

B 2330

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

Third Semester

Mechanical Engineering

ME 232 — KINEMATICS OF MACHINES

(Common to Mechatronics Engineering)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write expression governing Kutzbach criterion for mobility of a planer mechanism.
2. Name any four common mechanism with specific application
3. What is the speciality of a planar four bar linkage with regard to coupler curve?
4. Define instantaneous centre of velocity?
5. What are high speed cams? Give Examples.
6. Construct the displacement diagram for the follower motion to be cycloidal.
7. Define the law of gearing with the equation.
8. What are the principal reasons for the use of non -standard gears?
9. What do you mean by friction angle?
10. What are the significance of friction with regard to power transmission devices like clutches and bearings?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain different kinds of kinematic pairs with examples. (9)
 (ii) Sketch and explain any two inversions of single slider crank chain. (7)
- Or
- (b) (i) Explain the following :
 (1) Mechanical advantage.
 (2) Grashoff's Law
 (3) Mobility of a mechanism. (9)
- (ii) Sketch and explain any two inversions of double slider crank chain. (7)
12. (a) In the steam engine mechanism shown Figure 1, the crank AB rotates at 200 rpm. Find the velocities of C, D, E, F and P. Also, find the acceleration of the slider at C. The dimensions of the various links are AB = 12 cm, BC = 48 cm, CD = 18 cm, DE = 36 cm, EF = 12 cm and FP = 36 cm. (16)

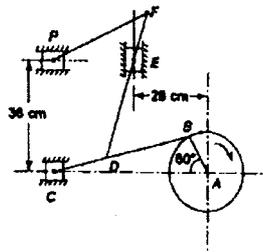


Figure 1

Or

- (b) In the mechanism shown in figure 2, O and Q are fixed centers. The crank OC revolves at uniform speed of 120 rpm. Draw the velocity diagram and find the velocity of C in the given configuration Find the angular acceleration of links CP, PA and AQ. (16)

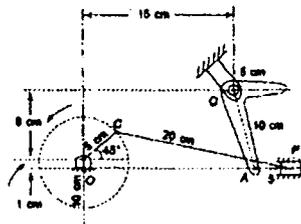


Figure 2

13. (a) A cam drives a flat reciprocating follower in the following manner :
 During first 120° rotation of the cam, the follower moves outwards through a distance of 200 mm with SHM. The follower dwells during 30° of cam rotation. During next 120° of cam rotation, the follower moves inwards with SHM. The Follower dwells for the next 90° of cam rotation. The minimum radius of the cam is 25 mm. Draw the profile of the cam. (16)

Or

- (b) In a symmetrical tangent cam operating a roller follower, the least radius of the cam is 30 mm and roller radius is 17.5 mm. The angle of ascent is 75° and the total lift is 17.5 mm. The speed of the cam shaft is 600 rpm. Calculate (10)
- The principal dimensions of the cam (3)
 - The acceleration of the follower at the beginning of the lift. (3)
 - The acceleration of the follower where straight flank merges into a circular nose. (3)
14. (a) A Pinion with 20 teeth and 125 mm pitch circle diameter drives a rack. The addendum of both pinion and rack is 6.25 mm. What is the least pressure angle which can be used to avoid interference? With this pressure angle, find the length of the arc of contact and the minimum number of teeth in contact at a time. (16)

Or

- (b) An internal wheel B with 80 teeth is keyed to a shaft F. A fixed internal wheel C with 82 teeth is concentric with B. A compound wheel D-E gears with the two internal wheel; D has 28 teeth and gears with C while E gears with B. The compound wheels revolve freely on a pin which projects from a disc keyed to a shaft A co-axial with F. If the wheels have the same pitch and shaft A makes 800 rpm, What is the speed of the shaft F? Sketch the arrangements. (16)
15. (a) The thrust of a propeller shaft in marine engine is taken up by a number of collars integral with the shaft which is 300 mm in diameter, The thrust on the shaft is 200 kN and the speed is 75 rpm. Taking ' μ ' = 0.05 and assuming intensity of pressure as uniform and equal to 0.3 N/mm^2 , find the external diameter of the collars and the number of collars required, if the power lost in friction is not to exceed 16 kW. (16)

Or

- (b) A leather belt is required to transmit 7.5 kW from a pulley 1.2 m in diameter, running at 250 rpm. The angle embraced is 165° and the coefficient of friction (μ) between the belt and the pulley is 0.3. If safe working stress for the leather belt is 1.5 MPa, density of leather is 1 Mg/m^3 and thickness of belt is 10mm. Determine the width of the belt taking centrifugal tension into account. (16)