Register Number: ……

B.E. DEGREE EXAMINATIONS: NOV/DEC 2010

Fourth Semester

MECHANICAL ENGINEERING

U07ME402: Kinematics of Machinery

Time: Three Hours **Maximum Marks: 100**

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. Piston and cylinder of an engine forms

   (a) sliding pair (b) turning pair (c) rolling pair (d) None of the above

2. A bolt and nut forms

   (a) screw pair (b) turning pair (c) rolling pair (d) None of the above

3. The component of the acceleration perpendicular to the velocity is called

   (a) Normal component (b) Tangential component

   (c) Coriolis component (d) None of the above

4. The total acceleration of a link is equal to

   (a) Vector sum of tangential and normal component

   (b) Vector sum of tangential and coriolis component

   (c) Vector sum of normal and coriolis component

   (d) None of the above

5. In a radial cam, the follower moves

   (a) In a direction perpendicular to the cam axis (b) In a direction parallel to the cam axis

   (c) In any direction irrespective of the cam axis (d) Along the cam axis

6. Offset is provided to a cam follower mechanism to

   (a) Minimize the side thrust (b) accelerate (c) Avoid jerk (d) none of these

7. The type of gears used to connect two non-parallel non-intersecting shafts are

   (a) Spur gears (b) helical gears (c) spiral gears (d) none of these

8. The radial distance of a tooth from the pitch circle to the bottom of the tooth, is called

   (a) Dedendum (b) addendum (c) clearance (d) working depth

9. When two pulleys of un equal size connected by the belt drive the angle θ is taken as

   (a) angle of contact of the smaller pulley (b) angle of contact of the larger pulley

   (c) average angle of contact on the two pulleys (d) None of the above

10. The maximum efficiency of a screw jack is a function of

    (a) friction angle (b) helix angle (c) load lifted (d) None of the above

PART B (10×2= 20 Marks)

11. What is meant by inversion of mechanism?
12. What is the use of oldhams coupling?
13. What is meant by coriolis acceleration?
14. What is meant by pressure angle in cam?
15. Give any two application of cam mechanism.
16. State the advantages of roller follower.
17. What is meant by epicyclic gear train?
18. Define module in gears.
19. Define slip in belt drives.
20. What is the difference between brake and clutch?

PART C (5×14= 70 Marks)

21. a) In a crank and slotted lever quick return mechanism, the distance between the fixed centres is 150 mm and the driving crank is 75 mm long. Determine the ratio of the time taken on the cutting and return strokes.

(OR)

b) Explain the working of whit worth quick return mechanism with neat sketch.

22. a) In a slider crank mechanism, the length of crank OB and the connecting rod AB are 125 mm and 500 mm respectively. The centre of gravity G of the connecting rod is 275 mm from the slider A. The speed is 600 r.p.m. clockwise. When the crank has turned 45° from the inner dead centre position, determine 1. Velocity of the slider A, 2. Velocity of the point G, and 3. Angular velocity of connecting rod AB.

b) In the toggle mechanism as shown in Fig.1, D is constrained to move in horizontal path. The dimensions of the various links are: AB = 200 mm; BC = 300 mm; OC = 150 mm; and, BD = 450 mm. The crank OC is rotating in a counter-clockwise dirction at a speed of 180 r.p.m., increasing at the rate of 50 rad/s². Find, for the given configuration 1. Velocity and acceleration of D, and 2. Angular velocity and angular acceleration of BD.

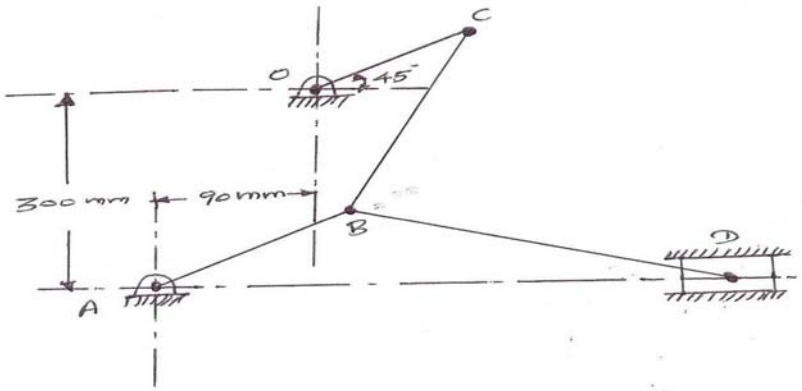

Fig - 1

23. a) A disc cam rotating in a clockwise direction is used to move a reciprocating roller with simple harmonic motion in a radial path as given below:

a. Outstroke with maximum displacement of 25 mm during 120 ^{0} of cam rotation.

