

**B.E. DEGREE EXAMINATIONS: APRIL / MAY 2010**

Fourth Semester

**MECHANICAL ENGINEERING**

U07ME402: Kinematics of Machinery

**Time: Three Hours**

**Maximum Marks: 100**

**Answer ALL the Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. A Kinematic chain requires at least,  
a) 2 links and 3 turning pairs                      b) 3 links and 4 turning pairs  
c) 4 links and 4 turning pairs                      d) 5 links and 4 turning pairs
2. A point on a link connecting double slider crank chain traces a,  
a) Circle                      b) ellipse                      c) hyperbola                      d) parabola
3. The total number of instantaneous centres for a mechanism consisting of n links are,  
a)  $n/2$                       b) n                      c)  $(n-1)/2$                       d)  $n(n-1)/2$
4. A point B on a rigid link AB, moves with respect to A with angular velocity  $\omega$  rad/s.  
The radial component of the acceleration of B with respect to A,  
a)  $V_{BA}^2 \times AB$                       b)  $V_{BA}^2 / AB$                       c)  $V_{BA} / AB$                       d)  $V_{BA} \times AB$
5. Cam size depends upon,  
a) base circle                      b) pitch circle                      c) prime circle                      d) outer circle
6. For high speed engines, the cam follower should move with,  
a) uniform velocity                      b) simple harmonic motion  
c) uniform acceleration and retardation                      d) cycloidal motion
7. The circle passing through the bottom of the teeth of gear is known as,  
a) inner circle                      b) base circle                      c) dedendum circle                      d) addendum circle
8. In a gear train, when the axes of the shafts, over which the gears are mounted, move relative to a fixed axis, is called  
a) simple gear train                      b) compound gear train                      c) reverted gear train                      d) epicyclic gear train
9. The centrifugal tension in belts,  
a) reduces power transmission  
b) increases power transmission  
c) does not affect power transmission  
d) increases power transmission upto certain speed and then decreases

10. The brake commonly used in motor car is,  
a) shoe brake      b) band brake      c) band and block brake      d) internal expanding brake

**PART B (10 x 2 = 20 Marks)**

11. Differentiate between a machine and a structure with examples.  
12. What is meant by mechanical advantage of a mechanism?  
13. Define rubbing velocity at a pin joint, what will be the rubbing velocity at pin joint when the two links move in the opposite direction.  
14. When coriolis component of acceleration occur?  
15. What are the different types of motion with which a follower can move?  
16. Sketch a cylindrical cam, the follower reciprocates in a direction parallel to the cam axis and also a cylindrical cam with oscillating follower.  
17. What is meant by contact ratio in gear? And write the equation to determine this value.  
18. How to change the direction of rotation of the output gear in simple gear train without changing the direction of rotation of input gear.  
19. What is the condition for self locking in screws?  
20. Distinguish between brakes and dynamometer.

