R20

II B. TECH I SEMESTER REGULAR EXAMINATIONS, FEB - 2022
KINEMATICS OF MACHINERY
(MECHANICAL ENGINEERING)

Time: 3 Hours   **Max. Marks: 70**

Note: Answer **ONE** question from each unit **(5 × 14 = 70 Marks)**

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UNIT-I

1. a) Explain the application of Kutzbach criterion to plane mechanisms. [7M]

    b) List the names of approximate straight-line motion mechanisms. Draw and explain about any two of them. [7M]

(OR)

2. a) What is inversion? Sketch and explain about any three inversions of a single-slider crank chain. [7M]

    b) What is the condition for correct steering? Sketch and show the two main types of steering gears and discuss their relative advantages. [7M]

UNIT-II

3. Velocity and acceleration diagrams [14M]

    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/s 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.

(OR)

4. a) Draw the acceleration diagram of a slider crank mechanism. [7M]

    b) Explain with sketch the instantaneous center method for determination of velocities of links and mechanisms [7M]

UNIT-III

5. Draw the displacement, velocity and acceleration diagrams for a follower when it moves with simple harmonic motion. Derive the expression for velocity and acceleration during outstroke and return stroke of the follower. [14M]

(OR)

6. A cam rotating clockwise at a uniform speed of 200 r.p.m. is required to move an offset roller follower with a uniform and equal acceleration and retardation on both the outward and return strokes. The angle of ascent, the angle of dwell and the angle of descent are 120°, 60° and 90° respectively. The follower dwells for the rest of cam rotation. The least radius of the cam is 50 mm, the lift of the follower is 25 mm and the diameter of the roller is 10mm. The line of stroke of the follower is offset by 20 mm from the axis of the cam. Draw the cam profile and find the maximum velocity and acceleration of the follower during the outstroke. [14M]

UNIT-IV

7. a) An open belt running over two pulleys 240 mm and 600 mm diameter [7M] connects two parallel shafts 3 metres apart and transmits 4 kW from the smaller pulley that rotates at 300 r.p.m. Coefficient of friction between the belt and the pulley is 0.3 and the safe working tension is 10N per mm width. Determine: i) minimum width of the belt, ii) initial belt tension, and iii) length of the belt required

   b) Discuss the advantages and disadvantages of chain drive over belt or rope [7M] drive.

(OR)

8. a) Derive an expression for the length of a belt in an open belt drive. [7M]

   b) A pulley used to transmit power by means of ropes has a diameter of [7M] 3.6 metres and has 15 grooves of 45° angle. The angle of contact is 170° and the coefficient of friction between the ropes and the groove sides is 0.28. The maximum possible tension in the ropes is 960 N and the mass of the rope is 1.5 kg per metre length. What is the speed of pulley in r.p.m. and the power transmitted if the condition of maximum power prevails?
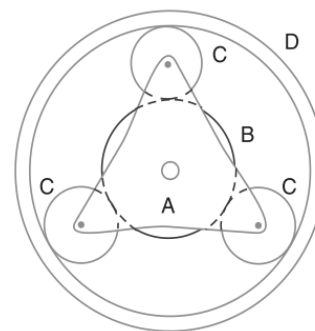
UNIT-V

9. A pinion having 30 teeth drives a gear having 80 teeth. The profile of the [14M] gears is involute with 20° pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and the contact ratio.

(OR)

10. a) A pair of 20° full depth involute spur gears having 30 and 50 teeth [7M] respectively of module 4 mm are in mesh. The smaller gear rotates at 1000 r.p.m. Determine: i) Sliding velocities at engagement and at disengagement of pair of teeth, and ii) Contact ratio.

   b) In an epicyclic gear train of the 'sun and planet [7M] type' as shown in Figure, the pitch circle diameter of the internally toothed ring D is to be 216 mm and the module 4 mm. When the ring D is stationary, the spider A, which carries three planet wheels C of equal size, is to make one revolution in the same sense as the sun wheel B for every five revolutions of the driving spindle carrying the sun wheel B. Determine suitable number of teeth for all the wheels and the exact diameter of pitch circle of the ring.

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