b. Dwell for 60 ^{0} of cam rotation.

c. Return stroke with maximum displacement of 25 mm during 90 ^{0} of cam rotation

d. Dwell during remaining 90 ^{0} of cam rotation.

The minimum radius of the cam is 40 mm. The roller radius is 10 mm .Draw the profile of the cam when the line of reciprocation of the follower passes through the cam shaft axis.

(OR)

b) Draw the profile of the cam with oscillating roller follower for the following motion:

a. Follower to move outwards through an angular displacement of 20° during 120 ^{0} of cam rotation.

b. Follower to dwell for 50 ^{0} of cam rotation.

c. Follower to return to its initial position in 90 ^{0} of cam rotation with uniform acceleration and retardation

d. Follower to dwell for the remaining period of cam rotation.

The distance between the pivot centre and the roller centre is 130 mm and the distance between the pivot centre and cam axis is 150 mm .The minimum radius of the cam is 80 mm and the diameter of the roller is 50 mm.

24. a) The pitch circle diameter of the smaller of the spur wheels which mesh externally and have involute teeth is 100mm .The number of teeth are 16 and 32. The pressure angle is 20º and the addendum is 0.32 of the circular pitch. Find the length of the path of contact of pair of teeth.

(OR)

b) In an epicyclic gear train of the 'sun and planet type' as shown in Fig.2, the pitch circle diameter of the internally toothed ring D is to be 216mm and the module 4mm. When the ring D is stationary, the spindle A, which carries three planet wheels C of equal size, is to make one revolution in the same sense as the sun wheel B for every five revolutions of the driving spindle carrying the sunwheel B. Determine suitable number of teeth for all the wheels and the exact diameter of pitch circle of the ring.

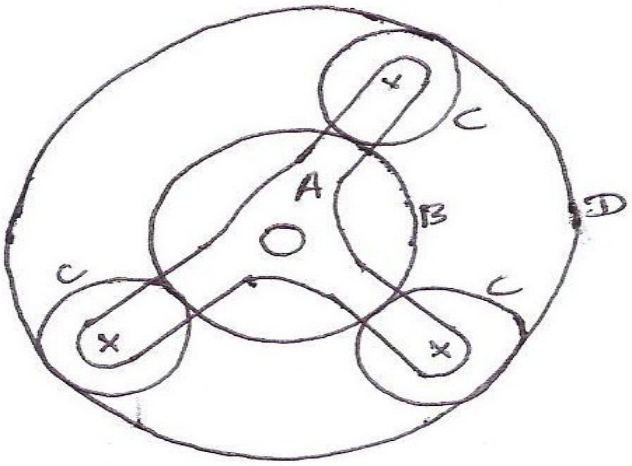

Fig. 2

25. a) Find the width of the belt, necessary to transmit 7.5 KW to a pulley 300 mm diameter, if the pulley makes 1600 rpm and the coefficient of friction between the belt and the pulley is 0.22. Assume the angle of contact as 210° and the maximum tension in the belt is not to exceed 8 N/mm width

(OR)

b) A dry single plate clutch is to be designed for an automotive vehicle whose engine is rated to give 100Kw at 2400rpm and maximum torque 500Nm. The outer radius of friction plate is 25% more than the inner radius and the pressure is not to exceed $0.07N/mm^2$. The coefficient of friction may be assumed to be 0.3. The helical springs required by this clutch to provide axial force necessary to engage the clutch is 8. If each spring has a stiffness equal to 40N/mm. Determine the initial compression in the springs and the dimensions of the friction plate.

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