CBCS SCHEME

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18ME44

Fourth Semester B.E. Degree Examination, Dec.2024/Jan.2025
Kinematics of Machines

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define the following with an example : i) Kinematic pair ii) Kinematic chain iii) Mechanism iv) Degree of freedom. **(08 Marks)**

b. Sketch and explain the following mechanisms :
i) Oscillating cylinder mechanism ii) Scotch yoke mechanism. **(12 Marks)**

OR

2 a. What is quick return motion mechanism? Sketch and explain crank and slotted lever mechanism. **(08 Marks)**

b. With neat sketches, explain the following mechanisms :
i) Ratchet and Pawl mechanism ii) Pantograph. **(12 Marks)**

Module-2

3 a. With a simple sketch, explain Corioli's component of acceleration. **(06 Marks)**

b. In a four bar mechanism ABCD. The link AD is fixed and crank AB rotates at 100 rpm clockwise. The link AB make 60° with fixed link AD. The lengths of link AB , BC ,CD and AD are 90, 120, 120 and 180 mm respectively. Determine angular velocity of link BC and CD by relative velocity method. **(14 Marks)**

OR

4 a. What is Instantaneous centre? Explain the types of instantaneous centres. **(08 Marks)**

b. The crank of an engine mechanism is 200 mm long and ratio of connecting rod to crank is 4. The crank speed is 240 rpm clockwise. When the crank has turned through 45° from inner dead centre determine the following using instantaneous centre method.
i) Angular velocity of connecting rod ii) Velocity of the slider. **(12 Marks)**

Module-3

5 a. What is Loop closure? Explain loop closure equation for Four bar mechanism. **(06 Marks)**

b. In a slider crank mechanism the crank and connecting rods are 150 mm and 600 mm long respectively. The crank rotates at uniform speed of 100 rpm clockwise. When the crank makes 30° with 1DC. Find
i) Angular velocity and angular acceleration at the connecting rod.
ii) Velocity and acceleration of the slider.
Use Complex algebra method. **(14 Marks)**

OR

6 a. Derive Freudenstein's equation for slider crank mechanism. **(08 Marks)**

b. Design a four bar mechanisms when the motions of the input and output links are governed by a function $y = 2x^2$ and x varies from 2 to 4 with an interval of 1. Assume θ to vary from 40° to 120° and ϕ from 60° to 132°. **(12 Marks)**

Module-4

7 Draw the profile of the cam with 30 mm minimum radius is rotating clockwise and has to give motion to the knife edge follower with follower axis offset to the right by 10 mm. The cam lifts the follower for 120° of cam rotation with SHM , followed by a dwell period of 60°. Then the follower returns to starting position through 90° with UARM and then dwells for the remaining period. Stroke = 300 mm. **(20 Marks)**

OR

8 The following data relate to a cam profile which operates a reciprocating inline roller follower.
Minimum radius of the cam = 30 mm
Roller diameter = 15 mm
Stroke of the follower = 30 mm
The follower moves outward during 150° with UARM.
Dwell for next 30°
Return during next 120° with SHM. Dwells for the rest of the rotation.
Draw the cam profile if the cam rotates in clockwise. **(20 Marks)**

Module-5

9 a. What is Interference in gears? Explain in brief the methods to avoid interference. **(08 Marks)**

b. Two spur gears have 24 and 30 teeth of module 10 mm. The standard addendum is 1 module and pressure angle is 20°. Determine
i) Length of path of contact ii) Length of arc of contact iii) Contact Ratio. **(12 Marks)**

OR

10 a. Sketch and explain i) Simple gear train ii) Reverted gear train. **(06 Marks)**

b. An epicyclic gear train consists of three gears A, B and C as shown in Fig. Q1(b). The internal gear A has 72 teeth and gear C has 32 teeth. The gear B meshes with both gear A and C and is carried on an arm F, which rotates about the centre of gear A and C at 20 rpm. If the gear A is fixed determine the speed of gears B and C using Tabular column method. **(14 Marks)**

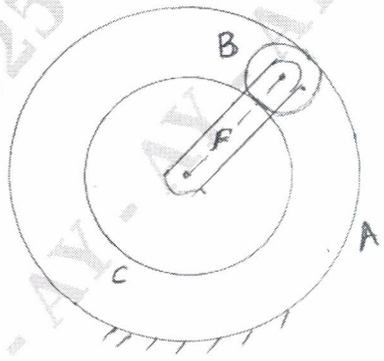

Fig. Q10(b)

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