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: V**

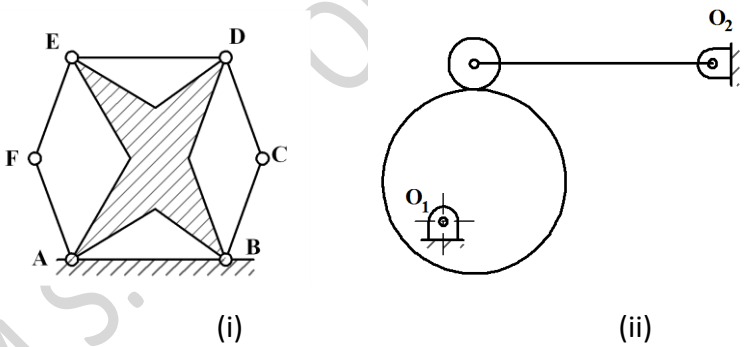
Branch: Aerospace Engineering **Duration: 3 hrs.**

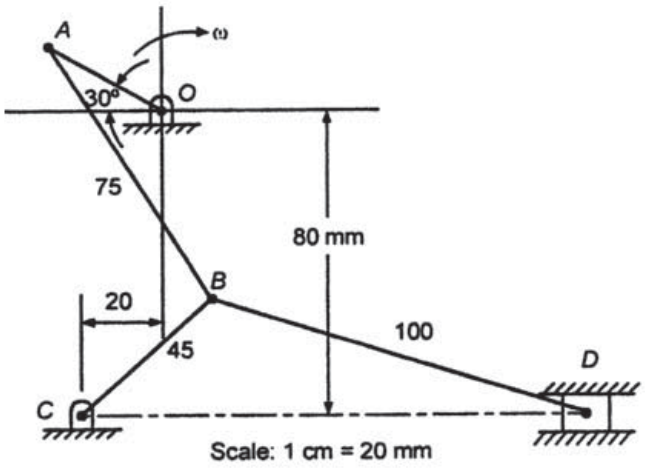
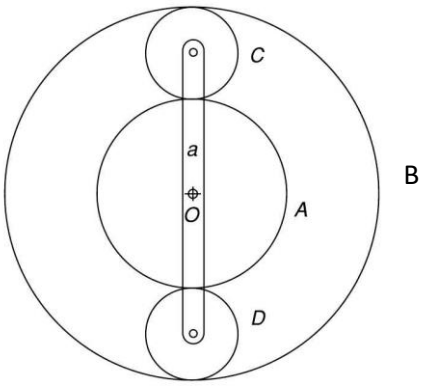
Course Code: 20AE5DCMAM **Max Marks: 100**

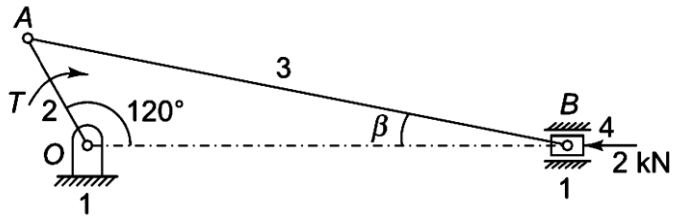
Course: MACHINES AND MECHANISMS

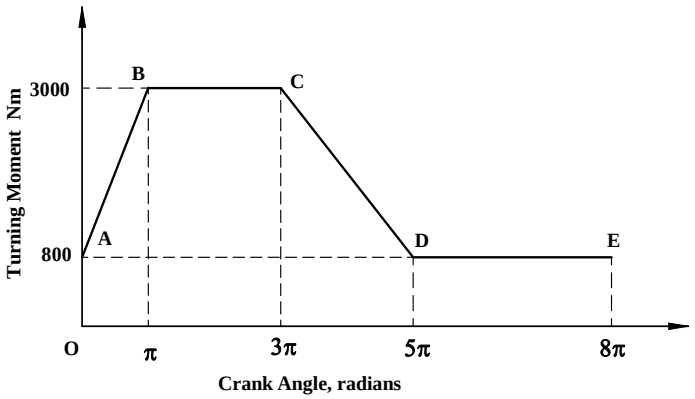
Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

