U.S.N.										

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

Autonomous Institute Affiliated to VTU

December 2023 Supplementary Examinations

Programme: B.E. **Semester: IV**
Branch: Mechanical Engineering **Duration: 3 hrs.**
Course Code: 22ME4PCTOM **Max Marks: 100**
Course: Theory of Machines

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

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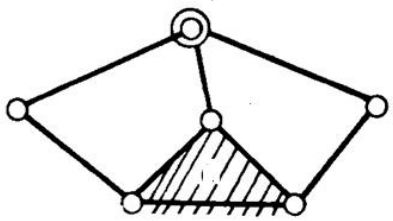
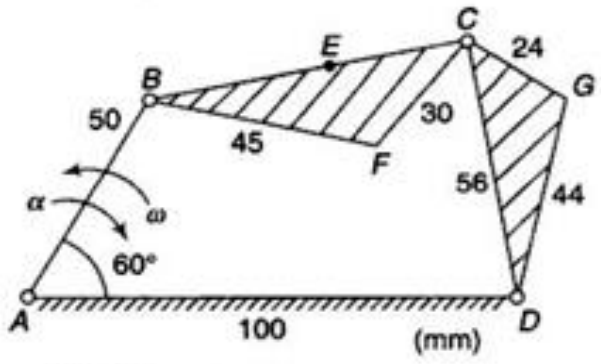
Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	*CO*	*PO*	Marks
1	a)	Explain the following terms (i) Kinematic chain (ii) Mechanism (iii) Degrees of freedom (iv) Grashof's law.	*CO1*	*PO 1*	**08**
	b)	Sketch and explain the working of an elliptical trammel. Prove that it traces an ellipse	*CO1*	*PO2*	**08**
	c)	Determine the degree of freedom for the given example as shown in Fig(1)  **Fig(1)**	*CO 1*	*PO2*	**04**
		UNIT - II			
2		Fig (2) shows the configuration diagram of a four-link mechanism along with the lengths of the links in mm. The link AB has an instantaneous angular velocity of 10.5 rad/s and angular acceleration is 26rad/s^2 . Find The angular acceleration of the link BC and CD. The linear acceleration of the points E, F and G.	*CO2*	*PO2*	**20**

			 BE = 40 mm BC = 66 mm **Fig(2)**			
			OR			
3	a)	What is Coriolis component of the acceleration? Derive the expression for the same.	*CO2*	*PO1*	**08**
	b)	In a reciprocating engine, the length of crank is 250mm and length of connecting rod is 1000mm.The crank rotates at an uniform speed of 300 rpm in clockwise direction and the crank is inclined at 30° with inner dead Centre. The Centre gravity of the connecting rod is 400 mm away from the crank end.By Klen's construction determine (i) Velocity and acceleration of piston. (ii) Angular velocity and angular acceleration of connecting rod and (iii) Velocity and acceleration at the centre of gravity of the connecting rod	*CO2*	*PO2*	**12**
		UNIT - III			
4	a)	State and prove law of gearing.	*CO3*	*PO1*	**06**
	b)	An epicyclical gear train consists of a sun wheel S, a stationary internal gear E and three identical planet wheels P carried on a star- shaped planet carrier C. The size of different toothed wheels are such that the planet carrier C rotates at 1/5th of the speed of the sun wheel S. The minimum number of teeth on sun wheel is 16. The driving torque on the sun wheel is 100 N-m. Determine: - (i) Sketch the arrangement (ii). Number of teeth on different wheels of the train, and (iii) Torque necessary to keep the internal gear stationary.	*CO3*	*PO2*	**14**
		UNIT - IV			
5	a)	Explain the function of a flywheel and Prove that the maximum fluctuation of energy in a flywheel as $\Delta E = 2EC_S$	*CO4*	*PO1*	**05**
	b)	For the static equilibrium as shown in Fig (3). determine the torque required on link OAB. Given details as; OA=OB=50mm,	*CO4*	*PO2*	**15**

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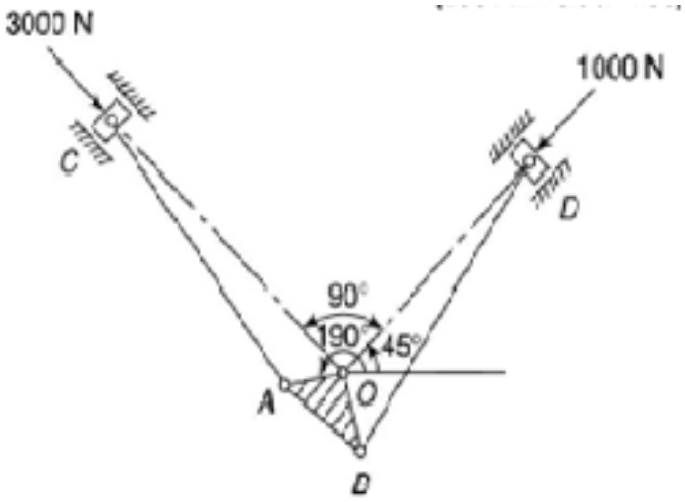
			AC=BD=250mm, Angle AOB=90º.  **Fig (3)**			
			UNIT - V			
	6	a)	With the help of neat diagrams explain Static and Dynamic Balancing.	*CO5*	*PO1*	**05**
		b)	Four masses A, B, C and D as shown below are to be completely balanced. A / B / C / D Mass (kg): - / 30 / 50 / 40 Radius (mm): 180 / 240 / 120 / 150 The planes containing masses B and C are 300 mm apart. The angle between planes containing B and C is 90°. B and C make angles of 210° and 120° respectively with D in the same sense. Find : 1. The magnitude and the angular position of mass A ; and 2. The position of planes A and D.	*CO5*	*PO2*	**15**
			OR			
	7	a)	Explain why only a part of unbalanced force due to reciprocating masses is balanced by revolving masses or partial balancing of reciprocating parts.	*CO5*	*PO1*	**05**
		b)	Derive equations for primary unbalanced forces for a twin V-engine when$2\alpha = 90^{o}$.	*CO5*	*PO2*	**06**
		c)	A radial aero-engine has seven cylinders equally spaced with all the connecting rods coupled to a common crank. The crank and each of the connecting rods are 200mm and 800mm respectively. The reciprocating mass per cylinder is 3 Kg. Determine the magnitude and angular position of the balance masses required at the crank radius for complete primary and secondary balancing of the engine.	*CO5*	*PO2*	**09**

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