CBCS SCHEME

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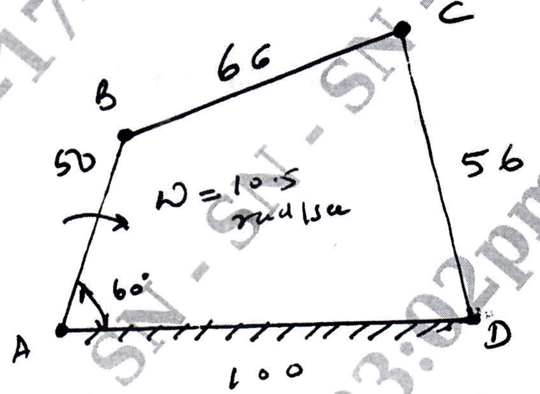
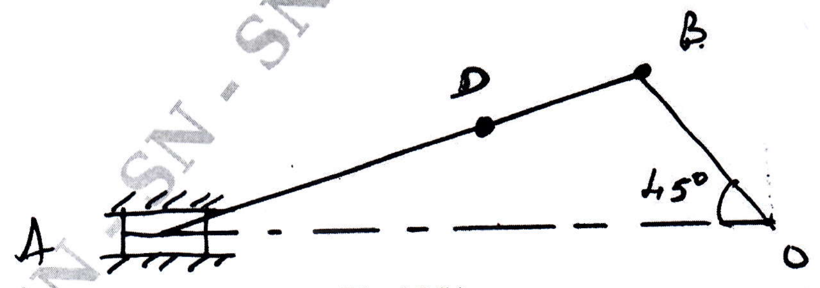
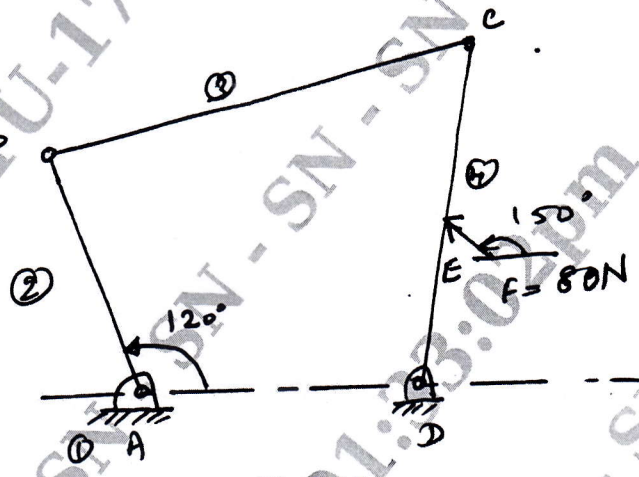
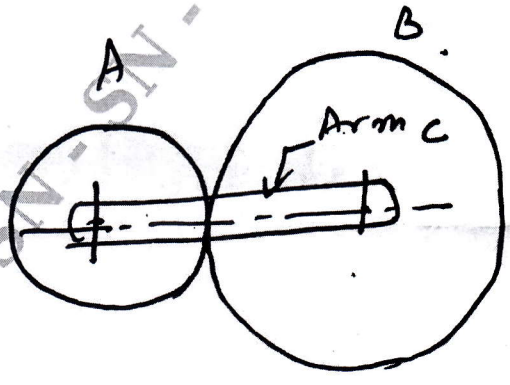
BMR503

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Theory of Machines

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	**M**	**L**	**C**
Q.1	**a.**	Define Inversion. With a neat sketch explain any three inversion of four bar kinematic chain.	**10**	**L2**	**CO1**
	b.	For a four–bar mechanism shown in Fig.Q1(b) draw velocity and acceleration diagram. Determine angular acceleration.  Fig.Q1(b) All dimensions are in mm	**10**	**L3**	**CO2**
		OR			
Q.2	**a.**	Define the following terms with example : i) Kinematic chain ii) Kinematic pair iii) Mechanism iv) Degree of freedom v) Structure.	**5**	**L2**	**CO1**
	b.	The crank of a slider crank mechanism rotates clockwise at a constant speed. If 300 rpm. The crank is 150 mm and connecting rod is 600 mm. Determine: i) Linear velocity and acceleration of the midpoint of the connecting rod ii) Angular velocity and acceleration of the connecting rod at a crank angle of 45° from the inner dead centre position. Refer Fig.Q2(b).  Fig.Q2(b)	**15**	**L3**	**CO2**

