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

Autonomous Institute Affiliated to VTU

May 2023 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: Aerospace Engineering **Duration: 3 hrs.**
Course Code: 22AS3PCTOM **Max Marks: 100**
Course: Theory of Mechanisms **Date: 23.05.2023**

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) Differentiate between Machine and a Mechanism. **3**

b) What do you mean by inversion of a mechanism? **2**

c) With the help of neat sketches, explain all three inversions of four bar mechanism. **15**

UNIT - II

2 a) Suggest a mechanism for the quick return of a tool for a shaping machine with a slotted lever. With a neat sketch explain the working principle of the mechanism. **10**

b) Explain the Grashoff's condition and Grubler's criterion of mechanisms with neat sketch. **10**

UNIT - III

3 a) The crank of a reciprocating engine revolves at a uniform speed of 310 rpm in clockwise direction. The crank and the connecting rod are 150mm and 650 mm long respectively. Using instantaneous centre method find the velocity of piston when the crank has turned through 30° from inner dead centre. **8**

b) A pin jointed 4-bar linkage shown in Fig. 3(b) is having dimensions AB = 0.5m, BC = 3m, DC = 1.5m, AD = 3.5m and BE = 2.25m. The link AB revolves at 20 rpm and angle BAD = 60˚. Find; (i) angular velocities of links CD&BC and (ii) Linear velocity of point E.

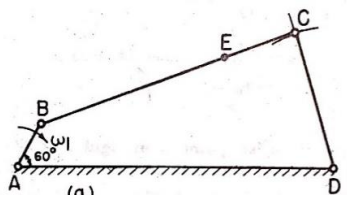

Fig. 3b **12**

UNIT - IV

4 a) In a four-bar mechanism ABCD, link AB = 300 mm, BC = CD = 360 mm and AD = 600 mm. Angle BAD = 60°. The link AB has an angular velocity of 10 rad/sec clockwise. Determine the angular velocity of links BC & CD. **12**

b) The crank of an engine mechanism measures 50 mm long and the ratio of connecting rod length to crank length is 4. The speed of crank is 1000 rpm clockwise. Determine analytically the angular velocity of CR and linear velocity of slider. **8**

OR

5 Fig. 5a shows the configuration OCPAQE of a mechanism. Find the angular acceleration of links CP, PA and AQ when the crank OC rotates uniformly at 120rpm in anticlockwise direction. The bell crank lever AQE is rocked about the fixed Centre Q by the link PA. Path of Point P is 25 mm vertically below point O. Also, OC = 125 mm, CP = 500 mm, PA = 125 mm, AQ = 250 mm, QE = 125 mm and Angle OC with horizontal is 45°.

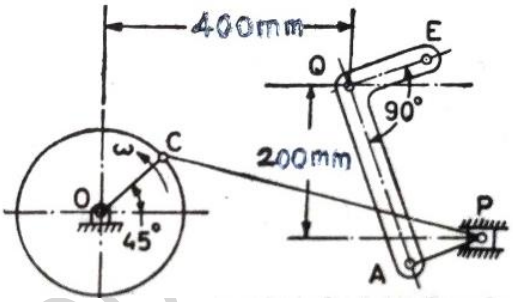

Fig. 5a **20**

UNIT - V

6 The following data refer to a quick return motion mechanism of crank and slotted lever type as shown in Fig. 6a. The dimensions are; Fixed link OA=250 mm, Crank AB=100 mm, Slotted lever OC=400 mm, CD=150 mm and Angle OAB=120°. Uniform speed of crank in clockwise direction is 1rps. The vertical distance of line of stroke of ram at D from O is 450 mm. Determine acceleration of ram at D and Coriolis acceleration of slider at B

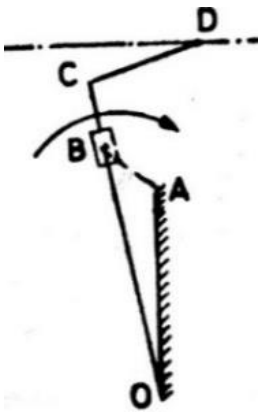

Fig. 6a **20**

OR

7 a) Derive an expression for Coriolis acceleration. **6**

b) A quick return mechanism is as shown in Fig. 7b. Link 2 rotates uniformly at 20 rad/sec. Draw the acceleration diagram and determine the Coriolis acceleration.

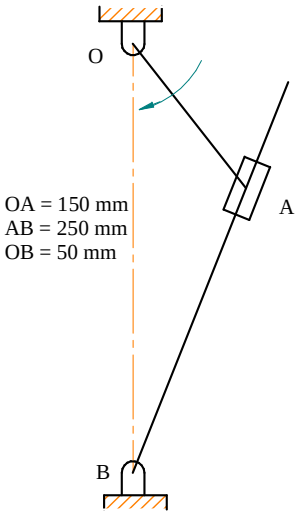

Fig.7b **14**

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