Register Number.....

B.E. DEGREE EXAMINATIONS: APRIL / MAY 2009

Fourth Semester

MECHANICAL ENGINEERING

U07ME402 Kinematics of Machinery

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

Answer ALL the Questions:-

PART A (20 x 1 = 20 Marks)

1. The motion of a piston in the cylinder of a steam engine is an example of

   a) Completely constrained motion
   b) incompletely constrained motion
   c) Successfully constrained motion
   d) Horizontal motion

2. The cam and follower without a spring forms a

   a) Lower pair
   b) higher pair
   c) Self closed pair
   d) force closed pair

3. Which of the following is an inversion of single slider crank chain?

   a) Beam engine
   b) Watt's indicator mechanism
   c) Elliptical trammels
   d) whit worth quick return mechanism

4. Which of the following is an inversion of double slider crank chain?

   a) Coupling rod of a locomotive
   b) Pendulum pump
   c) Elliptical trammels
   d) Oscillating cylinder engine

5. The total number of instantaneous centers for a mechanism consisting of n links are

   a) $\frac{n}{2}$ b) n c) $\frac{n-1}{2}$ d) $\frac{n(n-1)}{2}$

6. According to Aronhold Kennedy's theorem, if three bodies move relative to each other, their instantaneous centers will lie on a

   a) Straight line
   b) parabolic curve
   c) Ellipse
   d) circle

7. The component of the acceleration, Parallel to the velocity of the particle, at the given instant is called

   a) Radial component
   b) tangential component
   c) coriolis component
   d) Circular component

8. The coriolis component of acceleration is taken into account for

   a) Slider crank mechanism
   b) four bar chain mechanism
   c) Quick return motion mechanism
   d) rocking mechanism

9. The angle between the direction of the follower motion and a normal to the pitch curve is called

   a) Pitch angle
   b) prime angle
   c) Base angle
   d) pressure angle

10. The cam follower extensively used in air-craft engines is

a) Knife edge follower
b) flat faced follower
c) Spherical faced follower
d) roller follower

21.(a)

11. Offset is Provided to a cam and follower mechanism is to

a) Minimize the side thrust
b) accelerate
c) Avoid jerks
d) Minimize noise

(b)

22.(a)

12. Which of the following displacement diagrams should be chosen for better dynamic performance of a cam-follower mechanism?

a) Simple harmonic motion
b) Parabolic motion
c) Cycloidal motion
d) constant velocity

13. The size of a gear is usually specified by

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

14. The product of the diametral pitch and circular pitch is equal to

a) 1 b) $\frac{1}{\pi}$ c) π d) $2\ \pi$

15. The condition of correct gearing is

a) Pitch line velocities of teeth be same
b) Radius of curvature of two profiles be same
c) Common normal to the pitch surface cuts the line of centres at a fixed point
d) Tangent to the pitch surface cuts the line of centers at a fixed point

16. The conduct ratio for gears are

a) zero b) less than one c) Greater than one d)constant

17. The velocity ratio of two pulleys connected by an open belt or crossed belt is

a) Directly proportional to their diameters
b) Inversely proportional to their diameters
c) Directly proportional to the square of their diameters
d) Inversely proportional to the square of their diameters

18. Due to slip of the belt, the velocity ratio of the belt drive

a) decreases
b) increases
c) does not change
d)decrease or increase

23.

19. 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

20. The efficiency of a screw jack is given by

a) $\frac{\tan(\alpha+\phi)}{\tan\alpha}$ b) $\frac{\tan\alpha}{\tan(\alpha+\phi)}$ c) $\frac{\tan(\alpha-\phi)}{\tan\alpha}$ d) $\frac{\tan\alpha}{\tan(\alpha-\phi)}$

PART B (5 x 16 = 80 Marks)

21.(a) Sketch and explain any three kinematic inversions of four bar chain. (16)

(OR)

(b) Sketch and explain the two quick return mechanisms. (16)

22.(a). In the toggle mechanism as shown in Fig1. The slider D is constrained to move on a horizontal path. The crank OA is rotating in the counter clockwise direction at a speed of 180 rpm

The dimensions of various links are as follows:

OA=180mm CB=240mm AB=360mm BD=540mm. For the given configuration find i) velocity of slider D

ii) angular velocity of links AB, CB and BD.