		Module – 2			
Q.3	**a.**	Explain the static equilibrium of two forces, three forces and member with two forces and a torque.	**6**	**L2**	**CO2**
	b.	State and explain D'Alembert's principle.	**6**	**L2**	**CO2**
	c.	A punching machine carries out 6 holes per minute. Each hole of 40 mm diameter in 35 mm thick plate requires 8N/m of energy / mm^2 of the sheared area. The punch has a stroke of 95 mm. Find the power of the motor required if the mean speed of the flywheel is 20 m/sec. If total fluctuation of speed is not to exceed 3% of the mean speed, determine the mass of the fly wheel.	**8**	**L3**	**CO3**
		OR			
Q.4	**a.**	What is a flywheel? What is its use?	**6**	**L2**	**CO2**
	b.	What is static equilibrium? A four – link mechanism with the following dimensions is acted by a force 80 < 150°N on the link DC as shown in the Fig.Q4(b). AD = 500mm, AB = 400mm, BC = 1000 mm, DC = 450 mm, DE = 350 mm. Determine the input torque T on the link AB for the static equilibrium of the mechanism for the given configuration.  Fig.Q4(b)	**14**	**L3**	**CO3**
		Module – 3			
Q.5	**a.**	State law of gearing. Derive an expression for the minimum number of teeth on the pinion in order to avoid interference in insulate gear teeth when it is meshed with wheel.	**8**	**L3**	**CO3**
	b.	In a epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively as shown in Fig.Q5(b). If the arm rotates at 150 rpm in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed, makes 300 rpm in the clockwise direction, what will be the speed of gear B.  Fig.Q5(b)	**12**	**L3**	**CO3**

		OR			
Q.6	**a.**	What is a gear train? Explain different types of gear trains.	**6**	**L2**	**CO3**
	b.	With a neat sketch, explain spur gear terminology.	**6**	**L2**	**CO3**
	c.	A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20° pressure, angle, 12 mm module and 10 mm addendum. Find the length of path of contact arc of contract and the contract ratio.	**8**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	What is a Governor? Derive an expression for the equilibrium speed of a porter governor.	**8**	**L2**	**CO4**
	b.	A, B, C and D are four masses carried by a rotating shaft at radii 100, 125, 200 and 150 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 compute balance.	**12**	**L4**	**CO4**
		OR			
Q.8	**a.**	Explain the terms primary balancing and secondary balancing as used for balancing of reciprocating masses.	**6**	**L2**	**CO4**
	b.	The arms of a porter governor arc each 250 mm long and pivoted on the governor axis. The mass of each ball is 5 kg and the mass of the central sleeve is 30 kg. The radius of radiation of the balls is 150 mm when the sleeve begins to rise and reaches a value of 200 mm. for maximum speed. Determine the speed range of the governor. If the friction at the sleeve is equivalent of 20 N of load at the sleeve. Determine how the speed range is modified.	**14**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	What is logarithmic decrement? Derive the relation of the same.	**8**	**L3**	**CO4**
	b.	Determine the natural frequency of the simple pendulum by using Newton's method, neglecting the mass of rod.	**6**	**L3**	**CO4**
	c.	A vibrating system show that it has a mass of 8 kg and that the springs can be combined to give an equivalent spring of stiffness 5 N/mm. If the vibrating system have a dashpot attached which exerts a force of when the mass has a velocity of 1m/sec. Find : i) Critical damping coefficient ii) Logarithmic decrement iii) Damping factor iv) Ratio of two consecutive amplitudes.	**6**	**L4**	**CO4**
		OR			
Q.10	**a.**	Derive an expression for steady state solution with viscous damping due to harmonic force.	**10**	**L4**	**CO4**
	b.	The mass of an electromotor is 120 kg and it runs at 1500 rpm. The armature mass is 35 kg and its c.c, lies 0.5 mm from the axis of the rotation. The motor is mounted in five springs of negligible damping, so that the force transmitted is one-eleventh of the impressed force. Assume that the mass of the motor is equally, distributed among the fire springs. Determine i) Stiffness of each spring ii) Dynamic force transmitted iii) Natural frequency of the system.	**10**	**L3**	**CO4**

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