected at one end of the connecting rod, CD. (8)

Or

(b) (i) A four-bar mechanism has the following link lengths in mm: Input, A_0A = 25, coupler, AB = 70, Output, B_0B = 45, and frame, A_0B_0 = 60. Coupler point A is above and B is below the horizontal frame link A_0B_0, respectively. When the input link is an angular position of 105° counter clockwise from the frame link, draw the four bar mechanism and locate all the instantaneous centres. If the input link rotates with a constant angular velocity of 2.5 rad/sec clockwise, determine the linear velocity of B of the output link and the angular velocity of the output link. (10)

(ii) What is meant by coincident points in mechanisms? State their significance. (6)

13. (a) (i) Classify with neat sketches the cam followers according to their shape, location and motion. State also their advantages, if any, with respect to other followers. (9)

(ii) Sketch neatly the displacement, velocity and acceleration curves of a cycloidal motion follower. Why is it superior over other motion curves? (4)

(iii) Briefly explain the undercutting in cam mechanisms. (3)

Or

(b) Draw the profile of a cam for operating the exhaust valve of an oil engine. It is required to give equal uniform acceleration and retardation during opening and closing of the valve each of which corresponds to 60° of cam rotation. The valve must remain in the fully open position for 20° of cam rotation.

The lift of the valve is 37.5 mm and the least radius of the cam is 40 mm. The follower is provided with roller of radius 20 mm and its line of stroke passes through the axis of the cam. (16)

14. (a) (i) State the advantages over spur gear over helical gear. (4)

(ii) Which type of gear pair is to be used to get very large speed reduction in a single stage? State the reason. (4)

(iii) State and prove the fundamental law of gearing. (8)

Or

(b) A pair of 20° full depth involute spur gears having 30 and 50 teeth respectively of module 4 mm are in mesh. The smaller gear rotates at 1000 r.p.m. Determine : (i) Sliding velocities at engagement and at disengagement of pair of a teeth and (ii) Contact ratio. (16)

15. (a) The mean diameter of the screw jack having pitch of 10 mm is 50 mm. A load of 20 kN is lifted through a distance of 170 mm. Find the work done in lifting the load and efficiency of the screw jack when

(i) The load rotates with screw.

(ii) The load rests on the loose head which does not rotate with the screw

(iii) The external and internal diameters of the bearing surface of the loose head are 60 mm, and 10 mm respectively. The coefficient of friction for the screw as well the bearing surface may be taken as 0.08

Or

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(b) (i) Determine the equation to determine the torque required to lift the load by screw jack. (8)

(ii) A square threaded bolt of root diameter 22.5 mm and pitch 5 mm is tightened by screwing nut whose mean diameter of bearing surface is 50 mm. If coefficient of friction for nut and bolt is 0.1 and for nut and bearing surface 0.16, find the force required at the end of a spanner 500 mm long when the load on the bolt is 10 kN. (8)

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