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## Question Paper Code: 44702

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2018

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. In a kinematic chain, a quaternary joint is equivalent to

    (a) one binary joint              (b) two binary joints
    (c) three binary joints           (d) four binary joints

3. The total number of instantaneous centres for a mechanism consisting of $n$ links are

    (a) n/2              (b) n              (c) (n-1)/2              (d) [n(n-1)]/2

4. When a slider moves on a fixed link having curved surface, their instantaneous centre lies

    (a) on their point of contact            (b) at the centre of curvature
    (c) at the centre of circle              (d) at the pin joint

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. A differential gear in an automobile is a

    (a) simple gear train                  (b) compound gear train

    (c) epicyclic gear train               (d) none of these

8. The module is the reciprocal of

    (a) diametral pitch                   (b) circular pitch

    (c) pitch diameter                   (d) none of these

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. Which of the following clutches is positive type

    (a) Cone         (b) Disc         (c) Jaw         (d) Centrifugal

### 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. Define pressure angle of a gear.

15. State the law of static friction.

### PART - C (5 x 16 = 80 Marks)

16. (a) Describe various inversions of a slider crank mechanisms giving example.    (16)

Or

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

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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) In the mechanism shown in Figure, the slider C is moving to the right with a velocity of 1 m/s and an acceleration of 2.5 m/s2. The dimensions of various links are AB = 3 m inclined at 45° with the vertical and BC = 1.5 m inclined at 45° with the horizontal. Determine: **1.** The magnitude of vertical and horizontal component of the acceleration of the point B, and **2.** the angular acceleration of the links AB and BC. (16)
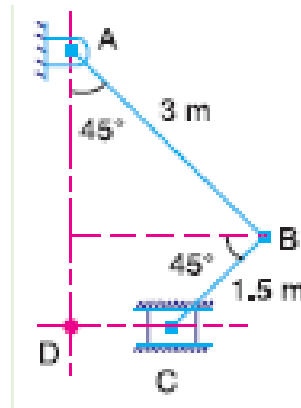


18. (a) A cam drives a flat reciprocating follower in the following manner :During first 120° rotation of the cam, follower moves outwards through a distance of 20 mm with simple harmonic motion. The follower dwells during next 30° of cam rotation. During next 120° of cam rotation, the follower moves inwards with simple harmonic motion. The follower dwells for the next 90° of cam rotation. The minimum radius of the cam is 25 mm. Draw the profile of the cam. (16)

Or

(b) A cam drives a flat reciprocating follower in the following manner: During first 120° rotation of the cam, follower moves outwards through a distance of 20 mm with simple harmonic motion. The follower dwells during next 30° of cam rotation. During next 120° of cam rotation, the follower moves inwards with simple harmonic

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motion. The follower dwells for the next 90° of cam rotation. The minimum radius of the cam is 25 mm. Draw the profile of the cam. (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 belt drive transmits 8 *kW* of power from a shaft rotating at 240 *rpm* to another shaft rotating at 160 *rpm*. The belt is 8*mm* thick. The diameter of the smaller pulley is 600 *mm* and two shafts are 5 *m* apart. The coefficient of friction is 0.25. If the maximum stress in the belt is limited to 3 *N/mm²*, find the width of the belt for (i) an open belt drive and (ii) a cross belt drive. (16)

Or

(b) A single dry plate clutch transmits 7.5 kW at 900 r.p.m. The axial pressure is limited to 0.07 N/mm2. If the coefficient of friction is 0.25,
find (i). Mean radius and face width of the friction lining assuming the ratio of the mean radius to the face width as 4, and (ii). Outer and inner radii of the clutch plate. (16)

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