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 inversion of a mechanism. List all the inversions of a single slider crank mechanism. Sketch & explain the inversion which is used in a shaping machine.	*CO1*	*PO 1*	**10**
	b)	What is mobility? Explain Grubler's criterion for mobility of a planar mechanism. Hence obtain the mobility of the linkages shown in fig. below;  (i) (ii)	*CO1*	*PO 1*	**10**
		OR			
2	a)	Name some exact straight line motion mechanisms. Sketch & prove that such a mechanism which has 8 links traces an exact straight line.	*CO1*	*PO 1*	**10**
	b)	Sketch and explain the following intermittent motion mechanisms. (i) Geneva wheel (ii) Ratchet and Pawl	*CO1*	*PO 1*	**10**
		UNIT - II			
3	a)	The dimensions of the various links of the mechanism shown in Fig. are OA = 30 mm, AB =75 mm, BD = 100 mm. The crank OA rotates at 120 rpm. Determine the velocity of the slider D and angular speed of links AB, BC, and BD.	*CO2*	*PO 2*	**10**

			 Scale: 1 cm = 20 mm			
3	b)	State and prove Kennedy's theorem for instantaneous centers. Hence locate all the instantaneous centers of (i) A four bar mechanism and (ii) Slider crank mechanism.	*CO2*	*PO 1*	**10**
		OR			
4		A four-bar mechanism ABCD has fixed link AD 180 mm long. The links AB, BC & CD are 90 mm, 120 mm and 120 mm long respectively. At a certain instant, link AB makes 60^0 with link AD. If link AB rotates at a uniform speed of 100 rpm clockwise, by using relative velocity method determine; (i) Angular velocities of links BC & CD (ii) Angular acceleration of links BC & CD.	*CO2*	*PO 2*	**20**
		UNIT - III			
5	a)	With usual notations and a neat sketch, derive an expression for length of path of contact and contact ratio for two spur gears meshing externally.	*CO3*	*PO 1*	**10**
	b)	An epicyclic gear train is shown in fig. The gears C & D are of equal size. The number of teeth on A & B is 80 & 200. Determine the speed of arm if; (i) A rotates at 100 rpm clockwise and B at 50 rpm counterclockwise. (ii) If A rotates at 100 rpm clockwise and B is stationary. 	*CO3*	*PO 2*	**10**
		OR			
6		A cam with 30 mm minimum radius is rotating clockwise at a uniform speed of 1200 rpm and must give motion to the knife edge follower as defined below. • Follower to move outward through 30 mm during 120^0 of cam rotation with SHM. • Dwell for the next 60^0.	*CO3*	*PO 2*	**20**

			• Follower to return to its starting position during next 90^0 with UARM. • Dwell for the remaining period. Draw the cam profile when the follower is offset to the right by 10 mm. Also find the maximum velocity and acceleration during inward & outward strokes.			
			UNIT - IV			
	7	a)	With usual notations and a neat sketch, obtain an expression for ratio of tensions in a flat open belt drive.	*CO4*	*PO 1*	**08**
		b)	A flat belt 100 mm wide & 10 mm thick is transmitting power at 1000 m/min. The net driving tension is 1.8 times the tension on the slack side. If the safe stress in the belt is 2 Mpa and the density of leather as 1000 Kg/m^3, calculate; (i) The power that can be transmitted at this speed. (ii) The absolute maximum power that can be transmitted by the belt & the speed at which it can be transmitted. (iii) Percentage increase in power.	*CO4*	*PO 2*	**12**
			OR			
	8	a)	With usual notations, derive an expression for gyroscopic couple	*CO4*	*PO 1*	**6**
		b)	An aeroplane makes a complete half circle of 50 meters radius, towards left, when flying at 200 km per hour. The rotary engine and the propeller of the plane has a mass of 400 kg with a radius of gyration of 300 mm. The engine runs at 2400 rpm. clockwise, when viewed from the rear. Find the gyroscopic couple on the aircraft and state its effect on it. What will be the effect, if the aeroplane? turns to its right instead of to the left?	*CO4*	*PO 2*	**14**
			UNIT - V			
	9	a)	Explain the condition for equilibrium of (i) A two force member (ii) Three force member (iii) Two force member with a torque with relevant sketches.	*CO5*	*PO 1*	**8**
		b)	Determine the torque T on the link OA for static equilibrium of the mechanism shown in fig. Length of crank OA= 100 mm, Length of connecting rod AB = 450 mm. 	*CO5*	*PO 2*	**12**
			OR			
	10	a)	With usual notations, derive an expression for energy stored in a flywheel.	*CO5*	*PO 1*	**8**
		b)	The turning moment diagram of a certain machine is shown in fig. The motor to which the machine is coupled exerts a constant torque at a mean speed of 250 rpm. A flywheel of mass 1800 kg at a radius of gyration of 500 mm is fitted to the shaft. Determine. (i) Power of the motor (ii) The total fluctuation of speed of the machine shaft	*CO5*	*PO 2*	**12**

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