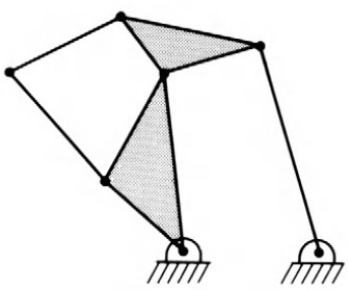
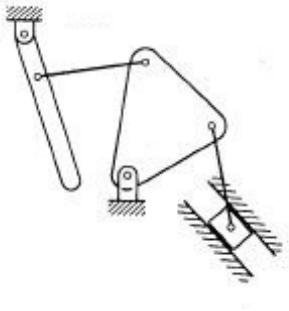
Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

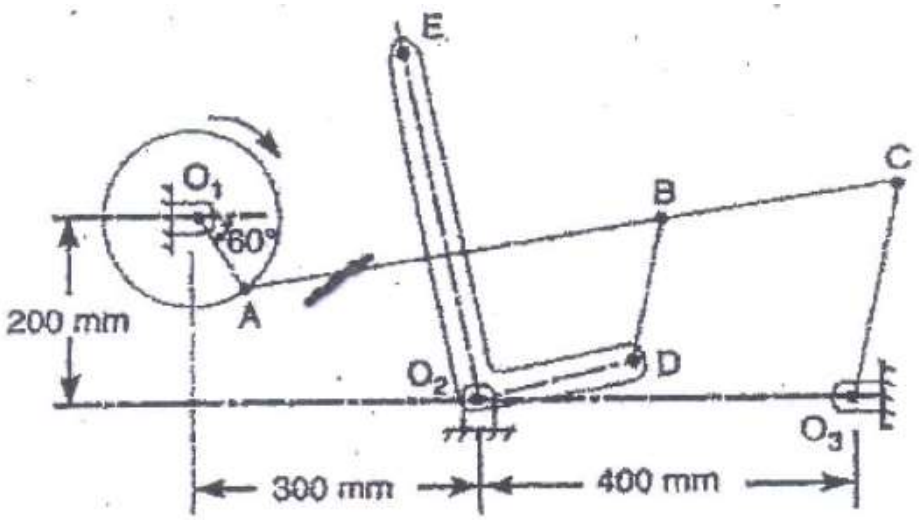
Course: Theory of Machine **Semester: IV**
Program: B. Tech ASE **Time : 03 hrs.**
Course Code: MECH 2013 **Max. Marks: 100**

Instructions: Make use of *sketches/plots* to elaborate your answer. Brief and to the point, answers are expected. *Assume suitable data if needed*

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Find the mobility of each mechanism shown in the figures below. Comment on whether linkages are mechanisms, structure or superstructure  Fig -1  Fig-2	**04**	**CO1**
Q 2	Explain the instantaneous center method approach for finding velocity and Kennedy theorem.	**04**	**CO2**
Q 3	Explain the types of constrained motion.	**04**	**CO1**
Q 4	State the law of gearing to maintain the condition for constant velocity ratio between a pair of toothed wheels. Name two types of gear tooth profile to satisfy these.	**04**	**CO1**
Q 5	Defined the following terms as applied to cam with neat sketch. a) Prime circle b) Pitch circle c) Base Circle d) Lift of the follower	**04**	**CO2**

SECTION B (4Qx10M= 40 Marks)			
Q 6	Determine the addendum radius of a gear pair consisting of two spur wheels each having 30 teeth to have a minimum contact ratio equal to to 2. The circular pitch is 2.5 cm and pressure angle is 20^0.	**10**	**CO3**
Q 7	Find the position and magnitude of the balance mass required for the four masses M_1, M_2, M_3 and M_4 having their radii of rotation as 200 mm, 150 mm, 250 mm and 300 are 200 kg, 300 kg, 240 kg, and 260 kg in magnitude respectively. The angle between the successive masses are 45^0, 75^0, and 135^0 respectively. If its radius of rotation is 200 mm	**10**	**C02**
Q 8	Determine maximum velocity and acceleration of the follower during the outward stroke and the return stroke. Under the following condition. A cam operating a knife-edged follower has the following data : (a) Follower moves outwards through 40 mm during 60° of cam rotation. (b) Follower dwells for the next 45°. (c) Follower returns to its original position during next 90°. (d) Follower dwells for the rest of the rotation. The displacement of the follower is to take place with simple harmonic motion during both the outward and return strokes. The least radius of the cam is 50 mm. Draw the profile of the cam when 1. the axis of the follower passes through the cam axis, and 2. the axis of the follower is offset 20 mm towards right from the cam axis. If the cam rotates at 300 Rpm., **OR** A disc cam rotating in a clockwise direction is used to move a reciprocating roller with simple harmonic motion in a radial path, as given below : (i) Outstroke with maximum displacement of 25 mm during 120° of cam rotation, (ii) Dwell for 60° of cam rotation, (iii) Return stroke with maximum displacement of 25 mm during 90° of cam rotation, and (iv) Dwell during remaining 90° of cam rotation. The line of reciprocation of follower passes through the camshaft axis. The maximum radius of cam is 20 mm. If the cam rotates at a uniform speed of 300 r.p.m. find the maximum velocity and acceleration during outstroke and return stroke. The roller diameter is 8 mm. Draw the profile of the cam when the line of reciprocation of the follower is offset by 20 mm towards right from the cam shaft axis	**10**	**C03**
Q 9	Analyze piston motion in single slider crank mechanism statically and dynamically.	**10**	**C04**

SECTION-C (2Qx20M=40 Marks)			
Q 10	The mechanism of a wrapping machine as shown in the figure has the following dimensions. O_1A = 100 mm; AC = 700 mm; BC = 200 mm; O_3C = 200 mm ; O_2E = 400 mm; O_2D = 200 mm and BD = 150 mm. the crank rotates at a uniform speed of 100 rad/s. for the given configuration determine. i) Linear velocity of point E on the bell crank lever by relative velocity method ii) Acceleration of point E and B iii) Angular acceleration of bell crank lever  	**20**	**CO3**
Q 11	a) Analyze the complete Involute Gear profile and determine the Path of contact, Arc of contact and importance of contact ratio. [15] b) Discuss the selection of gear in the following cases. [05] i) Helicopter power transmission ii) Automobile differential gear box OR a) Analyze the different way to avoid the interference in gear train and select the right method with justification [10] b) Draw the third inversion of single slider crank mechanism and discuss in detail with practical application. [05] c) Discuss the First inversion of double slider mechanism with neat sketch [05]	**20**	**C04**