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

Autonomous Institute Affiliated to VTU

September / October 2024 Supplementary Examinations

Programme: B.E.   **Semester: V**
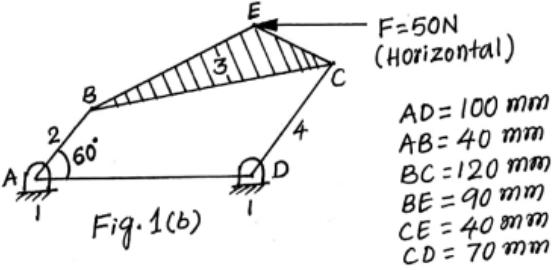**Branch: Mechanical Engineering**   **Duration: 3 hrs.**
Course Code: 20ME5DCDOM   **Max Marks: 100**
Course: Dynamics of Machines

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

			UNIT - I	**CO**	**PO**	**Marks**
1	a)		What are the conditions for a body to be in equilibrium under the action of two forces and three forces.	*CO1*	*PO1,2*	**04**
	b)		For the mechanism shown in fig. 1(b), determine the torque on the link AB for the static equilibrium of the mechanism. Fig. 1(b) — F=50N (Horizontal), AD=100 mm, AB=40 mm, BC=120 mm, BE=90 mm, CE=40 mm, CD=70 mm	*CO1*	*PO1,2*	**10**
	c)		What is Principle of virtual work? Explain.	*CO1*	*PO1,2*	**06**
			OR			
2	a)		Derive an expression for size of flywheel.	*CO2*	*PO1,2, 3*	**06**
	b)		The turning moment diagram of a four stroke engine may be assumed for the sake of simplicity to be represented by four triangles in each stroke. The areas of these triangles are as follows: Suction stroke = 5×10^{-5} m^2, Compression stroke = 21×10^{-5} m^2, Expansion stroke = 85×10^{-5} m^2, Exhaust stroke = 8×10^{-5} m^2. All the areas excepting expansion stroke are negative. Each 1 m^2 of area represents 14 MN-m of work. Assuming the resisting torque to be constant, determine the moment of inertia of the flywheel to keep the speed between 98 rpm and 102 rpm. Also find the size of a rim-type flywheel based on the minimum material criterion, given that density of flywheel material is 8150 kg/m^3, the allowable tensile stress of the flywheel material is 7.5 MPa. The rim cross-section is rectangular, one side being four times the length of the other.	*CO2*	*PO1,2, 3*	**14**

			UNIT - II			
3	a)	Derive an expression for ratio of tensions in flat belt drive.	*CO3*	*PO1,2, 3*	**08**
	b)	A belt embraces the shorter pulley by an angle of 165^0 and runs at a speed of 1700 m/min. Dimensions of the belt are, width= 20 cm and thickness= 8 mm. Its density is 1 gm/cm^3. Determine the maximum power that can be transmitted at the above speed, if the maximum permissible stress in the belt is not to exceed 250 N/cm^2 and μ= 0.25	*CO3*	*PO1,2, 3*	**12**
		OR			
4		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 75^0 and the total lift is 17.5 mm. The speed of the cam shaft is 600 rpm. Calculate i) The principal dimensions of the cam The accelerations of the follower at the beginning of the lift, where straight flank merges in to the circular nose and at the apex of the circular nose. Assume that there is no dwell between ascent and descent.	*CO4*	*PO1,2, 3*	**20**
		UNIT - III			
5	a)	Explain the methods of balancing of different masses revolving in the same plane.	*CO5*	*PO1,2, 3*	**05**
	b)	A, B, C and D are four masses carried by a rotating shaft at radii 100, 125, 200 and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the mass of B, C and D are 10 kg, 5 kg and 4 kg respectively. Find the required mass A and the relative angular settings of the four masses so that the shaft shall be in complete balance.	*CO5*	*PO1,2, 3*	**15**
		UNIT - IV			
6	a)	Explain primary unbalanced force and secondary unbalanced force for a reciprocating engine mechanism.	*CO5*	*PO1,2, 3*	**04**
	b)	A five cylinder in-line engine running at 750 rpm has successive cranks 144^0 apart, the distance between the cylinder centre lines being 375 mm. The piston stroke is 225 mm and the ratio of the connecting rod to the crank is 4. Examine the engine for balance of primary and secondary forces and couples. Find the maximum values of these and the position of the central crank at which these maximum values occur. The reciprocating mass for each cylinder is 15 kg.	*CO5*	*PO1,2, 3*	**16**
		UNIT - V			
7	a)	Derive an expression for gyroscopic couple.	*CO4*	*PO1,2, 3*	**06**

| | | b) | A ship propelled by a turbine rotor which has a mass of 5 tonnes and a speed of 2100 rpm. The rotor has a radius of gyration of 0.5 m and rotates in a clockwise direction when viewed from the stern. Find the gyroscopic effects in the following conditions.

i) The ship sails at a speed of 30 km/h and steers to the left in a curve having 60 m radius

ii) The ship pitches 6 degree above and 6 degree below the horizontal position. The bow is descending with its maximum velocity. The motion due to pitching is simple harmonic and the periodic time is 20 seconds

iii) The ship rolls and at a certain instant, it has an angular velocity of 0.03 rad/sec clockwise when viewed from stern. Determine also the maximum angular acceleration during pitching. Explain how the direction of motion due to gyroscopic effect is determined in each case. | *CO4* | *PO1,2,3* | **14** |

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