CBCS Scheme

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15ME42

Fourth Semester B.E. Degree Examination, June/July 2018
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. Define the following:
i) Link ii) Kinematic pairs iii) Kinematic chain
iv) Mechanism v) Structure vi) Degree of freedom **(06 Marks)**

b. Explain with neat sketch crank and slotted lever mechanism. **(05 Marks)**

c. Explain with neat sketch peaucellier mechanism. **(05 Marks)**

OR

2 a. Explain with neat sketch Ackerman steering mechanism. Mention condition for correct steering. **(08 Marks)**

b. Explain with neat sketch: i) Oldham's coupling ii) Pantograph. **(08 Marks)**

Module-2

3 The crank and connecting rod of a theoretical steam engine are 0.5 m and 2m long respectively. The crank makes 180 rpm in the clockwise direction. When it has turned 45° from the inner dead centre position, determine:
i) Velocity of piston
ii) Angular velocity of connecting rod
iii) Velocity of point E on the connecting rod 0.5 m from the crank end
iv) Velocities of rubbing at the pins of the crank shaft, crank and cross head when the diameter of their pins are 50 mm, 60 mm and 30 mm respectively
v) Position and linear velocity of any point G on the connecting rod which has the least velocity relative to crank shaft. **(16 Marks)**

OR

4 a. State and prove Aronhold Kennedy's theorem. **(04 Marks)**

b. In a slider crank mechanism, the length of crank and connecting rod are 125 mm and 500 mm respectively. The centre of gravity 'G' of the connecting rod is 275 mm from the slider. The crank speed is 600 rpm clockwise. The crank makes 45° from inner dead centre. Locate all the instantaneous centers and find velocity of slider, velocity of slider, velocity of point G and angular velocity of connecting rod. By Klein's construction, determine the acceleration of the slider and the point G. **(12 Marks)**

Module-3

5 The crank of an engine is 200 mm long and the ratio of connecting rod length to crank radius is 4. Determine the acceleration of piston when the crank has turned through 45° from the inner dead centre position and moving towards center at 240 rpm by complex algebra analysis. **(16 Marks)**

OR

6 a. Derive the expression for Freudenstein's equation for slider crank mechanism. **(12 Marks)**

b. Explain function generation for four bar mechanism. **(04 Marks)**

Module-4

7 a. Derive the equation for length of path of contact. **(08 Marks)**

b. A pair of involute spur gears with 16° pressure angle and pitch of module 6 mm in mesh. The number of teeth on pinion is 16 and its rotational speed is 240 rpm. When the gear ratio is 1.75, find in order that the interference is just avoided:

i) The addenda on pinion and gear wheel

ii) Length of path of contact

iii) The maximum velocity of sliding of teeth on either side of the pitch point. **(08 Marks)**

OR

8 a. Explain with neat sketch:

i) Simple gear train

ii) Compound gear train

iii) Reverted gear train

iv) Epicyclic gear train **(08 Marks)**

b. In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm of the gear train rotates at 150 rpm in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of the gear B. If the gear A instead of using fixed, makes 300 rpm in the clockwise direction, what will be the speed of gear B. Arrangement is shown in Fig.Q8(b).

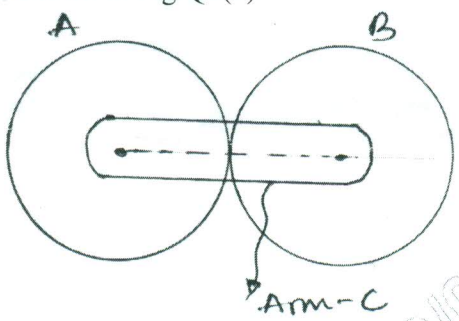

Fig.Q8(b) **(08 Marks)**

Module-5

9 A cam is to be designed for a knife edge follower with the following data, cam lift = 40 mm during 90° for cam rotation with simple harmonic motion, dwell for the next 30°, during the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion, dwell during the remaining 180°. Draw the profile of the cam when the line of stroke of the follower passes through the axis of cam shaft. The radius of the base circle of the cam is 40 mm. Determine the maximum velocity and acceleration of the follower during its ascent and descent, if the cam rotates at 240 rpm. Assume the direction of cam rotation is clockwise. **(16 Marks)**

OR

10 In a symmetrical tangent cam operating a roller follower, the least radius of the cam is 30 mm and roller radius is 17.5 mm. The angle of ascent is 75° and the total lift is 17.5 mm. The speed of the cam shaft is 600 rpm. Calculate:

i) The principal dimensions of the cam.

ii) The accelerations of the follower at the beginning of the lift, where straight flank merges into the circular nose and at the apex of the circular nose. Assume that there is no dwell between ascent and descent. **(16 Marks)**

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