Name: **Enrolment No:**	

UPES

End semester Examination, May2024

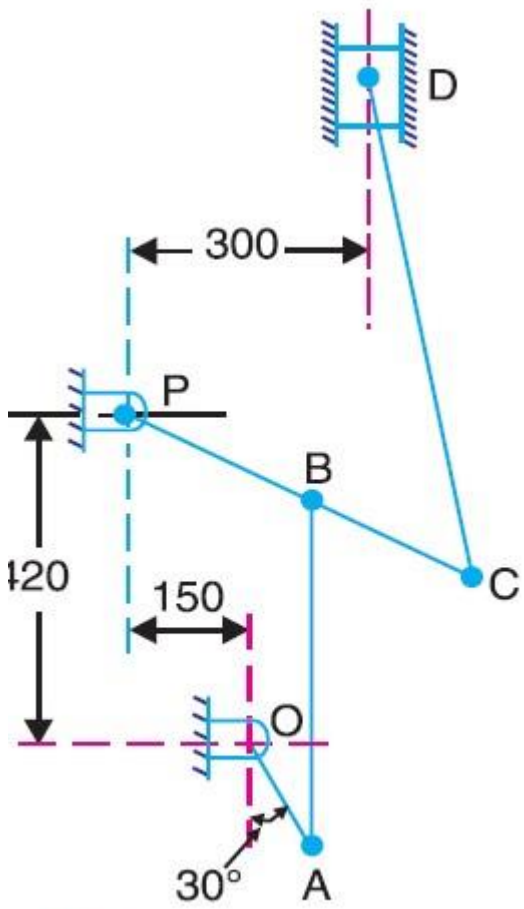
Program Name: ADE **Semester: 4**
Course Name: kinematics and dynamics of machines **Time: 03 hrs.**
Course Code: MECH2052 **Max. Marks: 100**
Nos. of page(s): 3
Instructions: Attempt all the questions

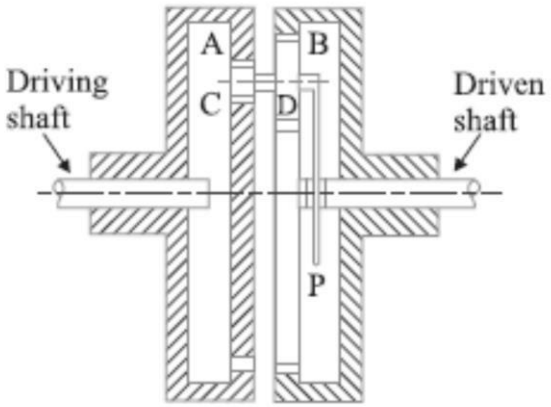
SECTION A (5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Define the following terms as applied to cam with a neat sketch :- (a) Base circle, (b) Pitch circle, (c) Pressure angle,	**5**	**CO1**
Q.2	State Grashof's law and explain how is it helpful in classifying the four-link mechanisms into different types.	**5**	**CO1**
Q.3	Differentiate between completely and incompletely constrained motion.	**5**	**CO2**
Q.4	Elaborate various types of gears along with their applications in day-to-day life.	**5**	**CO2**
Q5	Define Coriolis component of acceleration along with its application.	**5**	**CO1**

SECTION B (4Qx10M= 40 Marks)

Q.6	Find out the acceleration of the slider D and the angular acceleration of link CD for the engine mechanism shown in Fig.The crank OA rotates uniformly at 180 r.p.m. in clockwise direction. The various lengths are: OA = 150 mm ; AB = 450 mm; PB = 240 mm ; BC = 210 mm ; CD = 660 mm.	**10**	**CO3**

	 All dimensions in mm.		
Q.7	The two gear wheels mesh externally and are to give a velocity ratio of 3 to 1. The teeth are of involute form ; module = 6 mm, addendum = one module, pressure angle = 20°. The pinion rotates at 90 r.p.m. Determine: 1. The number of teeth on the pinion to avoid interference on it and the corresponding number of teeth on the wheel, 2. The length of path and arc of contact, 3.The number of pairs of teeth in contact, and 4. The maximum velocity of sliding.	**10**	**CO3**
Q.8	Define rubbing velocity at a pin joint. What will be the rubbing velocity at pin joint when the two links move in the same and opposite directions ?	**10**	**CO2**
Q.9	A vehicle moving on a rough plane inclined at 10° with the horizontal at a speed of 36 km/h has a wheelbase 1.8 meters. The center of gravity of the vehicle is 0.8 meter from the rear wheels and 0.9 meter above the inclined plane. Find the distance travelled by the vehicle before coming to rest and the time taken to do so when 1. The vehicle moves up the plane, and 2. The vehicle moves down the plane. The brakes are applied to all the four wheels and the coefficient of friction is 0.5.	**10**	**CO2**
	OR		

	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 center 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 ?	**10**	**CO3**
	SECTION-C (2Qx20M=40 Marks)		
Q 10	An epicyclic train is shown in Fig. Internal gear A is keyed to the driving shaft and has 30 teeth.Compound wheel C and D of 20 and 22 teeth respectively are free to rotate on the pin fixed to the arm P which is rigidly connected to the driven shaft. Internal gear B which has 32 teeth is fixed. If the driving shaft runs at 60 r.p.m. clockwise, determine the speed of the driven shaft. What is the direction of rotation of driven shaft with reference to driving shaft?  	**20**	**CO4**
Q.11	Design a cam for operating the exhaust valve of an oil engine. It is required to give equal uniform acceleration and retardation during opening and closing of the valve each of which corresponds to 60° of cam rotation. The valve must remain in the fully open position for 20° of cam rotation. The lift of the valve is 37.5 mm and the least radius of the cam is 40 mm. The follower is provided with a roller of radius 20 mm and its line of stroke passes through the axis of the cam	**20**	**CO4**
	OR		

	A cam, with a minimum radius of 25 mm, rotating clockwise at a uniform speed is to be designed to give a roller follower, at the end of a valve rod, motion described below : 1. To raise the valve through 50 mm during 120° rotation of the cam ; 2. To keep the valve fully raised through next 30°; 3. To lower the valve during next 60°;	**20**	**CO4**
	and 4. To keep the valve closed during rest of the revolution i.e. 150° ; The diameter of the roller is 20 mm and the diameter of the cam shaft is 25 mm. Draw the profile of the cam when (a) the line of stroke of the valve rod passes through the axis of the cam shaft, and (b) the line of the stroke is offset 15 mm from the axis of the cam shaft. The displacement of the valve, while being raised and lowered, is to take place with simple harmonic motion. Determine the maximum acceleration of the valve rod when the cam shaft rotates at 100 r.p.m. Draw the displacement, the velocity, and the acceleration diagrams for one complete revolution of the cam.		