CBCS SCHEME - Make-Up Exam

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BME/BMR503

Fifth Semester B.E./B.Tech. Degree Examination, June/July 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 kinematic link, kinematic pair, structure lower pair and higher pair. Explain double crank mechanism.	10	L2	CO1
	b.	In a four bar mechanism ABCD, 'AD' is fixed and crank 'AB' rotates at 200 rpm in clockwise direction. The dimensions of various links are as follows : BC = AD = 150 mm, CD = 800 mm, AB = 40 mm. find the angular velocity of link 'BC' and CD.	10	L3	CO1

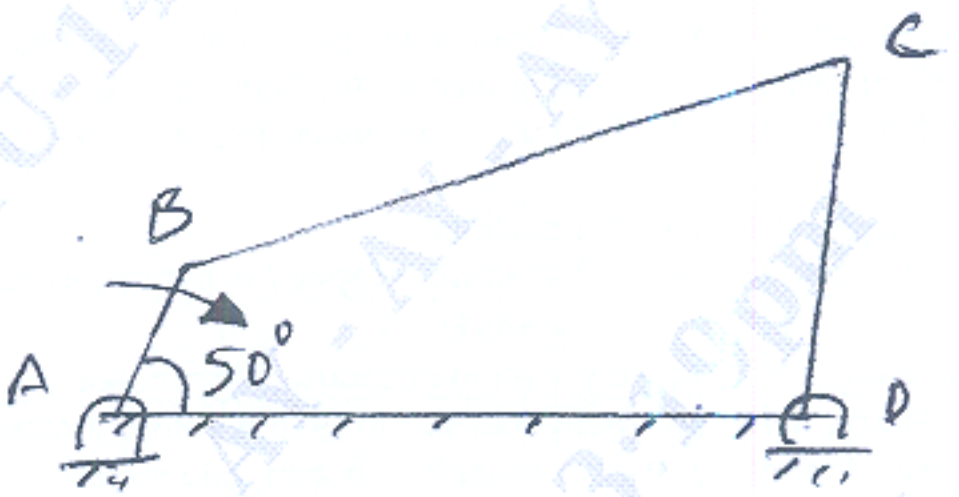


Fig.Q1(b)

OR

Q.2	a.	Define kinematic chain, machine mechanism, rigid link and fluid link. Explain crank and slotted mechanism.	10	L2	CO1
	b.	Fig.Q2(b) shows a quick return motion mechanism in which the driving crank 'OA' rotates at 120 rpm in clock wise direction. For the position shown determine the magnitude and direction. i) The acceleration block 'D' ii) The angular acceleration of the slotted bar 'QB' CD = 500 mm, QC = 150 mm and OA = 200 mm.	10	L3	CO1

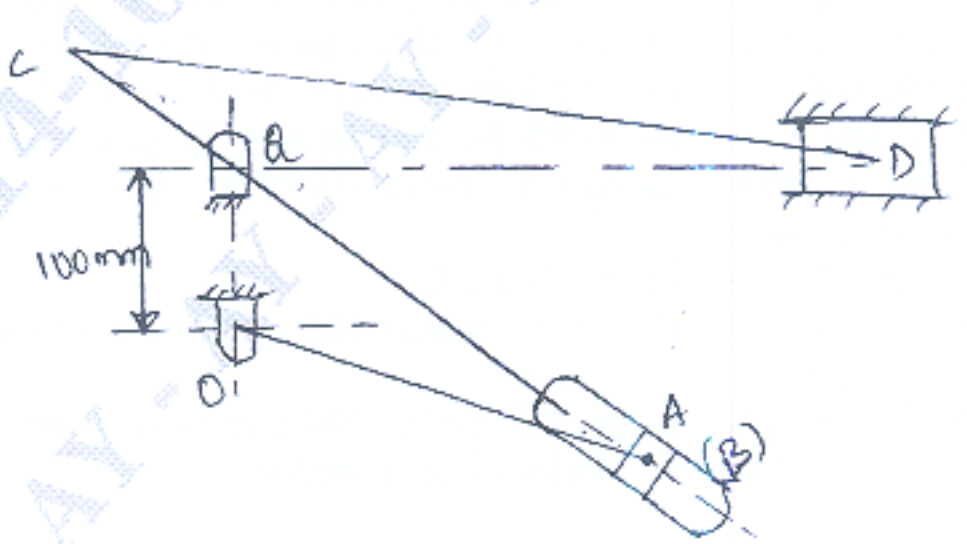
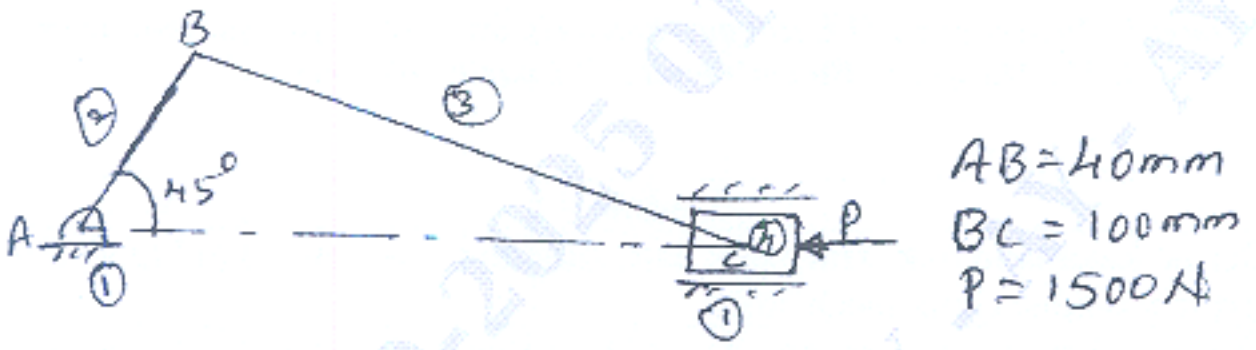


