B.E DEGREE EXAMINATIONS: APRIL/MAY 2011

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. Side mirror and its attachment has _____ pair.

   (a) Four bar chain mechanism   (b) Single slider crank chain mechanism

   (c) Double slider crank chain mechanism   (d) Clamping mechanism

2. Quick return motion mechanism is the inversion of _____ chain.

   (a) Higher and closed   (b) Higher and unclosed   (c) Closed   (d) Spherical

3. How many instantaneous centers are possible is a four bar chain mechanism?

   (a) 6 Centers   (b) 7 Centers   (c) 8 Centers   (d) 9 Centers

4. In a four bar chain, considering mechanical advantage of 0.7, FB = 50 N, What is the force acting on pin C.

   (a) 25 N   (b) 35 N   (c) 50 N   (d) 60 N

5. In a radial cam, the follower moves in a direction _____ to the axis.

   (a) Parallel   (b) Perpendicular   (c) Inclined   (d) None of the above

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. Two intersecting and coplanar shafts are connected by _____ gears.

   (a) Spur gear   (b) Helical gear   (c) Bevel gear   (d) All of the above

8. In watch mechanism _____ type of gear train is used.

   (a) Simple gear train   (b) Compound gear train   (c) Reverted gear train   (d) None of the above

9. What is the S.I. unit for frictional moment?

   (a) N/m^2 (b) N-m   (c) N-m/s   (d) N/m

10. Function of dynamometer is to measure.

   (a) Driving force   (b) Driving velocity   (c) Driving acceleration   (d) All of the above

PART B (10 x 2 = 20 Marks)

11. Write Grashoff's law for 4-bar mechanism.

12. Define Degree of Freedom of a mechanism.

13. What is meant by 'transmission angle'?

14. What is Coriolis acceleration?

15. How many instantaneous centres are possible in a four bar chain mechanism?

16. Draw at least any two types of cam with followers.

17. What are the different types of motion with which a follower can move?

18. State "Law of gearing".

19. What is creep in the case of belt?

20. What do you mean by friction angle?

PART C (5 x 14 = 70 Marks)

21. a) Explain the working of a quick return motion mechanism. Also derive an equation for the ratio of time taken for return stroke and forward strokes.

(OR)

b) Explain the following mechanisms in kinematics point of view.

   (i) Ratchats and escapements mechanism.

   (ii) indexing mechanism.

22. a) In a four bar chain ABCD, AD is fixed and is 120 mm long. The crank AB is 30 mm long and rotates at 100 rpm clockwise. While the link CD = 60 mm oscillates about D, BC and AD are of equal length. Find the angular velocity and angular acceleration of link BC when angle BAD = 60°.

(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 various links are OA = 30 mm; BC = 450 mm and CD = 450 mm.

   For the given configuration, determine

   (i) Velocity of sliding at B and D,   (ii) Angular velocity of CD,

   (iii) Linear acceleration of D and   (iv) Angular acceleration of CD

23.a) A cam is t give the following motion to a knife edge follower.

   (i) It lifts the follower through 37.5 mm during its 60° rotation with SHM.

(ii) The follower remains at rest for the next 40° rotation of the cam.

(iii) The follower then descends to its original during 90° of the cam with SHM.

(iv) The follower remains at rest for the rest of the rotation.

The line of stroke of the follower passes through the axis of the cam shaft. The least radius of the cam is 50 mm. If the cam rotates at 300 rpm, find maximum velocity and acceleration of the follower during its ascent and descent.

(OR)

b) A cam rotating clockwise with a uniform speed is to give the roller follower of 20 mm diameter with the following motion.

(i) Follower to move outwards through a distance of 30 mm during 120° of cam rotation;

(ii) Follower to dwell for 60° of cam rotation;

(iii) Follower to return to its initial position during 90° if cam rotation and

(iv) Follower to dwell for the remaining 90° of cam rotation.

The minimum radius of the cam is 45 mm and the displacement of the follower is   to take place with simple harmonic motion on both the outward and return strokes. Draw the cam profile when.

(i) The line of stroke of the follower is offset by 15 mm from the axis of the cam.

24. a) Two gear wheels of module pitch 4.5 mm have 24 and 33 teeth respectively. The pressure angle is 20° and each wheel has a standard addendum of 1 module. Find the length of arc of contact and maximum velocity of sliding if the speed of smaller wheel is 120 rpm.

(OR)

b) The annulus gear A is shown in Fig. rotates at 300 rpm about the axis of the fixed wheel S which has 80 teeth. The three-armed spider (only one arm 'a' is shown in Fig. is driven at 180 rpm. Determine the number of teeth required on the wheel P.
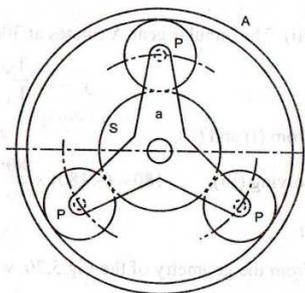
25. a) A single plate friction clutch, with both sides of the plate being affective, is used to transmit power at 1440 rpm. It has outer and inner radii 80 mm and 60 mm respectively. The maximum intensity of pressure is limited to 10×10^4 N/m^2. If the coefficient of friction is 0.3, determine:

(i) Total pressure exerted on the plate and   (ii) Power transmitted.

(OR)

b) A simple band brake shown in Fig. is applied to a shaft carrying a flywheel of mass 250 kg and of radius of gyration 300 mm. The shaft speed is 200 rpm. The drum diameter is 200 mm and the coefficient of friction is 0.25. The dimensions 'a' and 'l' are 100 mm and 280 mm respectively and angle $\beta = 135^\circ$. Determine:

(i) The brake torque when a force of 120 N is applied at the lever end,

(ii) The number of turns of the flywheel before it comes to rest and

(iii) The time taken by the flywheel to come to rest.

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