Reg. No. : | | | | | | | | | | |

Question Paper Code: 44702

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2019

Fourth Semester

Mechanical Engineering

14UME402 - KINEMATICS OF MACHINERY

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The lower pair is a

   (a) Open pair (b) Closed pair
   (c) Sliding pair (d) Point contact pair

2. A simple mechanism has

   (a) 1 link (b) 2 link (c) 3 link (d) 4 link

3. There are two points P and Q on a planar rigid body. The relative velocity between two points

   (a) Should always be along PQ
   (b) Can be oriented along any direction
   (c) Should always be perpendicular to PQ
   (d) Should be along QP when the body undergoes pure translation

4. Instantaneous centre of rotation of a link in a four bar mechanism lies on

   (a) Right side pivot of this link
   (b) Lift side pivot of this link
   (c) A point obtained by intersection on extending adjoining links
   (d) Bottom side of this link

5. In a The size of a cam depends upon

   (a) base circle (b) pitch circle
   (c) prime circle (d) pitch curve

6. 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

7. For a speed ratio of 100, smallest gear box is obtained by using

(a) a pair of spur gears
(b) a pair of helical and a pair of spur gear compounded
(c) a pair of bevel and a pair of spur gear compounded
(d) a pair of helical and a pair of worm gear compounded

8. Purpose of using differential gear in automobile is to

(a) Control speed (b) Avoid jerks
(c) Help in turning (d) Obtain rear movement

9. The angle of inclination of the plane, at which the body begins to move down the plane, is called

(a) angle of friction (b) angle of repose
(c) angle of projection (d) none of these

10. 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

PART - B (5 x 2 = 10 Marks)

11. List any two applications of quick return mechanism.

12. What do you mean by instantaneous centre?

13. List the terms used in cam.

14. State the law of gearing.

15. State the law of static friction.

PART - C (5 x 16 = 80 Marks)

16. (a) Sketch and explain the inversions of double slider crank chain. (16)

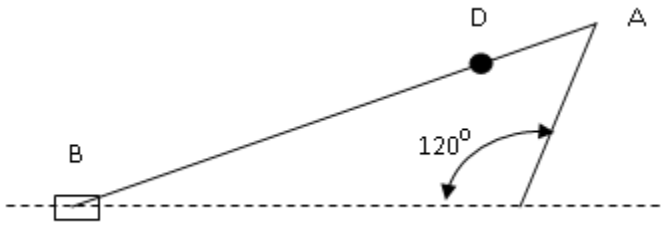
Or

(b) Explain the application of kutzbach Criterion to Plane Mechanisms. (16)

17. (a) 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 crosshead 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. (16)

Or

(b) Figure shows configuration of an engine mechanism. The dimensions are, crank *OA* = 200 *mm*, connecting rod *AB* = 600*mm*, distance of center of mass of the connecting rod from crank end *AD* = 200 *mm*. At the instant, the crank has an angular velocity of 50 *rad/s* clockwise and an angular acceleration of 800 *rad/* s^2, calculate the (i) velocity of *D* and angular velocity of *AB* (ii) acceleration of *D* and angular acceleration of *AB*. (16)



18. (a) A cam with a minimum radius of 25 *mm* is to be designed for a knife-edge follower with the following data:

(i) To raise the follower through 35 *mm* during 60^o rotation of the cam

(ii) Dwell for next 40^o of the cam rotation

(iii) Descending of the follower during next 90^o of the cam rotation

(iv) Dwell during the rest of the cam rotation

Draw the profile of the cam if the ascending and descending of the cam is with simple harmonic motion and the line of stroke of the follower is offset 10 *mm* from the axis of the cam shaft. What is the maximum velocity and acceleration of the follower during the ascent and the descent if the cam rotates at 150 *rpm*. (16)

Or

(b) Draw the profile of the cam when the roller follower moves with cycloidal motion during out stroke and return stroke, as given below: 1. Out stroke with maximum displacement of 31.4 *mm* during 180^o of cam rotation, 2. Return stroke for the next 150^o of cam rotation, 3. Dwell for the remaining 30^o of cam rotation. The minimum radius of the cam is 15 mm and the roller diameter of the follower is 10 *mm*. The axis of the roller follower is offset by 10 *mm* towards right from the axis of cam shaft. (16)

19. (a) A pinion of 20 involute teeth and 125 mm pitch circle diameter drives a rack. The addendum of both pinion and rack is 6.25 mm. What is the least pressure angle which can be used to avoid interference? With this pressure angle, find the length of the arc of contact and the minimum number of teeth in contact at a time. (16)

Or

(b) Two shafts A and B are co-axial. A gear C (50 teeth) is rigidly mounted on shaft A. A compound gear D-E gears with C and an internal gear G. D has 20 teeth and gears with C and E has 35 teeth and gears with an internal gear G. The gear G is fixed and is concentric with the shaft axis. The compound gear D-E is mounted on a pin which projects from an arm keyed to the shaft B. Sketch the arrangement and find the number of teeth on internal gear G assuming that all gears have the same module. If the shaft A rotates at 110 r.p.m., find the speed of shaft B. (16)

20. (a) A single plate clutch, with both sides effective, has outer and inner diameters 300 mm and 200 mm respectively. The maximum intensity of pressure at any point in the contact surface is not to exceed 0.1 N/mm^2. If the coefficient of friction is 0.3, determine the power transmitted by a clutch at a speed 2500 rpm. (16)

Or

(b) Determine the width of a 9.75 *mm* thick leather belt required to transmit 15 *kW* from a motor running at 900 *rpm*. The diameter of the driving pulley of the motor is 300 *mm*. The driven pulley runs at 300 *rpm* and the distance between the centre of two pulleys is 3 *m*. The density of the leather is 1000 kg/m^3. The maximum allowable stress in the leather is 2.5 *MPa*. The coefficient of friction between the leather and pulley is 0.3. Assume open belt drive and neglect the sag and slip of the belt. (16)