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Fourth Semester B.E. Degree Examination, June/July 2019
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 terms Kinematic chain, Inversion and Mechanism. **(06 Marks)**
    b. Draw the mechanism to convert reciprocating motion into rotary motion. Give its different inversions. **(05 Marks)**
    c. With neat sketch, explain Robert mechanism. **(05 Marks)**

OR

2   a. Draw the neat sketch of pantograph mechanism and explain its working and give its application. **(08 Marks)**
    b. Sketch neat figure of Whitworth mechanism. Justify that it gives quick return motion. **(08 Marks)**

Module-2

3   a. What are velocity and acceleration images? **(04 Marks)**
    b. The crank O_2A of a four bar mechanism shown in Fig.Q3(b) below rotates clockwise at a constant speed of 100 rad/sec. Determine:
        i)   Acceleration of the point C
        ii) Angular acceleration of links 3 and 4. The lengths of links are $O_2A = 120$ mm, $AB = 160$ mm, $O_4B = 120$ mm and $AC = 80$ mm.
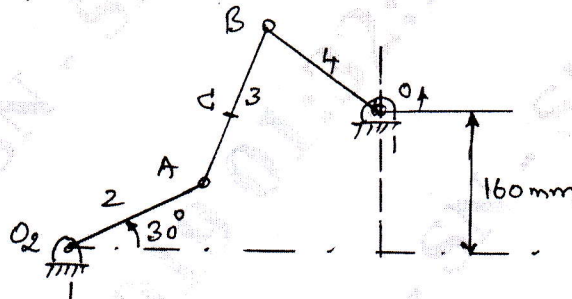

Fig.Q3(b) **(12 Marks)**

OR

4   a. State and prove Kennedy's theorem. **(06 Marks)**
    b. In a four bar mechanism ABCD, the Link AD is fixed, which is 120 mm long. The links AB, BC and CD are 60 mm, 80 mm and 80 mm respectively. At certain instant the crank AB makes an angle of 60° with the fixed link AD. If the crank AB rotates at uniform speed of 10 rpm clockwise, determine the angular velocity of the links BC and CD by I.C. method. **(10 Marks)**

Module-3

5   In a four bar mechanism ABCD links AB = 300 mm, BC = 360 mm, CD = 360 mm and the fixed link AD = 600 mm. The angle made by the link AB with fixed link AD is 60°. The link AB has an angular velocity of 10 rad/sec and angular acceleration of 30 rad/s² both clockwise. Determine the angular velocity and angular acceleration of link BC and CD by Raven's approach. **(16 Marks)**

OR

6   The crank of reciprocating engine is 90 mm long, the connecting rod is 360 mm long and the crank rotates at 150 rpm clockwise. The crank has rotated by 30° from IDC. Determine velocity and acceleration of the piston, angular velocity and angular acceleration of connecting rod solve by Klein's method. **(16 Marks)**

Module-4

7   a.   Define:
  i)   Pressure angle
  ii)   Addendum and dedendum
  iii)   Pitch with respect to spur gear. **(06 Marks)**

  b.   Two spur gears of equal diameter has 30 teeth each of involute shape. The circular pitch is 25 mm, and the pressure angle is 20°. Determine the addendum of the wheels if the arc of contact is twice the circular pitch. **(10 Marks)**

OR

8   a.   Enumerate different types of gear trains. Explain any one with neat sketch. **(06 Marks)**

  b.   In an epicyclic gear train an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 rpm in anticlockwise direction about the center of gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed makes 300 rpm in clockwise direction what will be the speed of gear B? **(10 Marks)**

Module-5

9   A cam with 25 mm as minimum radius is rotating clockwise at a uniform speed 100 rpm and has to give the motion to the knife edge follower as defined below (i) follower to move outwards through 25 mm during 120° cam rotation (ii) follower to dwell for next 60° of cam rotation (iii) follower to return to its starting position during next 90° of cam rotation (iv) follower to dwell for rest of cam rotation. The displacement of the follower takes place with uniform acceleration and retardation on both the outwards and return strokes. Draw the cam profile when follower axis is offset to right by 10 mm from the axis of cam, Determine the max velocity and acceleration during outstroke and return stroke. **(16 Marks)**

OR

10   A cam rotating clockwise at uniform speed of 300 rpm operates a reciprocating follower through a roller 10 mm diameter. The follower motion is defined below:
  i)   Follower lifts during 120° of cam rotation with UARM
  ii)   Follower dwells for next 30° of cam rotation
  iii)   Follower returns to its original position during 120° with SHM.
  iv)   Follower then dwells.
  The stroke of follower is 30 mm. The minimum radius of cam is 20 mm. Draw the profile of cam if axis of follower pass through centre of cam axis. Also determine maximum velocity and acceleration of follower during lift and return stroke. **(16 Marks)**

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