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December 2023 (REEXAM)

TY (SEMESTER - I)

COURSE NAME: KINEMATICS AND THEORY OF MACHINES **Branch: Mechanical** **COURSE CODE: MEUA31203**

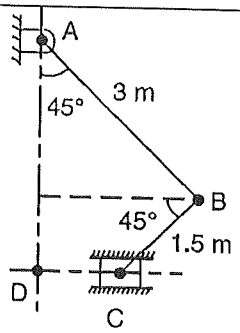
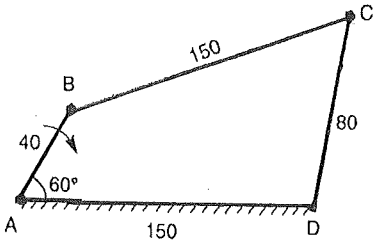
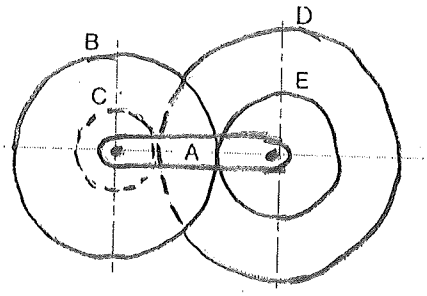
(PATTERN 2020)

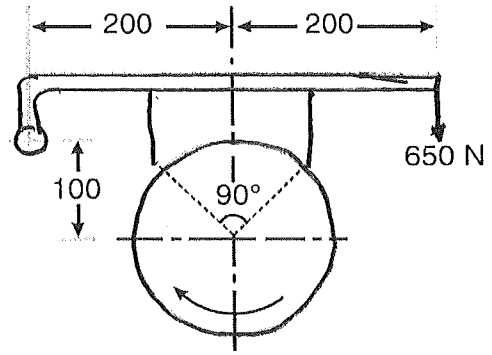
Time: [2 Hrs] **[Max. Marks: 60]**

(*) Instructions to candidates:

1) **Figures to the right indicate full marks.**
2) **Use of scientific calculator is allowed**
3) **Use suitable data wherever required**
4) **All questions are compulsory. Solve any two sub questions each from each Question 1 ,2, 3,4,5,and 6 respectively**

Q. No.	Question Description	Max. Marks	CO mapped	BT Level
Q.1	a) How are the kinematics pairs classified? Explain with examples.	[5]	1	3
	b) Discuss various types of constrained motion.	[5]	1	3
	c) Elaborate with neat sketch 'Coupling rod of locomotive'.	[5]	1	3
Q2	a) Locate all the instantaneous centers of the slider crank mechanism. The lengths of crank OB and connecting rod AB are 100 mm and 400 mm respectively. If the crank makes 45^0 angle with IDC and rotates clockwise with an angular velocity of 10 rad/s. Estimate the velocity of the slider.	[5]	2	4
	b) If the crank and the connecting rod are 300 mm and 1 m long respectively and the crank rotates at a constant speed of 200 r.p.m., determine: 1. The crank angle at which the maximum velocity occurs, and 2. Maximum velocity of the piston.	[5]	2	4
	c) The crank and connecting rod of a steam engine are 0.3 m and 1.5 m in length. The crank rotates at 180 r.p.m. clockwise. Determine the velocity and acceleration of the piston when the crank is at 40 degrees from the inner dead centre position. Also determine the position of the crank for zero acceleration of the piston.	[5]	2	4
Q3.	a) In a slider crank mechanism having stroke length 30 cm and an obliquity ratio is 4. The crank is rotating in a clockwise direction. The velocity of sider is 6 m/s when the crank has turned 120^0 from IDC. Estimate the acceleration of the slider with the help of Klein's construction.	[5]	3	4
	b) In Fig., the slider C is moving to the right with a velocity of 1 m/s. Estimate the velocity of the links AB and BC using a graphical method.	[5]	3	4

	 c) In a four-bar chain ABCD shown in Fig., AD is fixed and is 150 mm long. The crank AB is 40 mm long and rotates at 120 r.p.m. clockwise, while the link CD = 80 mm oscillates about D. Links BC and AD are of equal length. Estimate the angular velocity of link CD when angle BAD = 60°. 	[5]	3	4
Q.4	a) Derive an expression for path of contact. b) A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gear is involute with 20° pressure angle, 12 mm module and an addendum of 10 mm. Estimate the length of path of contact. c) Two spur gears with 20° involute tooth profile have a module of 10 mm. The addendum is equal to one module. The larger gear has 40 teeth while the pinion has 20 teeth. Estimate path of contact. Will the gear interfere with the pinion?	[5] [5] [5]	4 4 4	4 4 4
Q.5	a) Discuss the procedure to analyze the motion of simple epicyclic gear train. b) In a reverted epicyclic gear train shown in Fig., arm A carries two gears B and C and a compound gear D - E. The gear B meshes with gear E and the gear C meshes with gear D. The number of teeth on gears B, C and D are 75, 30 and 90 respectively. Find the speed and direction of gear C when gear B is fixed and arm A makes 100 rpm.  c) 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 r.p.m. in the anticlockwise direction about the centre of gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed, makes 300 r.p.m. in the clockwise direction, what will be the speed of gear B?	[5] [5] [5]	5 5 5	4 4 4

Q.6)	a) A single plate clutch is required to transmit 8 kW at 1000 rpm. The axial pressure is limited to 70 kN/m^2. The mean radius of the plate is 4.5 time the radial width of friction surface. If both sides of the plate are effective and coefficient of friction is 0.25, Estimate (i) inner and outer radii of the plate and mean radius (ii) Width of friction lining	[5]	6	4
	b) Conical pivot bearing supports a vertical shaft of 200 mm diameter. It is subjected to a load of 30 kN. The angle of the cone is 120° and the coefficient of friction is 0.025. Find the power lost in friction when the speed is 140 r.p.m., assuming 1. uniform pressure ; and 2. uniform wear.	[5]	6	4
	c) A single block brake, as shown in Fig., has a drum diameter 250 mm. The angle of contact is 90° and the coefficient of friction between the drum and the lining is 0.35. If the operating force of 650 N is applied at the end of the lever, estimate the torque that may be transmitted by the block brake. 	[5]	6	4