CBCS SCHEME

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17ME42

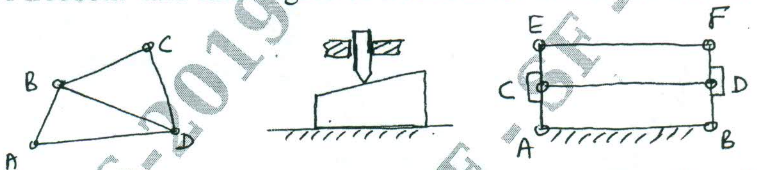
Fourth Semester B.E. Degree Examination, June/July 2019
Kinematics of Machinery

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define 'degree of freedom' and find degree of freedom for the chains shown in Fig.Q1(a).



(i) (ii) (iii) AB = CD = EF & AE = BF

Fig.Q1(a) **(10 Marks)**

b. Define 'inversion of a kinematic chain'. A four bar mechanism has links of lengths 150mm, 250mm, 300mm and frame L_0 mm. Find the range of L_0 if the mechanism has to work as (i) Double crank mechanism (ii) Crank-rocker mechanism. **(10 Marks)**

OR

2 a. Sketch a neat, proportionate 'Peaucellier's mechanism'. State geometric relationships among links. Identify the point tracing the straight line and prove that the point traces straight line. **(10 Marks)**

b. Draw 'Crank and Slotted lever' type of quick return motion mechanism showing the positions of crank clearly for extreme positions of lever. If the crank and frame are 200 mm, 800mm, find the ratio of time of return to time of cutting if the crank rotates uniformly. Also find angle of oscillation of lever. **(10 Marks)**

Module-2

3 In a four bar mechanism ABCD, AD is fixed link of 120 mm long. The crank AB is 30mm and rotates at 100 rpm clockwise, while CD = 60 mm oscillates about D. BC and AD are of same length. Find the angular velocity of link CD when angle BAD = 60° by
(i) relative velocity method (ii) instantaneous centre method. **(20 Marks)**

OR

4 a. State and prove Kennedy's theorem. **(08 Marks)**

b. Explain the procedure to construct 'Klein's construction' to determine the velocity and acceleration of a slider crank mechanism in which crank is rotating uniformly. **(12 Marks)**

Module-3

5 a. For the slider crank mechanism shown in Fig.Q5(a), write (i) loop closure equation (ii) differentiate loop closure equation with respect to time to get velocity equation (iii) differentiate velocity equation with respect to time to get acceleration equation.

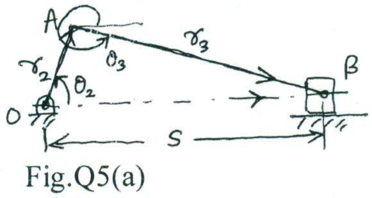


Fig.Q5(a) **(08 Marks)**

b. In Fig.Q5(a), if r_2 = 100mm r_3 = 350mm, θ_2 = 60°, find angular velocity and angular acceleration of connecting rod if crank rotates uniformly at 600 rpm in CCW direction. **(12 Marks)**

OR

6 a. For the 4-bar mechanism shown in Fig.Q6, obtain Frendenstein's equation. **(08 Marks)**

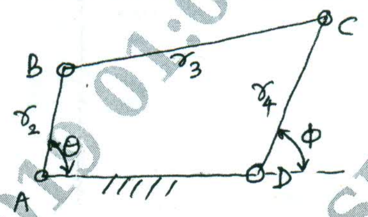


Fig.Q6

b. Find r_2, r_3 and r_4 to generate a function $y = x^3$, $1 \le x \le 3$ accurate at x = 1.1339, x = 2 and x = 2.866 if r_1 = 100mm, θ_s = 30°, θ_f = 90°, ϕ_s = 45° and ϕ_f = 135° with respect to Fig.Q6. **(12 Marks)**

Module-4

7 a. Define 'pitch circle', 'circular pitch', 'diametral pitch' and 'module'. **(08 Marks)**

b. Obtain an expression for the minimum number of teeth on pinion to avoid interference. **(12 Marks)**

OR

8 An epicyclic gear train consists of a sun-wheel S, a stationary internal gear E and three identical planet wheels P carried on a star shaped planet carrier C. The size of different tooth wheels are such that the planet carrier C rotates at $1/5^{th}$ of the speed of the sunwheel S. The no. of teeth on sun-wheel is 16. The driving torque on the sun-wheel is 100 N-m. Determine (i) no. of teeth on P and E. (ii) Torque required to keep the internal gear stationary. **(20 Marks)**

Module-5

9 From the following data draw the profile of a cam in which the follower moves with SHM during ascent while it moves with uniform acceleration and deceleration during descent.

Cam rotates in anticlockwise ; Lift of follower : 4 cm

Least radius of cam : 5 cm ; Angle of ascent : 48°

Angle of dwell between ascent and descent : 42° ;

Angle of descent = 60°

The diameter of roller = 3 cm

If cam rotates at 360 rpm, find maximum velocity and acceleration of the follower during descent. **(20 Marks)**

OR

10 a. Explain with sketch in brief 'radial cam' and 'cylindrical cam'. **(06 Marks)**

b. Obtain expressions for displacement, velocity and acceleration for a flat faced follower in contact with circular flank of a cam. **(14 Marks)**

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