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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

August 2023 Semester End Make-Up Examinations

Programme: B.E. | **Semester: III**
Branch: Aerospace Engineering | **Duration: 3 hrs.**
Course Code: 22AS3PCTOM | **Max Marks: 100**
Course: Theory of Mechanisms | **Date: 10.08.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT - I

1 a) Draw the kinematic diagram and determine the degree of freedom for the excavator mechanism as shown in the figure1a. **8**

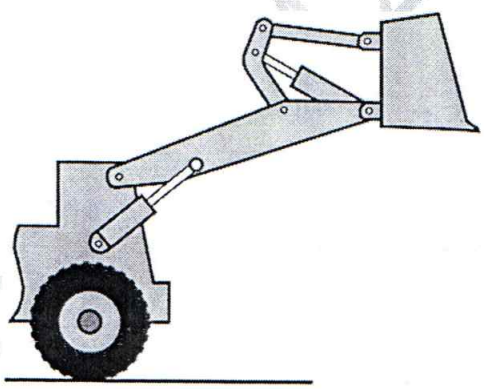

Fig. 1a

b) Explain with neat sketch the various types of, (i) Links (ii) Pairs or Joints with DOFs. **06**

c) A four-bar mechanism PQRS has lengths PQ = 100 mm, QR =250 mm, RS = 300 mm and PS = 400 mm. Determine the possibility of a full rotation and condition of the resulting mechanism by fixing each link using Grashoff's Law. **06**

UNIT - II

2 a) Obtain the neat kinematic inversion sketches of the double slider crank chain by fixing its different links and giving their applications. **07**

b) With a neat sketch explain the crank and slotted lever quick return mechanism. **07**

c) Determine the minimum and maximum transmission angle for the four-bar mechanism shown in Fig.-2c with dimensions shown along the lengths. **06**

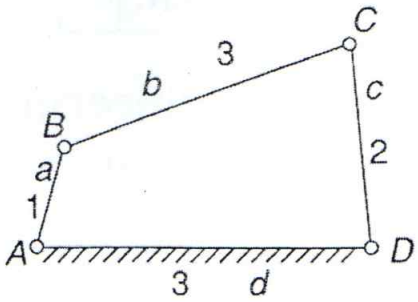

Fig.- 2c.

UNIT - III

3 a) For a slider crank mechanism, derive the analytical expressions for displacement and velocity of the slider. **08**

b) Locate all the instantaneous centers of the slider crank mechanism as shown in Fig 3b. The lengths of crank OB and connecting rod AB are 100 mm and 400 mm respectively. If the crank rotates clockwise with an angular velocity of 10 rad/s, find i). Velocity of the slider A, and ii). Angular velocity of the connecting rod AB. **12**

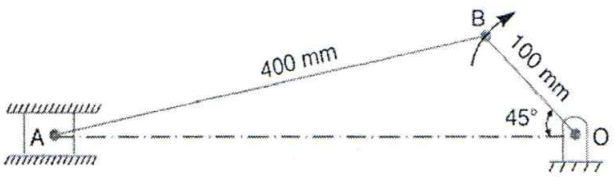

Fig.3b

UNIT - IV

4 a) Explain the radial and tangential acceleration of a link. **06**

b) A four-bar mechanism ABCD is pin jointed at the ends and the link AD length 600 mm is fixed. The links AB, BC, and CD are 300, 360, and 360 mm respectively. At a certain instant, the links AB makes an angle of 45 degrees with link AD. If the link AB rotates at an angular velocity of 10 rad/sec (CW) and angular acceleration of 30 rad/sec^2 (CW). Determine the angular velocity and angular acceleration of the midpoint of link BC and CD using the graphical method. **14**

OR

5 a) A link AB is moving in a vertical plane with constant angular velocity, at a certain instant when the link is inclined at 60° with the horizontal the point A is moving horizontally at 20 m/s, while B is moving vertically upwards. Find velocity at B and angular acceleration of link AB. **06**

b) A four-bar mechanism with the ternary link is shown in Fig 5b. The lengths of various links are given as below: O_1O_2 = 600 mm, O_1A = 300 mm, AB = 400 mm, O_2B = 450 mm, AC = 300 mm, BC = 250 mm, AD =100 mm, and angle AO_1O_2 is 75 degrees. Angular velocity of crank O_1A = 20 rad/s, Angular acceleration of crank O_1A = 100 rad/s^2 Determine (i) acceleration of coupler AB, (ii) acceleration of lever O_2B, (iii) acceleration of points C and D, and (iv) angular acceleration of ternary link. **14**

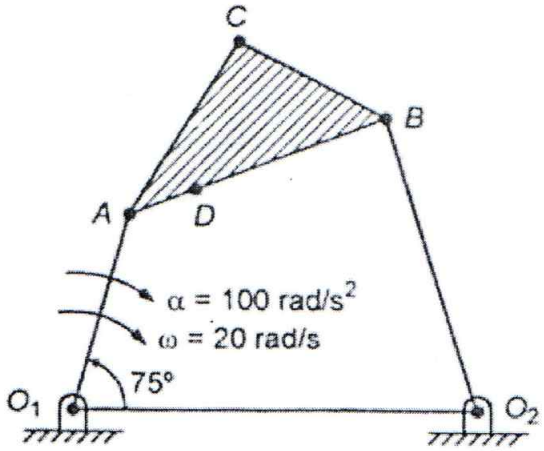

Fig 5b

UNIT - V

6 a) Derive the expression for the Coriolis acceleration of a moving point relative to a fixed body. **10**

b) The crank of a slider crank mechanism rotates clockwise at a constant speed of 300 r.p.m. The crank is 150 mm and the connecting rod is 600 mm long. Determine: a). linear velocity and acceleration of the midpoint of the connecting rod, and b). angular velocity and angular acceleration of the connecting rod, at a crank angle of 45° from the inner dead center position. **10**

OR

7 In the crank and slotted lever type quick return motion mechanism shown in Fig. 7a, the crank AB rotates at 120 rpm (CW). Determine (a) velocity of ram at D, (b) magnitude of Coriolis acceleration component, and (c) acceleration of ram at D. AB = 200 mm, OC =800 mm, CD =600 mm and OA =300 mm. **20**

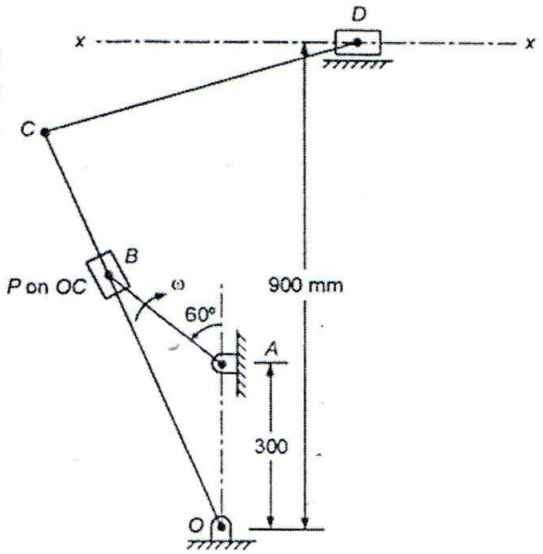

Fig.7a

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