CBCS SCHEME

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15ME42

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.

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:
   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 = 200mm AB = 600mm $\angle AOB = 30^\circ$ solve by relative method. **(16 Marks)**

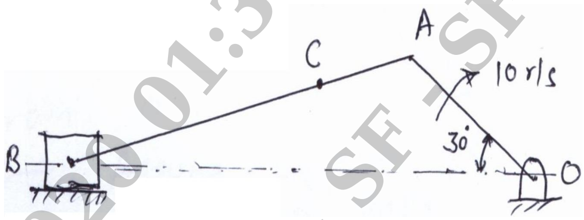

Fig.Q.3

OR

4 a. In a pin jointed four bar mechanism ABCD, the fixed link AD = 600mm, AB = 300mm BC = CD = 360mm and the angle BAD= 60°. 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)**

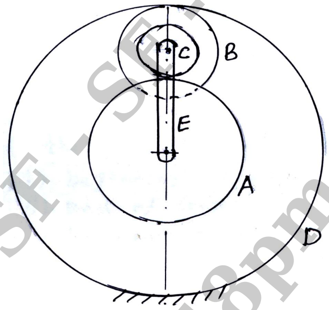

Fig.Q.8(b)

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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