U.S.N.										

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

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

Programme: B.E. **Semester: III**

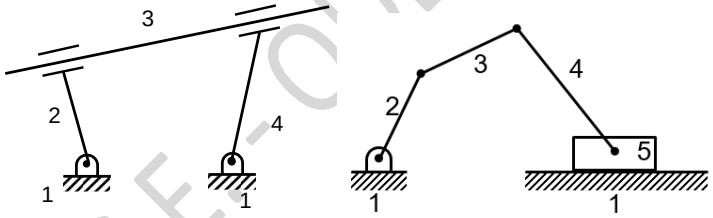
Branch: Aerospace Engineering **Duration: 3 hrs.**

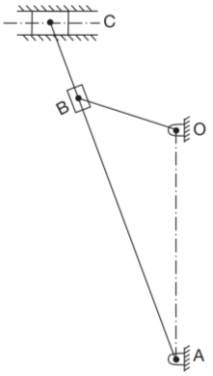
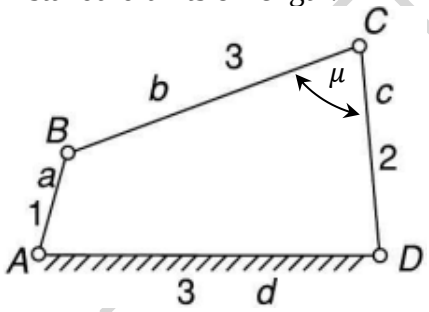
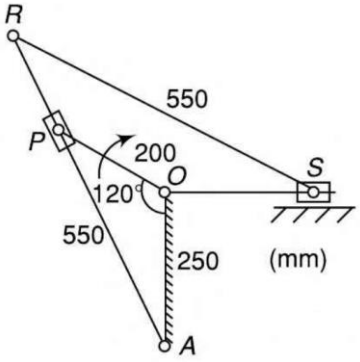
Course Code: 23AS3PCTOM **Max Marks: 100**

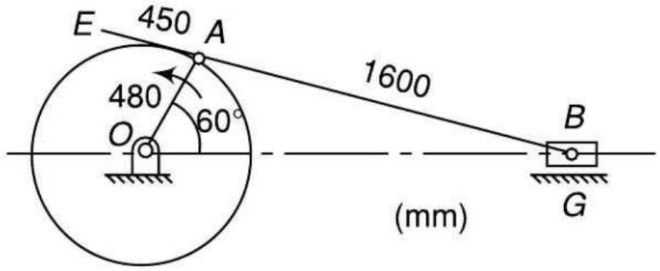
Course: Theory of Mechanisms

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

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	*CO*	*PO*	Marks
1	a)		Define the following briefly, (i) Machine and Mechanism, (ii) Inversion and DOF (iii) Higher and Lower Pairs (iv) Link and joints	*CO1*	*PO1*	**10**
	b)		Determine the mobility for the mechanism shown below in Figure 1.b.  (i) (ii) Fig.1b	*CO1*	*PO2*	**10**
			OR			
2	a)		Explain the Kutzbatch's Equation (Grubler's criterion) of mobility with sketch.	*CO1*	*PO1*	**10**
	b)		In a four bar mechanism, the length of driver crank, coupler, follower and fixed link links are 150 mm, 250 mm 300 mm and 'L' mm respectively. Find the range of values for link length 'L' so as to make it a (i) Crank-rocker mechanism (ii) Crank-crank mechanism.	*CO1*	*PO2*	**10**
			UNIT - II			
3	a)		Describe with neat sketches the inversions of the slider crank chain.	*CO2*	*PO1*	**12**

		b)	Design a quick return mechanism of the type shown in below Figure 3b The working stroke is 200 mm and the ratio of the time of working stroke to return stroke is 2:1. The driving crank is 50 mm long.  Fig.3b	*CO2*	*PO2*	**8**
			OR			
	4	a)	Describe with neat sketches of various miscellaneous mechanisms.	*CO2*	*PO1*	**12**
		b)	Find the maximum and minimum transmission angles(μ_{min} and μ_{max}) for mechanisms shown in below figure. The figure indicates the dimensions in standard units of length.  Fig.4b	*CO2*	*PO2*	**8**
			UNIT - III			
	5	a)	State and prove the Aronhold Kennedy Theorem.	*CO3*	*PO1*	**8**
		b)	Figure 5b represents a shaper mechanism. For the given configuration, what will be the velocity of the cutting tool at S and the angular velocities of the links AR and RS. Crank OP rotates at 10 rad/s.  Fig.5b	*CO3*	*PO2*	**12**
			OR			

	6	a)	Write the Instantaneous Center procedure for computing velocity of output link in a quadratic chain with Input link is cranking with uniform speed.	*CO3*	*PO1*	**8**
		b)	In a four bar chain ABCD, AD is fixed and is 150 mm long. The crank AB is 40 mm long and rotates at 120 r.p.m. clockwise, while the link CD = 80 mm oscillates about D. BC and AD are of equal length. Find the angular velocity of link CD when angle BAD = 60°.	*CO3*	*PO2*	**12**
			UNIT - IV			
	7	a)	Explain with a neat sketch the velocity and acceleration curves of a vehicle that starts from rest, attains a top speed, and then stops	*CO4*	*PO1*	**6**
		b)	For the configuration of a slider-crank mechanism shown in Figure 7b, calculate the (i) acceleration of the slider at B, (ii) acceleration of the point E, (iii) angular acceleration of the link AB. The crank OA rotates at 20 rad/s counter-clockwise.  Fig.7b	*CO4*	*PO2*	**14**
			OR			
	8	a)	Derive and explain the radial and tangential acceleration of a link.	*CO4*	*PO1*	**6**
		b)	Determine the acceleration of the mid-point BC of a four bar mechanism ABCD using relative velocity method. Given $AB = 25\ mm$, $BC = 40\ mm$, $CD = 50\ mm$, and $AD = 75\ mm$, AB is making 45° to horizontal link AD and has angular velocity $\omega_{BA} = 10\ rad/s$, $\alpha_{BA} = 10\ rad/s^2$ and link AD is grounded.	*CO4*	*PO2*	**14**
			UNIT - V			
	9		Derive the expression for the Coriolis acceleration for radial and tangential accelerations of a moving point relative to a fixed body the cases (without and with considering the angular acceleration).	*CO4*	*PO1*	**20**
			OR			
	10		In the crank and slotted lever type quick return motion mechanism shown in Figure 10a, the crank AB rotates at 120 rpm. Determine (i) velocity of ram at D, (ii) magnitude of Coriolis acceleration component, and (iii) acceleration of ram at D. AB = 200 mm, OC =800 mm, CD =600 mm and OA =300 mm.	*CO4*	*PO2*	**20**

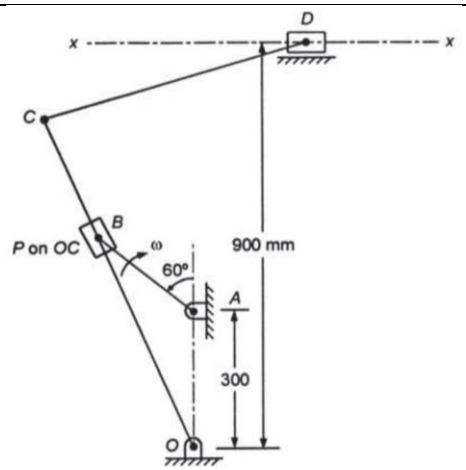


Fig.10a

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