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**

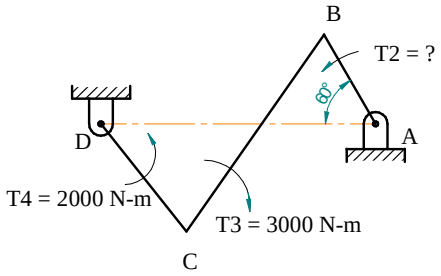
Branch: Mechanical Engineering **Duration: 3 hrs.**

Course Code: 20ME5DCDOM / 16ME5DCDOM **Max Marks: 100**

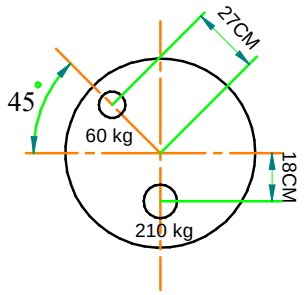
Course: Dynamics of Machines

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)	Explain how static force analysis is done on a slider crank mechanism	*CO1*	*PO1*	**06**
	b)	Determine T_2 for the static equilibrium of the mechanism (Fig 1b). Given: AD = 800 mm, AB = 300 mm, BC = 700 mm and CD = 400 mm.  Fig 1b	*CO1*	*PO2*	**14**
		OR			
2	a)	Show that $e_{max} = K_s I \omega^2/100$ and hence prove $e_{max} = 0.02 K_s E$, where e_{max} is Maximum fluctuation of energy, K_s is total fluctuation of speed and E is mean kinetic energy.	*CO2*	*PO1*	**06**
	b)	The TMD for a 4-stroke petrol engine may be considered for simplicity to be represented by four triangles, the areas of which from the line of zero are as follows. Expansion = 3550 mm^2, Suction = 350 mm^2, Exhaust = 500 mm^2& Compression = 1400 mm^2. Each Sq.mm represents 2.95 N-m of work. Assuming the resisting moment to be uniform, find the mass of the rim of the flywheel required to keep the mean speed 200rpm within ± 2% mean. Consider the radius of the rim as 750 mm.	*CO2*	*PO2*	**14**

	UNIT - II					
	3	a)	Considering both Uniform Pressure theory and Uniform wear theory, derive expressions for power lost due to friction in a conical pivot bearing.	*CO3*	*PO1*	**10**
		b)	In a thrust bearing the external and internal radii of the contact surfaces are 210 mm & 160 mm respectively. The total axial load is 60 KN and coefficient of friction = 0.05. The shaft is rotating at 380 rpm. Intensity of pressure is not to exceed 350 KN/ m^2.Calculate: (i) Power lost in overcoming the friction for both the design criteria and (ii) Number of collars required for the thrust bearing.	*CO3*	*PO2*	**10**
	OR					
	4	a)	Considering a circular arc cam with flat faced follower, derive the expressions for displacement velocity and acceleration of the follower when the flat face of the follower has contact on the circular flank.	*CO4*	*PO1*	**06**
		b)	In a symmetrical tangent cam operating a roller follower, the least radius of the cam is 30 mm and roller radius is 17.5 mm. The angle of ascent is 75° and the total lift is 17.5 mm. The speed of cam shaft is 600 rpm. Assume that there is no dwell between ascent and descent. Calculate: (i) The principal dimensions of the cam (ii) The accelerations of the cam at the beginning of the lift, where straight flank merges into the circular nose and at the apex of the circular nose	*CO4*	*PO2*	**14**
	UNIT - III					
	5	a)	With the help of neat sketches distinguish static and dynamic balancing.	*CO5*	*PO1*	**08**
		b)	A workman is required to machine a casting of 210 kg mass on a lathe. He fixes it in such a way that the centre of gravity of the casting is 18 cm from the lathe axis and 32 cm from the face plate. He balances it statically by bolting two weights to the face plate, one of them has 60 kg mass and is fixed as shown in Fig(5b). Its CG is 16cm from the face plate. The other is 50kg and its CG is 10 cm from the face plate. Determine (i) The radial and angular position of 50 kg weight & (ii) hTe rocking couple at 50 RPM.	*CO5*	*PO2*	**12**

			 Fig(5b)			
			OR			
	6	a)	What do you mean by balancing? Make a list of Five areas where we come across balancing problems in general.	*CO5*	*PO1*	**06**
		b)	Four masses A, B, C and D are to be completely balanced. Masses B, C and D are 30 kg, 50 kg and 40 kg respectively and their radii are 240 mm, 120 mm and 150 mm respectively. Mass A has a radius of 180 mm. The planes containing masses B and C are 300 mm apart and the angle between them is 90°. Masses B and C make angles of 120°and 210°espectively with D in the same sense. Find (i) The magnitude and angular position of mass A and (ii) The position of planes A and D.	*CO5*	*PO2*	**14**
			UNIT - IV			
	7	a)	Derive equations for primary and secondary unbalanced forces for a twin V- engine when $2\alpha = 90^o$	*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**
			OR			
	8	a)	The firing order in a 6-cylinder 4-stroke inline engine is 1-4-2-6-3-5. The stroke is 100 mm, connecting rod length is 200 mm, the pitch distance between the cylinder centre lines are 100 mm, 100 mm, 150 mm, 100 mm and 100 mm. Determine the out of balance primary and secondary forces and couples on this engine taking the mid plane between cylinders 3&4 as reference plane. The reciprocating mass per cylinder is 2 kg and the engine runs at 1500 rpm.	*CO5*	*PO2*	**14**
		b)	How the concept of direct and reverse cranks is made use of in estimating the unbalanced primary and secondary forces of an engine mechanism?	*CO5*	*PO1*	**06**
			UNIT - V			
	9	a)	Discuss the stability of a four-wheeler taking right turn. Axes of the engine and wheel axle are parallel and rotate in the same sense.	*CO4*	*PO1*	**10**

		b)	Each road wheel of a motor cycle has a moment of inertia of 1.5 kg-m^2. The rotating parts of the engine have a moment of inertia of 0.25 kg-m^2. The speed of the engine is six times the speed of the wheels and in the same sense. The mass of the vehicle along with the rider is 250 kg and its CG is 600 mm above the ground level. Find the angle of heel if the motor cycle is travelling at 60 KMPH and taking a turn of 30 m radius considering the wheel diameter as 600 mm.	*CO4*	*PO2*	**10**
			OR			
	10	a)	Derive an expression for the gyroscopic couple of a plane disc.	*CO4*	*PO1*	**06**
		b)	An aeroplane makes a complete half circle of 50 m radius towards left when flying at 200 KMPH. The rotary engine and the propeller of the plane have a mass of 400 kg with a radius of gyration of 30 cm. The engine rotates at 2400 rpm clockwise viewing 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 its left?	*CO4*	*PO2*	**14**

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