Fig.Q2(b)

		Module – 2			
Q.3	a.	Explain 2 force, 3 force and 4 force equilibrium condition.	6	L2	CO2
	b.	Determine the required input torque on the crank of single slider mechanism shown in Fig.Q3(b) for the static equilibrium when the applied piston load is 1500 N.  Fig.Q3(b)	14	L3	CO2
		OR			
Q.4	a.	Explain D'Alembert's principle.	6	L2	CO2
	b.	A punching machine punches 38 mm holes in 32 mm thick plate required 7 N/m/mm^2 of sheared area and punches one hole in every 10 sec. The mean speed of flywheel is 25 m/sec. The punch has to stroke of 100 mm find : i) Power required to drive the machine ii) Mass of flywheel, if total fluctuation of speed is not to exceed 3%.	14	L3	CO2
		Module – 3			
Q.5	a.	State and explain law of gearing with mathematical expression.	10	L2	CO3
	b.	Two gear wheels mesh externally and are to give a velocity ratio of 3 : 1. The teeth are of involutes form ; module = 6 mm, addendum = 1 module. Pressure angle = 20°C, the pinion rotates at 90 rpm. Find : i) Number of teeth on pinion to avoid interference on it and corresponding number of teeth on wheel ii) The length of path of contact and arc of contact iii) The number of pairs of teeth in contact iv) The maximum velocity of sliding.	10	L3	CO3
		OR			
Q.6	a.	Sketch and explain i) Compound gear train ii) Epicyclic gear train.	10	L2	CO3
	b.	In an epicyclic gear train, the internal gears 'A' and 'B' and compound gears C and D rotates independently about point '0'. All the gears have same module and the number of teeth are $Z_C = 28$, $Z_D = 26$, $Z_E = Z_F = 18$. The gear 'E' and 'F' rotates on pin fixed to the arm 'G' gear E meshes with gear 'A' and 'C' where as gear 'F' meshes with 'B' and 'D'. Sketch the arrangement and find : i) Number of teeth on gears A and B ii) Speed of gear 'B' if arm 'G' makes 200 rpm in clockwise and gear 'A' is fixed iii) Speed of gear 'B' if arm 'G' makes 200 rpm in clockwise and gear 'A' makes 20 rpm in anticlockwise direction.	10	L3	CO3

		Module – 4			
Q.7	**a.**	Five masses M_1, M_2, M_3, M_4 and M_5 revolve in the same plane magnitudes of M_1, M_2 and M_3 are 5, 2.5 and 4 kg respectively. Angular position M_2, M_3, M_4 and M_5 are 60°, 135°, 210° and 270° from M_1. Determine M_4 and M_5.	**6**	**L3**	**CO4**
	b.	Four masses M_1 = 100 kg, M_2 = 175 kg, M_3 = 200 kg and M_4 = 125 kg are fixed to the crank of 200 mm radius and revolve in planes 1, 2, 3, and 4 respectively. The angular position of the planes 2, 3, and 4 with respect to 1 are 75°, 135° and 240° taken in same sense. Distance of planes 2, 3, and 4 from '1' are 600 mm, 1800 mm and 2400 mm. Calculate the magnitude and position of balancing masses at radius 600 mm in planes 'L' and 'M' located in the middle of 1 and 2 and middle of 3 and 4 respectively.	**14**	**L2**	**CO4**
		OR			
Q.8	**a.**	Derive the relation for speed and height of the porter governor.	**6**	**L3**	**CO4**
	b.	A porter governor has all four arms 300 mm long. The upper arms are pivoted on the axis of rotation and lower arms are attached to the sleeve at a distance 35 mm from axis. The mass of each ball is 7 kg and the load on the sleeve is 540 M. Calculate the equilibrium speed and range of speed for the two extreme radii of 200 mm and 260 mm of rotation of governor balls.	**14**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	List and explain the types of free vibration.	**10**	**L2**	**CO5**
	b.	Define logarithmic decrement and derive the relation for logarithmic decrement.	**10**	**L3**	**CO5**
		OR			
Q.10	**a.**	A vibrating system consists of a mass of 50 kg a spring of stiffness of 30 KN/m and a dumper. The damping provided is only 20% of the critical value. Calculate : i) The damping factor ii) Critical damping co-efficient iii) The natural frequency of damped vibration iv) The logarithmic decrement v) The ratio of two consecutive amplitudes.	**10**	**L2**	**CO5**
	b.	Define transmissibility ratio and derive the relation fro transmissibility ratio for a transmitted force.	**10**	**L3**	**CO5**

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