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B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2007.

Fourth Semester

(Regulation 2004)

Mechanical Engineering

ME 1252 — KINEMATICS OF MACHINERY

(Common to B.E. (Part-Time) Third Semester Regulation 2005)

Time : Three hours Maximum : 100 marks

A3 size drawing sheet will be issued, if required.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Enumerate the difference between a Machine and a Structure.

2. List out the inversions of a double slider crank chain.

3. Define rubbing velocity.

4. Define Corioli's component of acceleration.

5. State the expressions for maximum velocity and acceleration of a follower moves with Cycloidal motion

6. What is prime circle of a cam? What is the radial distance between the prime circle and base circle for a cam with knife edge follower?

7. What is axial pitch of a helical gear?

8. List out the applications of epicyclic gear train.

9. What is the condition of maximum efficiency of a Screw jack?

10. What are the advantages of wire ropes over fabric ropes?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Define transmission angle of a four bar linkage. What is the effect of transmission angle on mechanical advantage? (4)

(ii) Briefly explain various types of constrained motions. (4)

(iii) Illustrate a crank and slotted lever mechanism as an inversion of single slider crank chain. Deduce an expression for length of stroke in terms of link lengths. (8)

Or

(b) Analytically perform the displacement analysis of a four bar mechanism.

12. (a) The driving crank AD of the quick-return mechanism, as shown in Fig. 12. (a). revolves at a uniform speed of 200 r.p.m. Find the velocity and acceleration of the tool-box R, in the position shown, when the crank makes an angle of 60° with the vertical line of centers PA. What is the acceleration of sliding of the block at B along the slotted lever PQ?

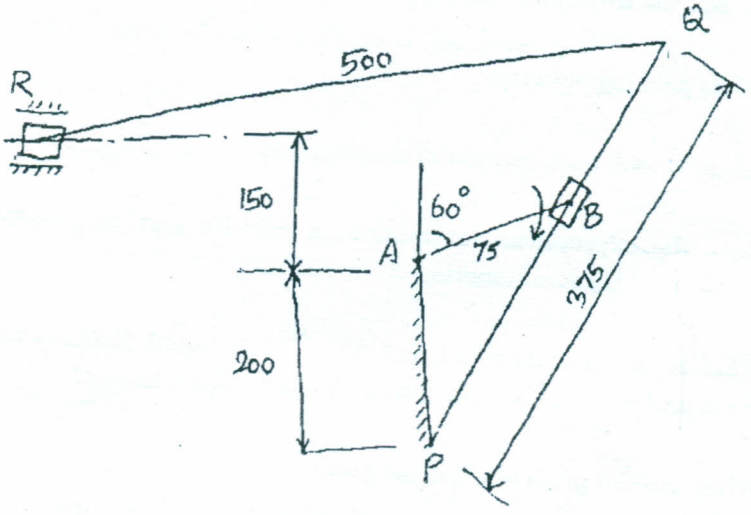

Fig. 12 (a)

Or

(b) For the toggle mechanism as shown in Fig. 12 (b), the slider D is constrained to move along horizontal direction. The crank rotates at 180 rpm. The dimension of various links are as follows. OA = 180 mm ; CB = 240 mm; AB = 360 mm; BD = 540 mm. For the given configuration determine the velocity of the slider and angular velocity of links AB, BC and BD. Also determine the linear acceleration of the slider D.

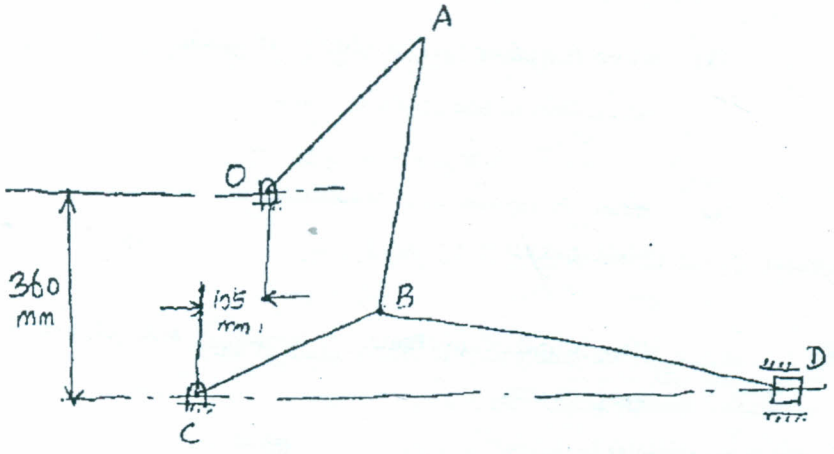

Fig. 12 (b)

13. (a) A cam with a minimum radius of 25 mm, rotating in clockwise direction with a uniform speed of 100 rpm is to be designed to give the motion for a roller follower as follows.

(i) To raise through 50 mm during 120° rotation of cam with SHM.

(ii) Fully raised through next 30°

(iii) To lower during next 60° with UAUR

(iv) Dwell for the remaining period.

Draw the profile of the cam when the line of stroke of the follower is offset by 15 mm from the axis of the camshaft.

Or

(b) Construct a tangent cam and mention the important terminologies on it. Also derive the expression for displacement, velocity, acceleration of a reciprocating roller follower when the roller has contact with the nose.

14. (a) (i) An epicyclic gear train is shown in the Fig. 14 (a). How many revolutions does the arm makes,

(1) when A makes one revolution in clockwise and D makes $\frac{1}{2}$ a revolution in the opposite sense

(2) when A makes one revolution in clockwise and D remains stationary.

The number of teeth in gears A and D are 40 and 90 respectively. (10)

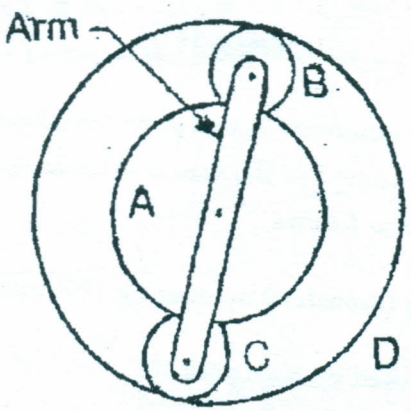

Fig 14 (a)

(ii) What is reverted gear train? Explain the arrangement of various gears in a reverted gear train and express the characteristic equations used to define their operation. (6)

Or

(b) (i) State and prove law of gearing. (4)

(ii) A pair of involute spur gears with 16° pressure angle and pitch of module 6 mm is in mesh. The number of teeth in pinion is 16 and its rotational speed is 240 rpm. The gear ratio is 1.75. In order to avoid the interference, determine

(1) addenda on pinion and wheel

(2) length of path of contact

(3) maximum velocity of sliding on either side of pitch point. (12)

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

(ii) A leather faced conical clutch has a cone angle of 30°. If the intensity of pressure between the contact surfaces is limited to 0.35 N/mm^2 and the breadth of the conical surface is not to exceed 1/3rd of the mean radius. Determine the dimensions of the contact surfaces to transmit 22.5 KW at 2000 rpm. Assume uniform wear rate and $\mu = 0.15$. (8)

Or

(b) (i) Derive the expression for Frictional torque on cone clutch based on uniform pressure theory. (6)

(ii) The brake whose dimensions are shown in figure 15 (b) has a co-efficient of friction of 0.3 and is to have a maximum pressure of 1000 kPa against the friction material.

(1) Using an actuating force of 1750 N, determine the face width of the Shoes (both shoes have same width) and

(2) What torque will the brake absorb?