**PART C (5 x 14 = 70 Marks)**

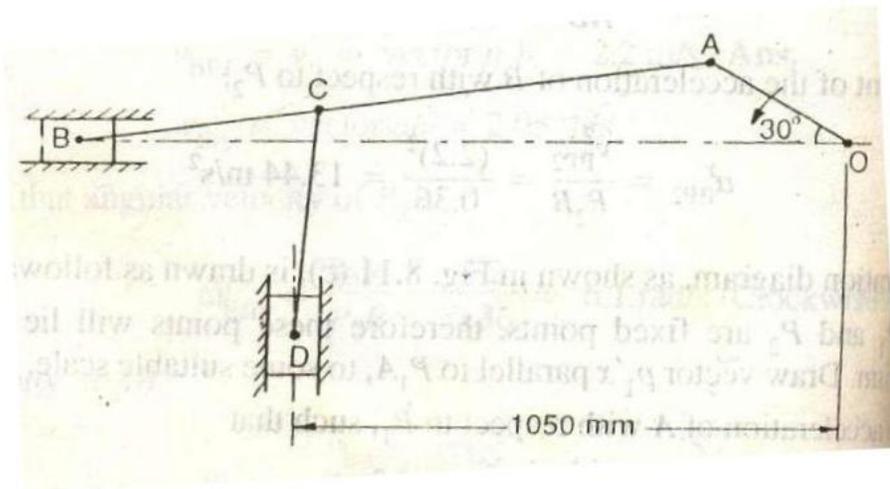
21. (a) (i) Sketch and explain any two inversions of a four bar chain. (7)  
(ii) With neat sketches, explain any two straight line generator mechanisms. (7)
- (OR)**
- (b) (i) Sketch and explain any two inversions of a double slider crank chain. (7)  
(ii) Describe the working of quick return motion mechanism. Derive an expression for the ratio of time taken in forward and return stroke of mechanism. (7)
22. (a) PQRS is a four bar chain with link PS fixed. The lengths of the links are fixed are PQ=62.5mm; QR=175mm; RS=112.5mm and PS=200mm. The crank PQ rotates at 10rad/sec clockwise. Draw the velocity and acceleration diagram when angle QPS=60° and Q and R lie on the same side of PS. Find the angular velocity and angular acceleration of the links QR and RS.

**(OR)**

- (b) In the mechanism, as shown in fig, the crank OA rotates at 20 rpm anticlockwise and gives motion to the sliding blocks B and D. The dimensions of the various links are OA=300mm; AB=1200mm; BC=450mm; and CD=450mm.

For the given configuration, determine:

- (i) velocities of sliding at B and D,
- (ii) angular velocity of CD,
- (iii) linear acceleration of D, and
- (iv) angular acceleration of CD.



Fig

23. (a) A cam rotating clockwise at a uniform speed of 100 rpm is required to give motion to knife edge follower as below,
- (i) follower to move outwards through 25mm during  $120^\circ$  of cam rotation
  - (ii) follower to dwell for the next  $60^\circ$  of cam rotation
  - (iii) follower to return to its starting position during next  $90^\circ$  of cam rotation, and
  - (iv) follower to dwell for the rest of the cam rotation

The minimum radius of the cam is 50mm and the line of stroke of the follower passes through the axis of the cam shaft. If the displacement of the follower takes place with uniform and equal acceleration and retardation on both the outward and return strokes, find the maximum velocity and acceleration during outstroke and return stroke and draw the profile of the cam

**(OR)**

- (b) The following particulars relate to a symmetrical circular cam operating a flat faced follower:

Least radius = 16mm, nose radius = 3.2mm, distance between cam shaft centre and nose centre = 25mm, angle of action of cam =  $150^\circ$ , and cam shaft speed = 600 rpm. Assuming that there is no dwell between ascent or descent, determine the lift of the valve, the flank radius and the acceleration and retardation of the follower at a point where circular nose merges into circular flank.

24. (a) Two involute gears of  $20^\circ$  pressure angle are in mesh. The number of teeth on pinion is 20 and the gear ratio is 2. If the pitch expressed in module is 5mm and the pitch line speed is 1.2m/s, assuming addendum as standard and equal to one module, find:

- (i) the angle turned through by pinion when one pair of teeth is in mesh; and
- (ii) the maximum velocity of sliding

**(OR)**

(b) In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 rpm in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed makes 300 rpm in the clockwise direction, what will be the speed of gear B?

25. (a) A shaft rotating at 200rpm drives another shaft at 300 rpm and transmits 6 KW through a belt. The belt is 100 mm wide and 10 mm thick. The distance between the shafts is 4 m. The smaller pulley is 0.5 m in diameter. Calculate the stress in the belt, if it is

- (i) an open belt drive and
- (ii) a cross belt drive. Take  $\mu = 0.3$

**(OR)**

(b) A single dry plate clutch transmits 7.5 Kw at 900 rpm. The axial pressure is limited to  $0.07\text{N/mm}^2$ . If the coefficient of friction is 0.25, find

- (i) Mean radius and face width of the friction lining assuming the ratio of the mean radius to the face width as 4, and
- (ii) outer and inner radii of the clutch plate

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