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**Question Paper Code: 54702**

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

Fourth Semester

Mechanical Engineering

15UME402 – KINEMATICS OF MACHINERY

(Regulation 2015)

Duration: Three hours                                              Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. In a kinematic chain, a quaternary joint is equivalent to                    CO1-R

   (a) one binary joint                      (b) two binary joints

   (c) three binary joints                   (d) four binary joints

2. Which of the following is an inversion of single slider crank chain?        CO1-R

   (a) Beam engine                           (b) Watt's indicator mechanism

   (c) Elliptical trammels                    (d) Whitworth quick return motion mechanism

3. The component of the acceleration , perpendicular to the velocity of the      CO2-R
   particle , at the given instant is called as

   (a) Radial component                      (b) Acceleration

   (c) Tangential  component                 (d) None of these

4. The component of the acceleration, parallel to the velocity of the           CO2-R
   particle, at the given instant is called

   (a) radial component                      (b) tangential component

   (c) coriolis component                    (d) none of these

5. The cam follower extensively used in air-craft engines is                    CO3-R

   (a) knife edge follower                   (b) flat faced follower

   (c) spherical faced follower              (d) roller follower

6. For high speed engines, the cam follower should move with            CO3-R

    (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     CO4-R

    (a) dedendum       (b) addendum       (c) clearance       (d) working depth

8. The contact ratio for gears is     CO4-R

    (a) zero       (b) less than one       (c) greater than one       (d) none of these

9. When the axes of first and last gear are co-axial, then gear train is known as     CO5-R

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

    (c) reverted gear train                 (d) epicyclic gear train

10. A differential gear in an automobile is a     CO5-R

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

    (c) reverted gear train                 (d) epicyclic gear train

<div align="center">PART – B (5 x 2= 10Marks)</div>

11. Define the term kinematic link.     CO1-R

12. Define Rubbing velocity at pin joint.     CO2-R

13. List the types of followers based on shape.     CO3-R

14. What is mean by pitch circle diameter?     CO4-R

15. What is the purpose of idle gears?     CO5-R

<div align="center">PART – C (5 x 16= 80Marks)</div>

16. (a) Explain the following inversions of four bar chain mechanism with application: crank lever, double crank and double lever mechanism.     CO1-App     (16)

<div align="center">Or</div>

    (b) Explain the working of Oscillating cylinder engine, Whitworth quick return motion mechanism and Rotary engine.     CO1-App     (16)

17. (a) 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: 1. Linear velocity and acceleration of the midpoint of the connecting rod, and 2. angular     CO2-App     (16)

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velocity and angular acceleration of the connecting rod, at a crank angle of 45° from inner dead centre position.

Or

(b) PQRS is a four bar chain with link PS fixed. The lengths of the links are PQ= 62.5 mm; QR = 175 mm; RS = 112.5 mm; and PS = 200 mm. The crank PQ rotates at 10 rad/sec clockwise. Draw the velocity and acceleration diagram when angle QPS = 60° and Q and R lie on the same side of PS. Find the angular velocity and angular acceleration of links QR and RS.    CO2-Ana    (16)

18. (a) Draw the profile of a cam operating a knife-edge follower having a lift of 30 mm. the cam raises the follower with SHM for 150° of the rotation followed by a period of dwell for 60°. The follower descends for the next 100° rotation of the cam with uniform velocity, again followed by dwell period. The cam rotates at a uniform velocity of 120 rpm and has a least radius of 20 mm. what will be the maximum velocity and acceleration of the follower during lift and return.    CO3-Ana    (16)

Or

(b) Draw the profile of a cam operating a roller reciprocating follower with the following data: minimum radius of cam= 25 mm, lift=30 mm, roller diameter = 15 mm, the cam lifts the follower for 120° with SHM followed by a dwell period of 30°. Then the follower lowers down during 150° of the cam rotation with uniform acceleration and deceleration followed by a dwell period. If the cam rotates at a uniform speed of 150 rpm, calculate the maximum velocity and acceleration of the follower during the descent period.    CO3-Ana    (16)

19. (a) A pair of gears, having 40 and 20 teeth respectively, are rotating in mesh, the speed of the smaller being 2000 r.p.m. Determine the velocity of sliding between the gear teeth faces at the point of engagement, at the pitch point, and at the point of disengagement if the smaller gear is the driver. Assume that the gear teeth are 20° involute form, addendum length is 5 mm and the module is 5 mm. Also find the angle through which the pinion turns while any pairs of teeth are in contact.    CO4-U    (16)

Or

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(b) Two gear wheels mesh externally and are to give a velocity ratio of 3 to 1. The teeth are of involute form; module = 6 mm, addendum = one module, pressure angle = 20°. The pinion rotates at 90 r.p.m. Determine: 1. The number of teeth on the pinion to avoid interference on it and the corresponding number of teeth on the wheel, 2. The length of path and arc of contact, 3. The number of pairs of teeth in contact, and 4. The maximum velocity of sliding.    CO4-Ana    (16)

20. (a) In an epicylic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 r.p.m. in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed makes 300 r.p.m. in the clockwise direction, what will be the speed of gear B?    CO5-U    (16)

Or

(b) In a reverted epicycle gear train, the arm A carries two gears B and C and a compound gear D-E. The gear B mashes with gear E and the gear C meshes with gear B. 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 100rpm clockwise.    CO5-U    (16)

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