Register Number: ……

B.E. DEGREE EXAMINATIONS: NOV/DEC 2010

Third Semester

MECHATRONICS ENGINEERING

MCT101: Kinematics of Machinery

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

Answer ALL Questions:-

PART A (10 x 1 = 10 Marks)

1. The motion of a piston in the cylinder of a steam engine is an example of
   a) sliding
   b) rolling
   c) may be rolling or sliding depending upon the shape of teeth
   d) partly sliding and partly rolling
2. A ball and a socket joint forms a
   a) Turning pair b) rolling pair c) sliding pair d) spherical pair
3. The sense of tangential acceleration of a link is :
   a) The same as that of velocity
   b) Opposite to the velocity
   c) Could be either the same or opposite to velocity
   d) Always in a plane perpendicular to the plane of motion
4. When a slider moves on a fixed link having curved surface, their instantaneous centre lies
   a) on their point of contact b) at the centre of curvature
   c) at the centre of circle d) at the pin joint
5. The cam follower extensively used in aircraft engine is
   a) knife edged follower b) flat faced follower
   c) roller follower d) spherical faced follower
6. For low and moderate speed engines, the cam follower should move with
   a) uniform velocity b) simple harmonic motion
   c) uniform acceleration and retardation d) cycloidal motion
7. A differential gear in automobile is used to
   a) Reduce speed b) Assist in changing speed
   c) Provide jerk free movement of vehicle d) Help in turning

8. The size of a gear is usually specified by

a) Pressure angle b) circular pitch c) diametral pitch d) pitch circle diameter

9. In a cone pulley, if the sum of radii of the pulleys on the driving and driven shafts is constant, then

a) Open belt drive is recommended

b) Cross belt drive is recommended

c) Both open belt drive and cross belt drive are recommended

d) The drive is recommended depending upon the torque transmitted

10. 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 up to a certain speed and then decreases

PART B (10 x 2 = 20 Marks)

11. State the Grashoff's law

12. Define the transmission angle.

13. Write any two rules to locate Instantaneous center?

14. What is the expression for Coriolis component of acceleration?

15. What is angle of ascend?

16. What is radial cam?

17. State the law of gearing.

18. When involute interference occurs?

19. Define the angle of repose.

20. Why self locking screws have lesser efficiency?

PART C (5 x 14 = 70 Marks)

21. a) (i) Explain the working of Whitworth quick return mechanism. (7)

(ii) Describe various types of kinematic joints. (7)

(OR)

b) Explain the various inversions of a four bar chain mechanism.

22. a) The crank of a slider crank mechanism rotates clockwise at a constant speed of 300m. The crank is 150 mm and the connecting rod is 600 mm long. Determine

(i) linear velocity and acceleration of the midpoint of connecting rod

(ii) angular velocity and angular acceleration of connecting rod at a crank angle of 45°from inner dead centre position.

(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 side of PS. Find the angular velocity and angular acceleration of links QR and RS.

23. a) A cam is to be designed for a knife edge follower with the following data:

1. Cam lift=40 mm during 90° of cam rotation with simple harmonic motion
2. Dwell for the next 30°
3. During the next 60° of cam rotation, the follower returns to its original position with SHM
4. Dwell during the remaining 180°

Draw the profile of the cam when the line of stroke of offset 20 mm from the axis of the cam shaft.

The radius of the base circle of the cam is 40 mm. Determine the maximum velocity and acceleration of the follower during its ascent and descent, if the cam rotates at 240 rpm.

(OR)

b) A cam rotating clockwise at a uniform speed of 1000 rpm is required to give a roller follower the motion defined below:

1. Follower to move outwards through 50 mm during 120° of cam rotation
2. Follower to dwell for next 60° of cam rotation
3. Follower to return to its starting position during next 90° of cam rotation
4. Follower to dwell for the rest of the cam rotation.

The minimum radius of the cam is 50 mm and the diameter of roller is 10 mm. The line of stroke of the follower is off-set by 20 mm from the axis of the cam shaft. If the

displacement of the follower takes place with uniform and equal acceleration and retardation on both outward and return strokes, draw the profile of the cam and find the maximum velocity and acceleration during out stroke and return stroke.

24. a) Derive the expression for minimum number of teeth of the pinion in order to avoid interference.

(OR)

b) A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20° pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and the contact ratio.

25. a) 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 co-efficient of friction between the belt and the pulley is 0.3. If the safe working stress for the leather belt is 1.5 MPa, density of leather 1 Mg/m^3 and thickness of belt 10 mm, determine the width of the belt taking centrifugal tension into account.

(OR)

b) The mean diameter of a square threaded screw jack is 50 mm. The pitch of the thread is 10 mm. The co-efficient of friction is 0.15. What force must be applied at the end of a 0.7 m long lever, which is perpendicular to the longitudinal axis of the screw to raise a load of 20 kN and to lower it?

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