iii) velocities of rubbing on the pins of diameter 30mmat A and D and

iv) Torque applied to the crank OA, for a force of 2kN at D. (16)

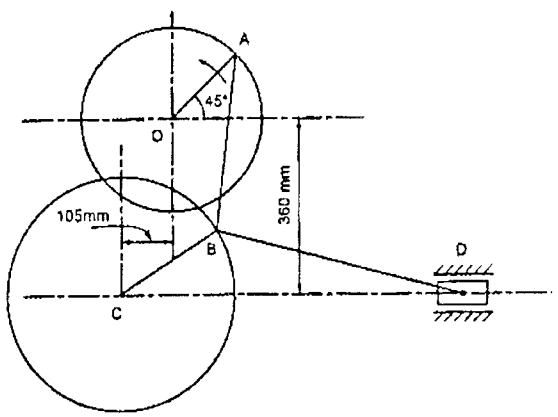

Fig1

(OR)

(b) PQRS is a four bar chain with link PS fixed. The lengths of the links are PQ = 62.5mm, QR = 175mm, RS = 112.5mm and PS = 200mm. the crank PQ rotates at 10rad/s clockwise. Draw the velocity and acceleration diagram when angle QPS = 60° and Q and R lie on the same side of PS. Find angular velocity and angular acceleration of the links QR and RS. (16)

23. (a) Design a cam to raise a valve with simple harmonic motion through 50 mm in $\frac{1}{3}$ of a revolution, keep it fully raised through $\frac{1}{12}$ revolution and to lower it with harmonic motion in $\frac{1}{6}$ revolution. The valve remains closed during the rest of the revolution. The diameter of the roller is 20 mm and minimum radius of the cam is 25mm.Tdiameter of the cam shaft is 25 mm. The axis of the rod passes through the axis of the cam shaft. If the cam shaft rotates at uniform speed of 100 rpm; find the maximum velocity and acceleration of a valve during raising and lowering. (16)

(OR)

(b) In a symmetrical tangent cam operating a roller follower, the least radius of cam is 30mm and roller radius is 17.5mm. The angle of ascent is 75° and total lift is 17.5mm. The speed of the camshaft is 600 rpm calculate:

(i) The principal dimension of cam

(ii) The acceleration of the follower at the beginning of lift where straight flank merges into the circular nose and at the apex of the circular nose. Assume that there is no dwell between ascent and descent. (16)

24. (a) A pair of involute spur gears with 16° pressure angle and module of 6mm is in mesh. The number of teeth on pinion is 16 and its rotational speed is 240rpm. When the gear ratio is 1.75, find in order to avoid interference.

(i) The addenda on pinion and gear wheel (4)

(ii) The lengths of path of contact and (8)

(iii) The maximum velocity of sliding of teeth on either side of the pitch point.(4)

(OR)

(b) In an Epicyclic gear of the sun and planet type as shown in Fig2. the annular gear A has 48 teeth cut and mesh with internally. Three planet wheels of equals size mesh with annular gear A and sun wheel B. when gear A is stationary, the spider C which carries the planet wheels is to make one revolution for every five rotations of the spindle carrying the sun wheel B. Determine the number of teeth for all the wheels. (16)

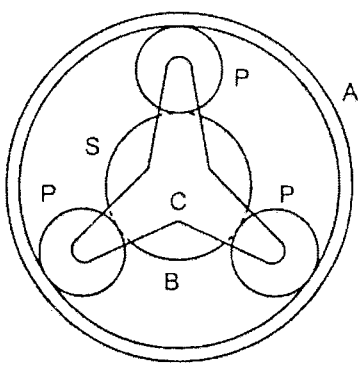

Fig.2

25. (a) A load of 10kN is raised by means of a screw jack, having a square threaded screw of 12mm pitch and of mean diameter 50mm. If a force of 100N is applied at the end of a lever to raise the load, what should be the length of the lever used? Take co-efficient of friction =0.15.what is the mechanical advantage obtained? State whether the screw is self locking. (16)

(OR)

(b) A cone clutch is to transmit 7.5Kw at 900rpm. The cone has a face angle of 12°. The width of the face is half of the mean radius and the normal pressure between the contact faces is not to exceed 0.09N/mm^2. Assuming uniform wear and the co-efficient of friction between contact faces as 0.2, find the main dimension of the clutch and the axial force required to engage the clutch. (16)

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