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CBCS SCHEME

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17AU43

Fourth Semester B.E. Degree Examination, Feb./Mar. 2022
Kinematics of Machines

Time: 3 hrs. Max. Marks: 100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Define the following:
(i) Kinematic link (ii) Kinematic chain (iii) Inversion
(iv) Mechanism (v) Machine and structure **(10 Marks)**

b. Sketch and explain Withworth Quick return motion mechanism. **(10 Marks)**

OR

2 a. What are Intermittent motion mechanisms? Where they are used? Explain any one, with a neat sketch. **(10 Marks)**

b. Sketch and explain Ackermann Steering Gear Mechanism. **(10 Marks)**

Module-2

3 In a slider crank mechanism, the crank OB = 30 mm and the connecting rod BC = 120 mm. The crank rotates at a uniform speed of 300 rpm clockwise. For the crank position 60° from inner dead centre. Find:
(i) Velocity of piston 'C' and angular velocity of connecting rod BC.
(ii) Acceleration of piston 'C' and angular acceleration of connecting rod BC. **(20 Marks)**

OR

4 a. State Kennedy's theorem and prove it. **(06 Marks)**

b. A pin jointed four bar mechanism ABCD. The link AB is 150 mm and makes an angle of 60° with the link AD and rotates uniformly at 100 rpm. The link BC = 180 mm, CD = 180 mm and fixed link AD = 300 mm. Locate all instantaneous centers and find the angular velocity of link BC and the linear velocity of link CD. **(14 Marks)**

Module-3

5 a. Using complex algebra, derive expression for velocity and acceleration of the piston, angular acceleration of connecting rod of a reciprocating engine mechanism. **(10 Marks)**

b. If the crank and connecting rod are 150 mm and 600 mm long respectively and crank rotate at uniform speed of 100 rpm clockwise, determine:
(i) Angular velocity and angular acceleration of connecting rod.
(ii) Velocity and acceleration of piston, using Raveni's approach.
The angle which the crank makes with inner dead centre is 30°. **(10 Marks)**

OR

6 a. Illustrate use of Klen's construction for velocity diagram for slider crank mechanism. **(08 Marks)**

b. Determine the velocity and acceleration of the piston by Klein's construction to the following specification.
Stroke = 300 mm; Ratio of length of connecting rod to crank is 4;
Speed of engine = 300 rpm. Position of crank is 45° with inner dead centre. **(12 Marks)**

Module-4

7 a. Demonstrate law of gearing or condition for correct gearing. **(08 Marks)**

b. Two gears in mesh have a module of 8 mm and a pressure angle of 20°. The larger gear has 57 teeth while pinion has 23 teeth. If the addendum on pinion and gear wheel are equal to one module. Find:

(i) The number of pairs of teeth in contact.

(ii) The angle of action of the pinion and the gear wheel. **(12 Marks)**

OR

8 a. Two spur gear A and B of an epicyclic gear train shown in Fig.Q8(a) have 24 and 30 teeth respectively. The arm rotates at 100 rpm clockwise. Find the speed of gear B on its own axis when gear 'A' is fixed. If instead of being fixed the wheel 'A' rotates at 200 rpm in counter clock direction, what will be the speed of 'B'. Use algebra method only.

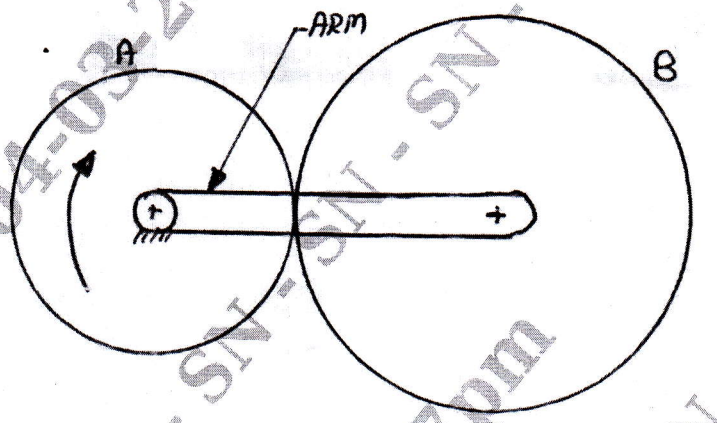

Fig.Q8(a) **(10 Marks)**

b. In an epicyclic gear train, the internal wheels A, B and the compound wheel C and D rotate independently about the axis 'O'. The wheels E and F rotate on a pin fixed to the arm 'G'. E gears with A and C, and F gears with B and D. All the wheels have same pitch and the number of teeth on E and F are 18, C = 28, D = 26.

(i) Sketch the arrangement

(ii) Find the number of teeth on A and B

(iii) If the arm G makes 150 rpm CW and A is fixed, find speed of B

(iv) If the arm G makes 150 rpm CW and wheel A makes 15 rpm CCW, find the speed of B. **(10 Marks)**

Module-5

9 The exhaust valve of a diesel engine has a lift of 62.8 mm. It is operated by a cam to give cycloidal motion during opening and closing periods each of which corresponds to 120° of cam rotation. The follower is provided with a roller of 20 mm diameter and its line of stroke is radial. Minimum radius of the cam is 25 mm. Draw the profile of cam. Also determine the maximum velocity and acceleration of the follower during outward and inward stroke, if the speed of the cam is 300 rpm clockwise. **(20 Marks)**

OR

10 A cam rotates at a uniform speed of 300 rpm clockwise and give an oscillating follower 75 mm long, an angular displacement of 30° in each stroke. The follower if fitted with a roller of 20 mm diameter which makes contact with the cam. The outward and inward displacements of follower each occupying 120° cam rotation and there is no dwell in the lifted position. The follower moves throughout with SHM. The axis of fulcrum is 80 mm from the axis of cam and the least distance of roller axis from cam axis is 40 mm. **(20 Marks)**

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