Name: **Enrolment No:**	

UPES

End Semester Examination, May 2025

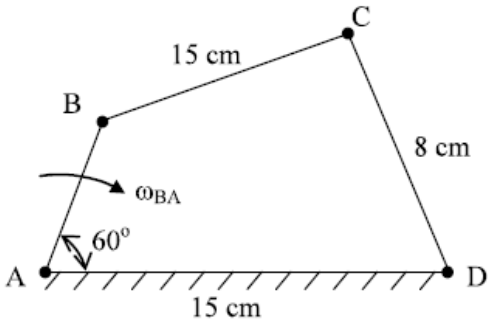
Course: Theory of Machines **Semester: VI**

Program: B.Tech Mechatronics **Time : 03 hrs.**

Course Code: MECH 3060 **Max. Marks: 100**

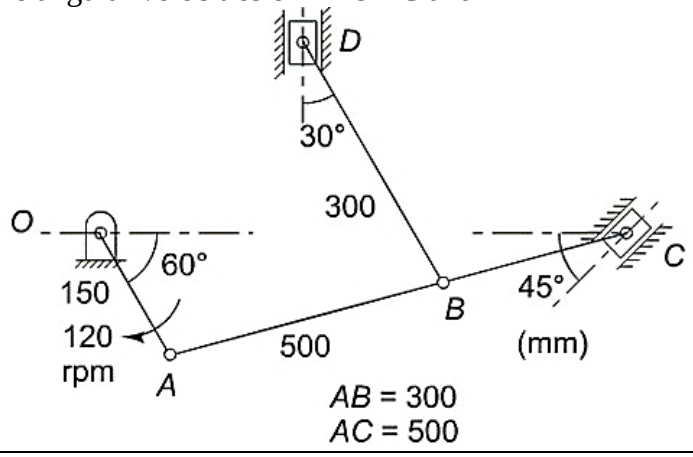
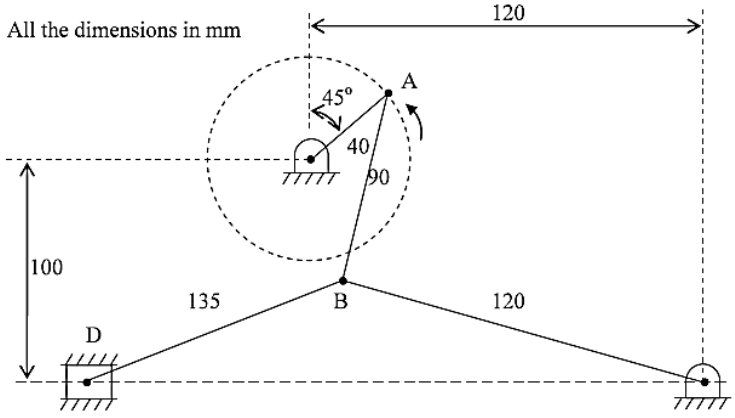
Instructions: State clearly any assumption.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Compare between mechnism and machine	**4**	**CO1**
Q 2	Compare different Inversions of crank slider Mechanism.	**4**	**CO1**
Q 3	In a four bar chain ABCD link AD is fixed and in 15 cm long. The crank AB is 4 cm long rotates at 180 rpm(cw) while link CD rottes about D is 8 cm long BC=AD and angle BAD=60 deg. Find angular velocity of link CD. 	**4**	**CO2**
Q 4	Discuss the selection of gear in helicopter power transmission and automobile differential gear box .	**4**	**CO3**
Q 5	Find the amount of the counter mass at a radial distance of 340 mm for the static balancing, if the rotor has the following properties: M1=4 kg R1=30 mm θ1=30 deg M2=3 kg R2=20 mm θ2=130 deg M3=2 kg R3=25 mm θ3=250 deg	**4**	**CO4**

SECTION B
(4Qx10M= 40 Marks)

Q 6	A) How gyroscopic affects motion of naval ships and airplane? B) Compare different types of gear and their application.	**10**	**CO1**

Q 7	Show that velocity ratio of compound belt with thick (t) and slip percentage (s) is given by $$\frac{N_2}{N_1} = \frac{d_1 + t}{d_2 + t}\left(1 - \frac{s}{100}\right)$$	**10**	**CO2**
Q 8	Solve with Instantaneous center method and find linear velocities of sliders C and D and the angular velocities of links AC and BD 	**10**	**CO3**
Q 9	The crank of reciprocating Engine is 230mm long, the connecting rod is 900 mm long and the rpm is 150. Find the velocity and acceleration of piston and the angular velocity and angular acceleration of the connecting rod when the angle which crank make with i.d.c is a) 30 deg and b) 120 deg. **OR** A single cylinder reciprocating engine has a reciprocating mass of 50 kg. The crank rotates at 80 rpm and the stroke is 350 mm. Mass of the revolving parts at 160 mm radius is 30 kg. If two-thirds of the reciprocating parts and the whole of the revolving parts are to be balanced, determine i) the balanced mass required at a radius of 320 mm	**10** **10**	**CO4**
SECTION-C **(2Qx20M=40 Marks)**			
Q 10	Figure below shows a toggle mechanism in which the crank OA rotates at 100 rpm. Find the velocity and acceleration of slider D. (Draw space, velocity and acceleration diagrams) 	**20**	**CO3**

Q 11	B) A disc with radius of gyration 60 mm and a mass of 4 kg is mounted centrally on a horizontal axle of 80 mm length between the bearings. It spins about the axle at 800 rpm counter-clockwise when viewed from the right hind side bearing. The axle precesses about a vertical axis at 50 rpm I the clockwise direction when viewed from above. Determine the resultant reaction at each bearing due to the mass and gyroscopic effect. B) A pinion gear with 22 teeth and a module of 6 mm has a rotational speed of 1200 rpm and drives a gear at 660 rpm. Determine: i) The number of teeth on the gear, and; ii) The theoretical centre distance. **OR** An engine running at 160 rpm, drives a line shaft by means of a belt. The engine pulley is 800 m diameter and pulley on the line shaft being 400 mm. A 900 m diameter pulley of the line shaft drives a 150 mm diameter pulley keyed to a dynamo shaft. Find the speed of the dynamo shaft. When i) there is no slip, and ii) there is lip of 3 % at each drive. Compare these results with cross belt configuration.	**20**	**CO4**