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Fourth Semester B.E. Degree Examination, Aug./Sept.2020 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:
- i) Kinematic pair
 - ii) Kinematic chain
 - iii) Mechanism
 - iv) Structure. (08 Marks)
- b. State Grashoff's law. Explain with simple sketches three inversions of Grashoff's chain. (08 Marks)

OR

- 2 a. With a neat sketch, explain Whitworth quick return motion mechanism. (08 Marks)
- b. Sketch and explain Peaucellier mechanism. Also prove that it can be used to trace an exact straight line. (08 Marks)

Module-2

- 3 In the slider crank mechanism shown in Fig.Q.3. the crank rotates at 10r/s , uniformly in clockwise direction. Determine: i) The acceleration of the connecting rod ii) Acceleration of the slider B iii) Acceleration of a point C on connecting rod. The lengths of various links are $OA = AC = 200\text{mm}$ $AB = 600\text{mm}$ $\angle AOB = 30^\circ$ solve by relative method. (16 Marks)

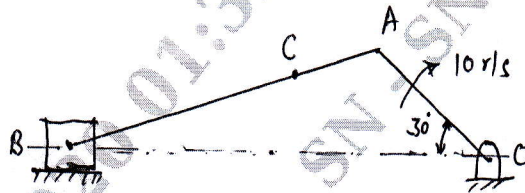


Fig.Q.3

OR

- 4 a. In a pin jointed four bar mechanism ABCD, the fixed link $AD = 600\text{mm}$, $AB = 300\text{mm}$, $BC = CD = 360\text{mm}$ and the angle $\angle BAD = 60^\circ$. The crank AB rotates uniformly at 100rpm (clockwise) locate all the instantaneous centres and find the angular velocity of the link BC. (08 Marks)
- b. Draw Klein's construction for single slider crank mechanism and explain how to determine the velocity and acceleration of the slider. (08 Marks)

Module-3

- 5 For the slider crank mechanism, crank rotating uniformly, using complex algebra, derive expressions for the following:
- i) Velocity and acceleration of the slider
 - ii) Angular velocity and angular acceleration of the connecting rod. (16 Marks)

OR

- 6 Design a four link mechanism when motions of the input and the output links are governed by a function $y = x^2$ and x varies from 0 to 2 with no error at $x = 0, 1$ and 2. Assume angular position of input link θ to vary from 50° to 150° and angular position of output link ϕ vary from 80° to 160° . Assume the length of fixed link as 100mm. (16 Marks)

Module-4

- 7 a. Define: i) Module ii) Circular pitch iii) Backlash. (06 Marks)
 b. Two spur gears have 24 and 30 teeth of module = 10mm, standard addendum = 1 module and pressure angle = 20° . Determine:
 i) Length of path of contact
 ii) Length of arc of contact
 iii) Contact ratio. (10 Marks)

OR

- 8 a. Sketch and explain: i) Compound gear train ii) Epicyclic gear train (06 Marks)
 b. In the epicyclic gear train shown in Fig.Q.8(b), the internal gear D is fixed and the sun gear A rotates at 120rpm CCW direction. The number of teeth on gear A, B and C are 60, 40 and 25 respectively. Determine the speed and sense of the arm E. (10 Marks)

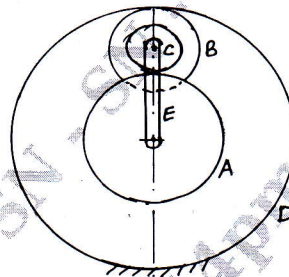


Fig.Q.8(b)

Module-5

- 9 Draw the profile of the cam to give the following motion to a flat faced reciprocating follower:
 i) Follower to raise through 24mm during 150° of the cam rotation with SHM.
 ii) Follower to dwell for the next 30° of the cam rotation.
 iii) Follower to return to the initial position during 90° of the cam rotation with SHM.
 iv) Follower to dwell for the remaining 90° of cam rotation.
 Take the minimum radius of the cam as 25mm. (16 Marks)

OR

- 10 The following data relate to a symmetrical circular cam operating a flat faced follower:
 Minimum radius of the cam = 40mm
 Lift = 24mm, angle of lift = 75°
 Nose radius = 8mm
 Speed of the cam = 420rpm
 Determine the main dimensions of the cam and the acceleration of the follower at the
 i) Beginning of the lift
 ii) End of contact with circular flank
 iii) Beginning of contact with the nose
 iv) Apex of the nose. (16 Marks)

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