Register Number _____

### B.E DEGREE EXAMINATIONS – OCTOBER/ NOVEMBER – 2009

### B.E MECHATRONICS ENGINEERING (2007 REGULATION)
### Third Semester

### U07MH 305 – KINEMATICS OF MACHINERY

Time – Three Hours                                         Maximum Marks: 100

ANSWER ALL QUESTIONS:-

### PART –A   (10 x 1 = 10 Marks)

1.      In a mechanism which one is true
        a) All links are fixed  b) One link fixed  c) All links free  d) None of the above

2.      The elements or links which are connected together in such a way that their
        relative motion is completely constrained, form a
        a) Kinematic pair  b) Machine  c) Mechanism  d) Kinematic chain

3.      When crank rotates with uniform speed, it has
        a) only radial acceleration  b) only tangential acceleration
        c) only coriolis acceleration  d) None of the above

4.      If three bodies move relative to each other then according to kennedy's theorem,
        their instantaneous centre will lie on
        a) parabolic curve  b) ellipse  c) circle  d) straight line

5.      In a radial cam, the follower moves
        a) In a direction perpendicular to the cam axis   b) In a direction parallel to the
        cam axis  c) In any direction irrespective of the cam axis  d) Along the cam axis

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 radial distance of a tooth from the pitch circle to the bottom of the tooth is
        called
        a) dedendum  b) addendum  c) clearance  d) working depth

8.      When the axes of first and last gear are co-axial, then gear train is known as
        a) simple gear train  b) compound gear train  c) reverted gear train
        d) epicyclic gear train

9.      Due to slip of the belt, the velocity ratio of the belt drive
        a) decreases  b) increases  c) does not change  d) None of these

10. The frictional torque transmitted by a disc or plate clutch is same as that of
a) flat pivot bearing  b) flat collar bearing  c) conical pivot bearing
d) trapezoidal pivot bearing

ANSWER ALL QUESTIONS:-
**PART-B (10 x 2 = 20 Marks)**
11. Define kinematic chain.
12. What is higher pair?
13. How does velocity of a point on a link acts?
14. When does a coriolis component of acceleration acts?
15. What is trace point?
16. What is stroke in cams?
17. Define module.
18. Define pressure angle with respect to gears.
19. Define greasy friction.
20. What is creep of belt.

## PART-C (5 x 14 = 70 Marks)

21. (a)  Sketch and explain the various inversions of single slider crank chain      (14)

(OR)

(b) Sketch and explain the straight line generators                          (14)

22. (a) In the toggle mechanism as shown in fig. 1, the slider D is constrained to move on a horizontal path. The crank OA is rotating in the anti-clockwise rotation at a speed of 180 r.p.m.
The dimensions of various links are OA = 180 mm; AB = 360 mm; and BD = 540 mm.
For the given configuration, find : (i) velocity of slider D and (ii) angular velocity of links BD, CB and BD                                                    (14)

(OR)

(b) The crank of a slider crank mechanism rotates clockwise at a constant speed of 300 r.p.m. The crank is 150 mm and the connecting rod is 600 mm long. Determine (i) linear velocity and acceleration of the mid-point of the connecting rod and (ii) angular velocity and angular acceleration of the connecting rod at a crank angle of 45° from inner dead centre position.                      (14)

23. (a) Draw the profile of a cam operating a knife edge follower from the following data:
(i)  Follower moves outward through a distance of 40 mm during 60° of cam rotation.
(ii)  Follower dwells for the next 45° of cam rotation.

(iii) Follower to return to its initial position during next 90º of cam rotation.
(iv) Follower to dwell for the rest of cam rotation.
The cam is rotating clockwise at a uniform speed of 300 rpm. The least radius of the cam is 50 mm and the line of stroke of the follower is offset by 20 mm from the axis of the cam and the displacement of the follower is to take place with simple harmonic motion during both outward and return strokes.

(14)

OR

b) Draw the profile of a cam to raise through harmonic motion through 50 mm in 1/3 of revolution, keep it fully raised through 1/12 revolution, and to lower it with harmonic motion in 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 to be 25 mm. The diameter of the cam shaft is 25 mm. The axis of the valve rod passes through the axis of the cam shaft. Assume the shaft rotate with a uniform velocity. (14)

24.　a) Two mating spur gears with module pitch of 6.5 mm have 19 and 47 teeth of 20º pressure angle, and 6.5 mm addendum. Determine the number of pairs of teeth in contact and the angle turned through by the larger wheel for one pair of teeth in contact. (14)

(OR)

b) The arm of an epicyclic gear train rotates at 100 r.p.m. in the anticlockwise direction. The arm carries two wheels A and B having 36 and 45 teeth respectively. The wheel A is fixed and the arm rotates about the centre of wheel A. Find the speed of wheel B. What will be the speed of B, if the wheel A instead of being fixed makes 200 r.p.m. clockwise? (14)

25. a) Determine the width of a 9.75 mm thick leather belt required to transmit 15 kW from a motor running at 900 r.p.m. The diameter of the driving pullry of the motor is 300 mm. The driven pulley runs at 300 r.p.m. and the distance between the centre of two pulleys is 3 m. The density of leather is 1000 kg/m$^3$. The maximum allowable stress in the leather is 2.5 MPa. The co-efficient of friction between the leather and pulley is 0.3. Assume open belt drive and neglect any sag and slip of the belt.　　　　　　　　　　　　　.　　　(14)

(OR)

b) A cone clutch of cone angle 30º is used to transmit a power of 10 kW at 800 r.p.m. The intensity of pressure between the surfaces in contact is not to exceed 85 kN/m$^2$. The width of conical friction surfaces is half of the mean radius. If co-efficient of friction is 0.15, Determine the dimensions of contact surfaces. Assume uniform wear. Also find the axial load or force required to hold the clutch while transmitting the power. What is the width of the friction surface? (14)