

B.E. DEGREE EXAMINATIONS: NOVEMBER 2009

Third Semester

MECHATRONICS ENGINEERING

U07MH305: Kinematics of Machinery

Three hours

Maximum Marks: 100

Answer ALL the Questions:-

PART A (10 x 1 = 10 Marks)

1. Kinematics pair having point contact when in motion is called as:
a) higher pair b) lower pair c) closed pair d) unclosed pair
2. The study of relative motion between the parts of a machine is called
a) statics b) hydrodynamics c) kinematics d) kinetics
3. The component of acceleration parallel to the link is called _____ component
a) radial b) tangential c) coriolis d) absolute
4. The relative instantaneous centre of two bodies having a point contact, lies
a) at the point of contact b) on the common tangent
c) on the common normal d) None of the above
5. The size of a cam depends upon
a) base circle b) pitch circle c) prime circle d) pitch curve
6. The cam follower extensively used in aircraft engines is
a) knife-edged follower b) flat faced follower
c) spherical faced follower d) roller follower
7. The module is the reciprocal of
a) diametral pitch b) circular pitch c) pitch diameter d) pressure angle
8. The train value of a gear train is called
a) equal to velocity ratio of a gear train b) reciprocal of velocity ratio of a gear train
c) always greater than unity d) always less than unity
9. The centrifugal tension in belts
a) increases power transmitted
b) decreases power transmitted
c) have no effect on the power transmitted
d) increases power transmitted upto a certain speed and then decreases
10. The brakes commonly used in railway trains is
a) shoe brake b) band brake c) band and block brake d) internal

PART B (10 x 2 = 20 Marks)

11. Define kinematic pair?
12. What is degree of freedom?
13. What is instantaneous centre of rotation?
14. When does a body can have radial acceleration?
15. What are the different motions of a follower?
16. Define pressure angle applied to cams.
17. Define circular pitch.
18. What is reverted gear train?
19. Define dry friction.
20. What is slip of belt?

PART C (5 x 14 = 70 Marks)

21. (a) Discuss the inversions of four bar crank chain

(OR)

- (b) Discuss the inversions of double slider crank chain

22. (a) In fig.1, the angular velocity of the crank OA is 600 r.p.m. Determine the linear velocity of slider D and the angular velocity of the link BD, when the crank is inclined at an angle of 70° to the vertical. The dimensions of various links are: OA = 28 mm; AB = 44 mm; BC = 49 mm; BD = 46 mm. The centre distance between the centres of rotation O and C is 65 mm. The path of travel of the slider is 11 mm below the fixed point C. The slider moves along a horizontal path and OC is vertical.

(OR)

- (b) PQRS is a four bar chain with link PS fixed. The lengths of the links are PQ = 62.5 mm, QR = 175 mm, RS = 112.5 mm and PS = 200 mm. The crank PQ rotates at 10 rad/s clockwise. Draw the velocity and acceleration diagram when angle QPS = 60° and Q and R lie on the same straight line of PS. Find the angular velocity and angular acceleration of links QR and RS.

23. (a) A cam rotating clockwise with uniform speed is to give the roller follower of 20 mm diameter the following motion:
- (i) Follower moves outward through a distance of 30mm during 120° of cam rotation.
 - (ii) Follower dwells for the next 60° of cam rotation.
 - (iii) Follower to return to its initial position during 90° of cam rotation.
 - (iv) Follower to dwell for the remaining 90° of cam rotation.

The least radius of the cam is 45 mm and the line of stroke of the follower is offset by 15 mm from the axis of the cam and the displacement of the follower is to take place with simple harmonic motion during both outward and return strokes. Draw the profile of the cam.

(OR)

b) Draw the profile of a cam to give the follower motion to the reciprocating follower with a flat or mushroom contact face:

- (i) Follower to move outward through a distance of 20 mm during 120° of cam rotation.
- (ii) Follower to dwell for 30° of cam rotation.
- (iii) Follower to return to its initial position during 120° of cam rotation.
- (iv) Follower to dwell for the remaining 90° of cam rotation.

The least radius of the cam is 25 mm and the flat face of the follower is at right angles to the line of stroke of the follower. The outward and return strokes of the follower are to take place with simple harmonic motion.

4. (a) 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.

(OR)

(b) In a reverted reverted epicyclic gear train, the arm F carries two wheels A and D and a compound wheel B-C. The wheel A meshes with wheel B and wheel D meshes with wheel C. The numbers of teeth on wheel A, D and C are 80, 48 and 72 respectively. Find the speed and direction of wheel D when wheel A is fixed and arm F makes 200 r.p.m. clockwise.

25. (a) Determine the maximum power that can be transmitted using a belt of 1000 mm x 10 mm with an angle of lap of 160° . The density of belt is 10^{-3} gm/mm³ and co-efficient of friction is 0.25. The tension in the belt should not exceed 1.5 N/mm².

(OR)

(b) A power of 60 kW is transmitted by a multi-plate clutch at 1500 r.p.m. Axial intensity of pressure is not to exceed 0.15 N/mm². The co-efficient of friction for the friction surfaces is 0.15. The external radius of friction surface is 120 mm. Also the external radius is equal to 1.25 times the internal radius. Find the number of plates needed to transmit the required power. Assume uniform wear.

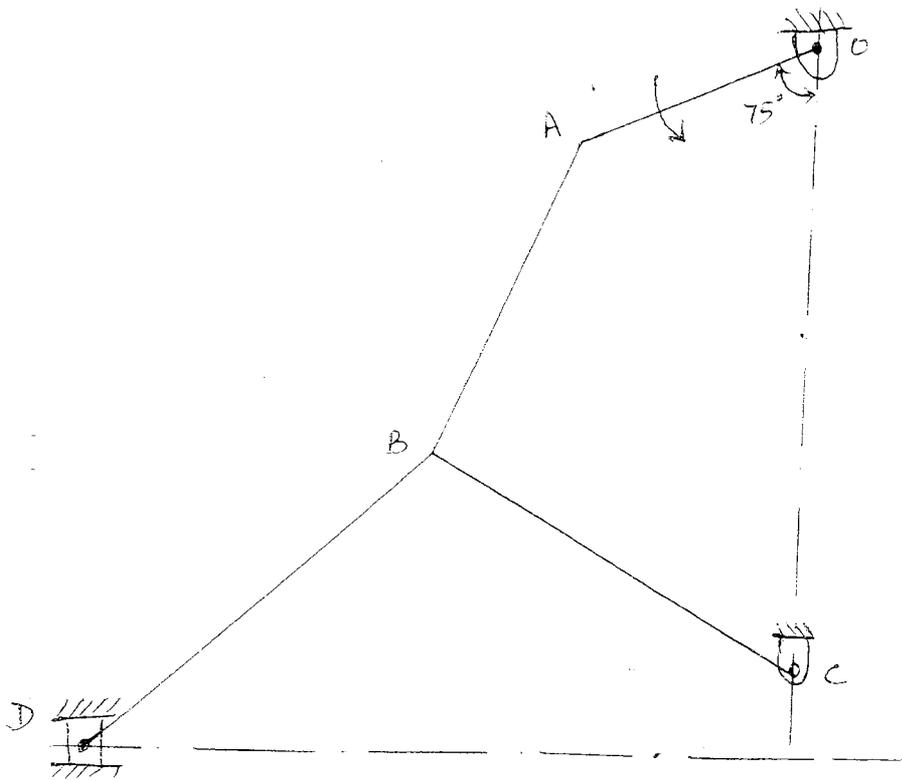


Fig. 1
