CBCS SCHEME

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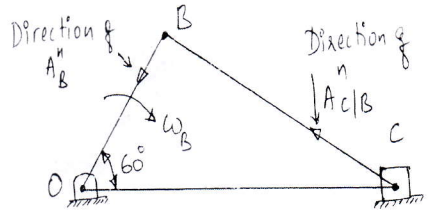
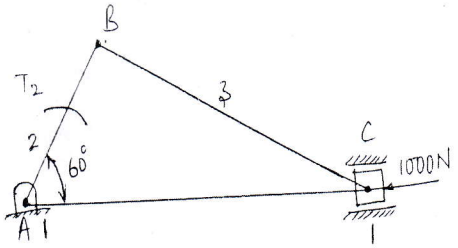
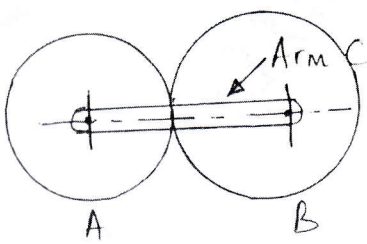
BME503

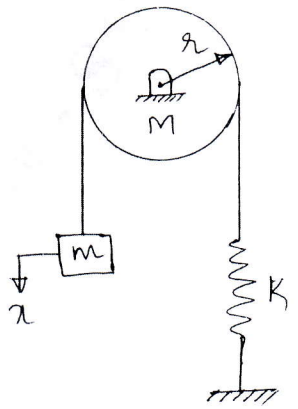
Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Theory of Machines

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 : (i) Kinematic link (ii) Kinematic pair (iii) Kinematic chain (iv) Mechanism (v) Machine.	10	L1	CO1
	b.	Briefly explain the following inversions : (i) Beam engine (ii) Watt's straight line mechanism	10	L1	CO1
		OR			
Q.2	a.	In a slider crank mechanism, the crank OB = 30 mm and connecting rod BC = 120 mm. The crank rotates at a uniform speed of 300 rpm clockwise. For the crank position as shown in Fig. Q2 (a) ; find (i) Velocity of Piston C and angular velocity of connecting rod BC (ii) Acceleeration of piston C and angular acceleration of connecting rod BC.  Fig. Q2 (a)	10	L3	CO1
	b.	If the crank and connecting rod are 150 mm and 600 mm long respectively and the crank rotates at a uniform speed of 100 rpm clockwise; determine the angular velocity and angular acceleration of connecting rod and velocity of the piston by using Raven's approach. The angle which the crank makes with the inner dead center is 30°.	10	L3	CO1
		Module – 2			
Q.3	a.	With a neat sketch, explain the following : (i) Equillibrium of Three force members (ii) Equillibrium of Four force members.	10	L1	CO2
	b.	For a slider crank mechanism as shown in Fig. Q3 (b), the force applied to the piston is 1000 N when the crank is at 60° from IDC. Given AB = 100 mm and BC = 300 mm. Calculate the driving torque T_2.  Fig. Q3 (b)	10	L3	CO2

		OR			
Q.4	**a.**	Explain : (i) Dynamic force analysis. (ii) D'Alembert's principle.	**10**	**L1**	**CO2**
	b.	A punching machine punches 38 mm holes in 32 mm thick plate requires 7 N-m/mm^2 of sheared area and punches one hole in every 10 sec. The mean speed is of the flywheel given is 25 m/sec. The punch has a stroke of 100 mm. Find : (i) Power required to drive the machine. (ii) Mass of the flywheel, if total fluctuation of speed is not to exceed 3%.	**10**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	Define the following gear terminologies : (i) Pitch circle. (ii) Pitch circle diameter. (iii) Addendum (iv) Dedendum (v) Module.	**10**	**L1**	**CO3**
	b.	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 and length of arc of contact.	**10**	**L3**	**CO3**
		OR			
Q.6	**a.**	Derive with usual notations ; an expression for velocity ratio of compound gear trains.	**10**	**L2**	**CO3**
	b.	In an Epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 rpm in anticlockwise direction about centre of gear A which is fixed as shown in Fig. Q6 (b); then determine speed of gear B. If the gear A instead of being fixed makes 300 rpm in clockwise direction, what will be the speed of gear B? Use Tabular method.  Fig. Q6 (b)	**10**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	A shaft carries 4 masses A, B, C, D in parallel planes in this order along its length. The masses at B and C are 18 kg and 12.5 kg respectively. Each of B and C has an eccentricity of 60 mm. The masses at A and D have an eccentricity of 80 mm. The angle between B and C is 100° and in between B and A is 190°, both being measured in same direction. The axial distance between A and B is 100 mm and in between B and C is 200 mm. For the shaft to be in complete balance, determine magnitude of masses at A and D as well as the angular position of mass at D.	**10**	**L3**	**CO4**
	b.	A four cylinder vertical engine has cranks 150 mm long. The planes of rotation of the 1st, 2nd and 4th cranks are 400 mm, 200 mm and 200 mm respectively from 3rd crank and their reciprocating masses are 50 kg, 60 kg and 50 kg respectively. Find the mass of the reciprocating parts of 3rd cylinder and relative angular positions of the cranks in order that the engine may be in complete primary balance.	**10**	**L3**	**CO4**

		OR			
Q.8	**a.**	Define the following terminologies : (i) Sensitiveness (ii) Stability (iii) Hunting (iv) Effort (v) Power.	**10**	**L1**	**CO4**
	b.	A Porter governor has equal arms each of 250 mm long and pivoted on the axis of rotation. Each flyball has a mass of 5 kg and the mass of central sleeve is 15 kg. The radius of rotation of the flyball is 150 mm when the governor begins to lift and 200 mm when the governor is at maximum speed. Find the minimum, maximum speeds and the range of speed of the governor.	**10**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	Define the following types of vibrations : (i) Free vibration. (ii) Forced vibration (iii) Damped vibration. (iv) Undamped vibration (v) Longitudinal vibration.	**10**	**L1**	**CO5**
	b.	Determine the natural frequency of the spring mass pulley system as shown in Fig. Q9 (b).  Fig. Q9 (b)	**10**	**L3**	**CO5**
		OR			
Q.10		Explain the following : **a.** Rotating unbalance. **b.** Reciprocating unbalance. **c.** Vibration isolation **d.** Critical speed.	**20**	**L2**	**CO5**

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