CBCS SCHEME

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15ME42

Fourth Semester B.E. Degree Examination, Jan./Feb. 2023
Kinematics of Machines

Time: 3 hrs.   Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. With neat sketch, explain the types of joints in a kinematic chain. **(08 Marks)**
   b. What are the Inversions? With sketch describe various inversions of 4 bar chain. **(08 Marks)**

OR

2 a. Derive an expression for necessary conditions for current steering and explain Ackerman steering gear with neat sketch. **(08 Marks)**
   b. With a neat proportionate sketch, explain crank and slotted lever quick return motion mechanism. **(08 Marks)**

Module-2

3 In a 4 bar mechanism, the dimensions of the links are under : AB = 50mm , BC = 66mm , CD = 56mm , AD = 100mm. at the instant when $\angle DAB = 60°$, the link AB has an angular velocity of 10.5 rad/s in the counter – clockwise direction. Determine
   i) Angular velocities of links BC and CD.
   ii) Velocity of the point E on the link BC when BE = 40mm.
   iii) Velocity of robbing at pins A, B, C and D, when the radii of the pins are 30, 40, 25 and 35mm respectively. **(16 Marks)**

OR

4 a. Explain the method of finding acceleration of slider crank mechanism using Klen's construction. **(08 Marks)**
   b. State and prove Kennedy's theorem. **(08 Marks)**

Module-3

5 In an IC engine mechanism, crank radius is 50mm and connecting rod length is 200mm. The crank is rotating at 100 rad/s clockwise. At a particular instant the crank is at 40° from TDC position. For this position of the mechanism, find out the velocity of piston using complex algebra method. **(16 Marks)**

OR

6 a. Explain function generation for slider crank mechanism. **(08 Marks)**
   b. Derive the expression for Freudenstein's equation for 4 bar mechanism. **(08 Marks)**

Module-4

7 a. A pinion with 120mm pitch diameter mesher with a gear of 400 rpm pcd. The teeth are of module 2mm and pressure angle of 25°. If the addendum of each wheel is 6mm find the angle by which the pinion turns to maintain contact. Also find the maximum sliding velocity, assume pinion is the driver and it rotates at 200 rpm. **(08 Marks)**
   b. Obtain an expression for the minimum number of teeth on pinion to avoid interference. **(08 Marks)**

OR

8 An epicyclic gear train has a fixed annular wheel. A concentric with sun wheel C. The gear A has a 72 teeth and C has 32 teeth. A planet wheel B gears with A and C and is carried on an arm F which rotates about the centre of A at 18 rpm. Determine the speed of gears B and C.**(16 Marks)**

Module-5

9 A symmetrical cam with convex flanks operates a flat – faced follower. The lift is 8mm, base circle radius is 25mm and the nose radius is 12mm. If the total angle of cam action is 120°, find the radius of the convex flank. Determine the maximum velocity and the maximum acceleration when the cam shaft rotates at 500 rpm. **(16 Marks)**

OR

10 The following data relate to a cam profile which operates a knife edge follower rising with SHM and lowering with UARM.

Minimum radius of the cam = 30mm.

Line of stroke of follower is offset 15mm from the axis of the cam.

Lift of the follower 45mm.

Angle of ascent = 70°.

Angle of descent = 120°.

Angle of dwell in highest position of follower is 45°.

Speed of cam 200rpm in CW direction.

Draw the profile of the cam and determine maximum velocity and acceleration during lift of the follower. **(16 Marks)**

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