

B.E DEGREE EXAMINATIONS: DEC 2014

(Regulation 2009)

Fourth Semester

MECHATRONICS ENGINEERING

MCT 101: Kinematics of Machinery

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The lead screw of a lathe with nut forms a
 - a) Sliding pair
 - b) Rolling pair
 - c) Screw pair
 - d) Spherical pair
2. Which of the following is a turning pair?
 - a) Piston and cylinder
 - b) Shaft with collars at both ends fitted in circular hole
 - c) Lead screw of a lathe with nut
 - d) Ball and socket joint
3. The component of the acceleration perpendicular to the velocity is called
 - a) Normal component
 - b) Tangential component
 - c) Coriolis component
 - d) none of the above
4. 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 points
 - b) perpendicular to the link joining the points
 - c) at 45° to the link joining the points
 - d) none of these
5. The size of a cam depends upon
 - a) Base circle
 - b) Pitch circle
 - c) prime circle
 - d) pitch curve
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. Train value of a gear train is

22. a) In a four bar chain ABCD, AD is fixed and is 150 mm long. The crank AB is 40 mm long and rotates at 120 r.p.m. clockwise, while the link CD=80 mm oscillates about D. BC and AD are of equal length, find the angular velocity of link CD when angle BAD =60°.

(OR)

- b) The crank and connecting rod of a theoretical steam engine are 0.5 m and 2 m long respectively. The crank makes 180 r.p.m. in the clockwise direction. When it has turned 45° from the inner dead centre position, determine 1. Velocity of piston, 2. Angular velocity of connecting rod, 3. Velocity of point E on the connecting rod 1.5 m from the gudgeon pin, 4. Velocities of rubbing at the pins of the crank shaft, crank and cross head when the diameters of their pins are 50 mm, 60 mm, and 30 mm respectively, 5. Position and linear velocity of any point G on the connecting rod which has the least velocity relative to crank shaft.

23. a) Design a cam for operating the exhaust valve of an oil engine. It is required to give equal uniform acceleration during opening and closing of the valve each of which corresponds to 60° of cam rotation. The values must remain in the fully open position for 20° of cam rotation. The lift of the valve is 37.5 mm and the least radius of the cam is 40 mm. The follower is provided with a roller of radius 20mm and its line of stroke passes through the axis of the cam.

(OR)

- b) Draw the profile of the cam to drive an oscillating roller follower to the specifications given below.

(i) Follower to move outwards through an angular displacement of 20° during the first 120° rotation of the cam.

(ii) Follower to return to its initial position during 120° rotating of the cam.

(iii) Follower to dwell during the next 120° of cam rotation.

The distance between pivot centre and roller centre =120mm; distance between pivot centre and cam axis=130 mm; minimum radius of the cam is 40mm; radius of the roller=10mm; inward and outward strokes takes place with simple harmonic motions.

24. a) Two spur gears of 24 teeth and 36 teeth of 8 mm module and 20° pressure angle are in mesh. Addendum of each gear is 7.5mm. The teeth are of involute form. Determine: 1. The angle through which the pinion turns while any pair of

teeth are in contact and 2. The velocity of sliding between the teeth when the contact on the pinion is at a radius of 102mm. The speed of the pinion is 450 r.p.m.

(OR)

- b) In a reverted epicyclic gear train, the arm A carries two gears B and C and a compound gear D-E. The gear B meshes with gear E and the gear C meshes with gear D. The number of teeth on gears B, C and D are 75, 30 and 90 respectively. Find the speed and direction of gear C when gear B is fixed and the arm A makes 100 r.p.m. clockwise.

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 coefficient 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 is 10 mm, determine the width of the belt taking centrifugal tension into account.

(OR)

- b) A conical friction clutch is used to transmit 90 kW at 1500 rpm. 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 intensity of normal pressure is not to exceed 0.25 N/mm². Find the dimension of the conical bearing surface and the axial load required.
