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17ME42

Fourth Semester B.E. Degree Examination, July/August 2022
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 the following :
(i) Link   (ii) Kinematic Pair   (iii) Kinematic Chain
(iv) Mechanism   (v) Structure   (vi) Degree of freedom   **(06 Marks)**
b. Explain with a neat sketch crank and slotted lever mechanism.   **(06 Marks)**
c. Explain with a neat sketch Peaucellier mechanism.   **(08 Marks)**

OR

2 a. Explain with a neat Ackerman steering mechanism mention condition for correct steering.
    (10 Marks)
b. Draw a neat proportionate sketch of Whitworth mechanism and explain.   **(10 Marks)**

Module-2

3 In a four bar mechanism ABCD, AD is fixed and crank AB rotates at 200 rpm in clockwise direction. [Refer Fig.Q3]. The dimensions of versions links are as follows:
BC = AD = 150mm,   CD = 80mm,   AB = 40 mm.
(i) Find angular velocity of link BC and CD
(ii) Find angular acceleration of link BC and CD
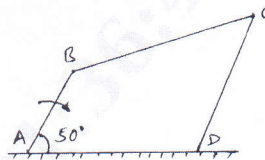

Fig.Q3   **(20 Marks)**

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 slider crank mechanism in which crank is rotating uniformly.   **(12 Marks)**

Module-3

5 The four bar mechanism ABCD is shown in Fig.Q5 which is driven by link 2 at $w_2 = 45$ rad/sec counter clockwise. Find the angular velocities of links 3 and 4 by using complex algebra method. Take AB = 100 mm, CD = 300mm, AD = 250mm.
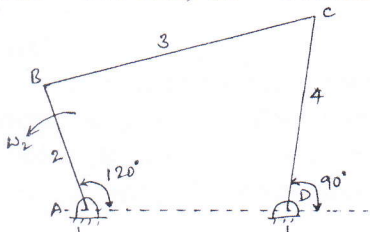

Fig.Q5   **(20 Marks)**

OR

6   a.   Derive Freudenstein's equation for slider crank mechanism. (08 Marks)
    b.   Design a four link mechanism if the motion of the input and output links are governed by a function $y = x^{1.5}$ and x varies from 1 to 4. Assume θ to vary from 30° to 120° and ϕ from 60° to 130°. The length of the fixed link is 30mm. Use Chebychev spacing of accuracy points. (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 interferences. (12 Marks)

OR

8   a.   Explain with neat sketch:
         (i) Single gear train   (ii) Compound gear train
         (iii) Reverted gear train   (iv) Epicyclic gear train (08 Marks)
    b.   The arm of an epicyclic gear train rotates at 100 rpm in anticlockwise direction. The arm carries two wheels A and B having 36 and 45 teeth respectively. The wheel A is fixed and the arm rotates about the centre of wheel A. Find the speed of wheel B. What will be the speed of B if the wheel A instead of being fixed, makes 200 rpm clockwise? [Refer Fig.Q8(b)]
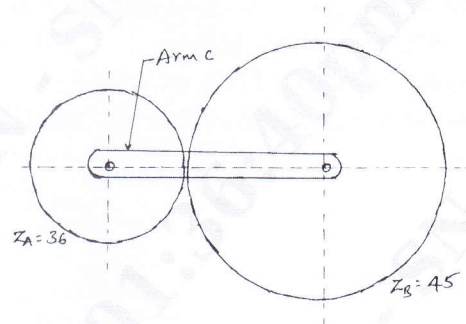

Fig.Q8(b) (12 Marks)

Module-5

9   Draw the profile of a cam to raise a valve with SHM through 40mm in $1/4^{th}$ of revolution, keep it fully raised though $1/10^{th}$ revolution and to lower it with uniform acceleration and retardation in $1/6^{th}$ revolution. The valve remains closed during the rest of the revolution. The diameter of the roller is 20mm and minimum radius of the cam to be 30mm. The axis of the valve rod passes through the axis of cam shaft. The cam shaft rotates at 360 rpm clockwise. Determine maximum velocity and acceleration of the following during outstroke and return stroke. (20 Marks)

OR

10 a.   Define the following terms related to cam:
         (i) Lift   (ii) Dwell   (iii) Pressure angle   (iv) Base angle (08 Marks)
    b.   Obtain expression for displacement, velocity and acceleration for a flat faced follower in contact with circular flank of a cam. (12 Marks)

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