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

Autonomous Institute Affiliated to VTU

September / October 2023 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Mechanical Engineering **Duration: 3 hrs.**
Course Code: 22ME4PCTOM **Max Marks: 100**
Course: Theory of Machines
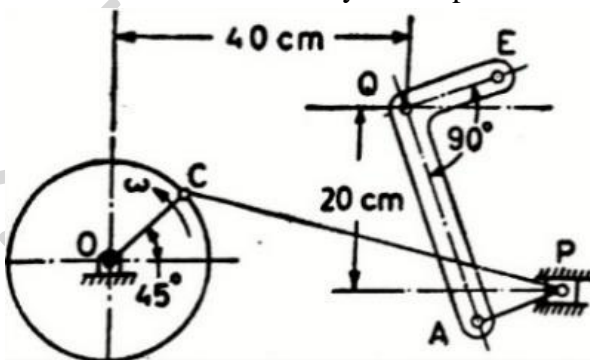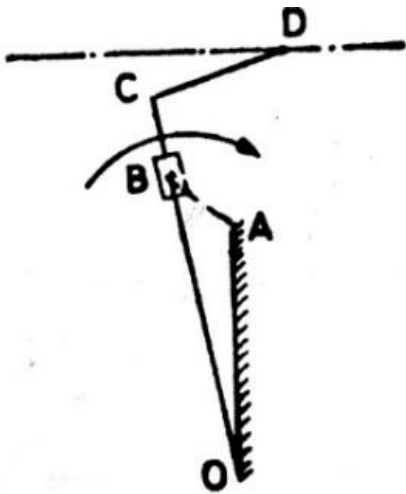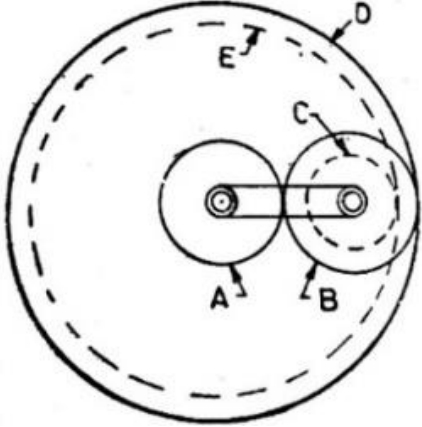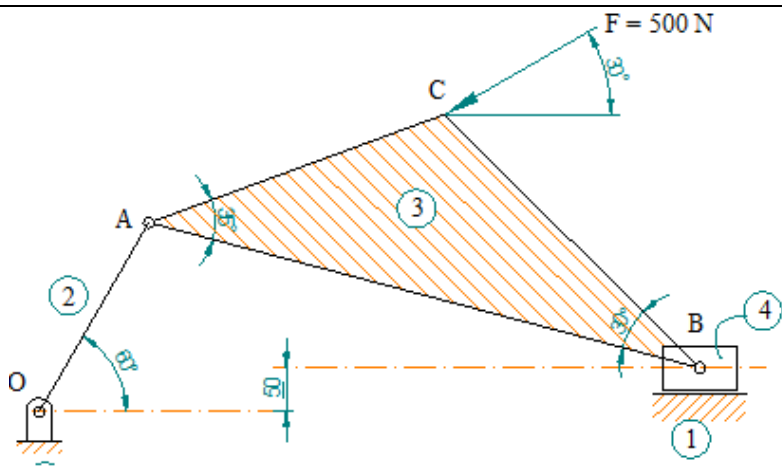
Instructions: 1. Answer FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

				CO	PO	Marks
			UNIT - I	*CO*	*PO*	**Marks**
1	a)		Differentiate between Machine and a Mechanism.	*CO1*	*PO1*	**03**
	b)		What do you mean by inversion of a mechanism?	*CO1*	*PO1*	**02**
	c)		With the help of neat sketches, explain all three inversions of four bar mechanism.	*CO1*	*PO1*	**15**
			UNIT - II			
2	a)		Fig (2a) 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. Point P is 2.5cm vertically below point O. Fig (2a)	*CO2*	*PO2*	**15**
	b)		Derive an expression for Coriolis acceleration.	*CO2*	*PO1*	**05**
			OR			
3			The following data refer to a quick return motion mechanism of crank and slotted lever type as shown in Fig (2). The dimensions are; Fixed link OA=25cm, Crank AB=10cm, Slotted lever OC=40cm, CD=15cm 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 45cm. Determine acceleration of	*CO2*	*PO1*	**20**

ram at D and coriolis acceleration of slider at B.

Fig (3a)

			UNIT - III			
4	a)		With the help of a neat sketch, give the Gear terminology.	CO3	PO1	**06**
	b)		Fig (4b) shows an epicyclic gear train arrangement in which pinion A has 20 teeth and is rigidly fixed to the motor shaft. The wheel B has 25 teeth and gears with A and also with annular fixed wheel D. Pinion C has 20 teeth and is integral with B(C and B being a compound gear wheel). Gear C meshes with annular wheel E which is keyed to the machine shaft. The arm rotates about the same shaft on which A is fixed and carries the compound wheels B and C. If the motor runs at 1000rpm, find the speed of machine shaft.	CO3	PO2	**14**

Fig (4b)

			UNIT - IV			
5	a)		For the mechanism as shown in Fig (5a), find the required input torque for the static equilibrium. The length of OA and AB are 250 mm and 650 mm respectively.	CO4	PO2	**14**

Fig (5a)

	b)	Prove that the maximum fluctuation energy $e_{max} = 0.02 K_s E$	CO4	PO1	**06**

UNIT - V

6	a)	With the help of neat sketches distinguish static and dynamic balancing.	CO5	PO1	**08**
	b)	A 2.7 m long shaft carries three pulleys, two at its ends & the third at the midpoint of the shaft. The left and right end pulleys have masses 48 kg and 20 kg, with C.G. being offset by 15 mm and 12.5 mm respectively from the center of the shaft. The middle pulley is of 56 kg mass and its C.G. is offset by 15 mm. The pulleys are arranged in a way to get static balance When the shaft rotates at 300rpm in two bearings1.8 m apart, with equal overhangs on either side. Determine; (i) Relative angular position of pulleys. (ii) Dynamic force on two bearings.	CO5	PO2	**12**

OR

7	a)	Derive equations for primary and secondary unbalanced forces for a twin V- engine when $2\alpha = 90°$	CO5	PO1	**10**
	b)	The length of each CR of 60° V-engine is 220 mm and stroke is 100 mm. The mass of the reciprocating parts is 1.2 kg per cylinder and speed of crank is 2400 rpm. Find the values of Primary and Secondary forces.	CO5	PO2	**10**

******