B.E. DEGREE EXAMINATIONS – OCTOBER/ NOVEMBER – 2008

Third Semester

MECHATRONICS ENGINEERING

U07MH 305:KINEMATICS OF MACHINERY

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

Answer ALL Questions: -

PART A (20 x 1 = 20 Marks)

1. The cam and follower without spring forms a

   a) Lower pair   b) Higher pair
   c) Self closed pair   d) Force closed pair

2. A kinematic chain is known as a mechanism when

   a) None of the link is fixed   b) One of the links is fixed
   c) Two of the links are fixed   d) All the links are fixed

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

   a) Beam engine   b) Watt's indicator
   c) Oscillating cylinder   d) Elliptical trammels

4. A kinematic chain requires minimum of:

   a) 3 links and 3 turning pairs   b) 4 links and 5 turning pairs
   c) 4 links and 4 turning pairs   d) 4 links and 3 sliding pairs

5. 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

6. The centripetal acceleration of a link of length 'r' and angular velocity 'ω' is given as

   a) $\omega . r^2$ b) $\omega^2 . r$ c) $\omega . r$ d) zero

7. The direction of linear velocity of any point on a link with respect to another point on the same link is

   a) Parallel to the link joining the point
   b) Perpendicular to the link joining the point
   c) At 45° to the link joining the point
   d) None of these

8. The component of acceleration, parallel to the velocity of the particle, at the given instant is called

   a) Radial component   b) Tangential component
   c) Coriolis component   d) None of the above

9. Offset is provided to a cam follower mechanism to

   a) Minimize the side thrust   b) Accelerate
   c) Avoid jerk   d) None of these

10. For high speed engines, the cam follower should move with

   a) Uniform velocity　　　　　　　　　b) Simple harmonic motion
   c) Uniform acceleration and retardation　　d) None of the above

11. A cam profile is the

   a) Profile of path traced by a cam follower.
   b) Actual working of the contour of the cam
   c) The profile of the path to be traced by the mechanism
   d) Total surface area of the cam

12. Cam profile and pitch curve are same for

   a) Flat face follower　　　　　　　　b) Roller follower
   c) Knife edge follower　　　　　　　d) None of the above

13. The module is the reciprocal of
   a) Diametral pitch　　　　　　　　　b) Circular pitch
   c) Pitch diameter　　　　　　　　　d) None of these

14. 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

15. The range of pressure angle for spur gear is
   a) $5°$ to $14°$　　　　　　　　　　b) $14°$ to $20°$
   c) $20°$ to $30°$　　　　　　　　　d) $30°$ to $40°$

16. The type of gear used to connect two parallel co-planar shafts is,

   a) Bevel gear　　　　　　　　　　　b) Spur gear
   c) Helical gear　　　　　　　　　　d) Spiral gear

17. The clutch is a device used

   a) To absorb frictional torque
   b) To absorb frictional power
   c) To transmit power from one shaft to another
   d) All of the above

18. The frictional torque transmitted by a cone clutch is same as that of

   a) Flat pivot bearing　　　　　　　　b) Flat collar bearing
   c) Conical pivot bearing　　　　　　　d) Trapezoidal pivot bearing

19. The centrifugal tension in belts

   a) Increases power transmission
   b) Decrease the power transmission
   c) Have no effect on the power transmission
   d) Increase power transmission up to a certain speed and then decrease

20. Due to slip of the belt, velocity ratio of belt drive is

   a) Increase　　　b) no effect　　　c) decrease　　　d) Maximum

21.a) Sketch and explain the following inversion of a double slider crank chain:

(i) Elliptic trammel
(ii) Scotch yoke mechanism
(iii) Oldham's coupling (16)

(OR)

b) Sketch the single slider crank chain and various, inversions, stating its
application (16)

22.a) In a slider crank mechanism, the length of crank OB and connecting rod AB are
125 mm and 500mm respectively. The centre of gravity of the connecting rod is
250mm from the slider A. the crank speed is 600 r.p.m. clockwise. When the
crank has turned 45° from the inner dead centre position, determine

(i) Linear velocity and acceleration of the connecting rod

(ii) Angular velocity and acceleration of the connecting rod (16)

(OR)

b) In a four bar chain ABCD, AD is fixed and is 120mm long. The crank AB is 30
mm long and rotates at 100 r.p.m. clockwise. While the link CD=60 mm oscillate
about D, BC and AD are of equal length. Find the angular velocity and angular
acceleration of the link BC when angle bad = 60° (16)

23. a) A cam operating knife edge follower has the following data. (16)

(a) Follower moves outwards through 40mm 60° of cam rotation.

(b) Follower dwells for the next 45°

(c) Follower returns to its original position during 90°

(d) Follower dwells for the rest of the rotation.

The displacement of the follower is to take place with uniform velocity during
both outward and return strokes. The least radius of the cam is 50mm. draw the
profile of the cam when the axis of the follower passes through the cam axis.

(OR)

b) A cam rotating clockwise with uniform speed is to give the roller follower of
20mm diameter with the following motion. (16)

(a) Follower move outward through a distance of 30mm during 120° of cam
rotation
(b) Follower to dwell for 60° of cam rotation

(c) Follower to return to its initial position during 90° of cam rotation and

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

The minimum radius of the cam is 45mm 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 the line of strike of the follower passes
through the axis of the cam shaft.

24.a)   (i)Define the following terms:

(i) Module,   (ii) circular pitch,   (iii) diameter pitch

(iv) Pressure angle   (v) addendum   (vi) dedendum   (6)

(ii)Drive an expression for the minimum number of teeth on the pinion in order to avoid interference.   (10)

(OR)

b)   In an epicyclical gear train an annular wheel A having 54 teeth meshes with a planet wheel B which gears with a sun wheel C, the wheels A and C being coaxial. The wheel B is carried on a pin fixed on one end of arm P which rotates about the axis of the wheels A and C. If the wheel A makes 20 r.p.m in a clockwise sense and the arm rotates at 100 r.p.m in the anticlockwise direction and the wheel C has 24 teeth, determine the speed and sense of rotation of wheel C.   (16)

25. a) A belt is required to transmit 18.4kW from a pulley 140 cm diameter running at 300 rpm. The angle of contact between the belt and pulley is 160° and the coefficient of friction is 0.25. The safe working stress for belt is 315 N/cm². The thickness of the belt is 6.5 mm and the density of belt material is 0.0011 kg/cm³. Determine the belt width required.   (16)

(OR)

b) A conical friction clutch is used to transmit 90 kW at 1500rpm. The semi cone angle is 20° and the coefficient of friction is 0.2. If the mean diameter of the bearing surface is 375 mm and the intensity of normal pressure is not to exceed 0.25 N/mm², find the dimensions of the conical bearing surface and the axial load required.   (16)

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