Name:

Enrolment No:

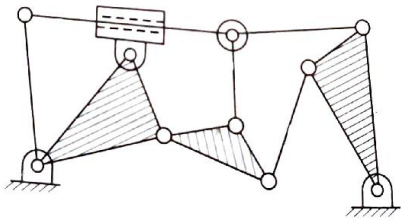
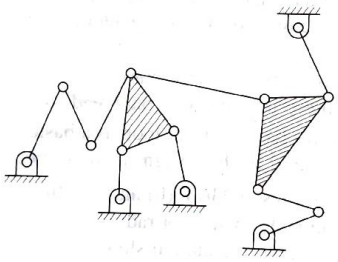
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2021

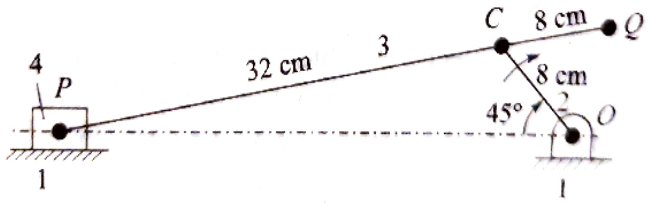
Course: Theory of Machines (MECH 3019) **Semester: V**
Program: B. Tech (Mechatronics) **Time: 3 Hours**
Max. Marks: 100

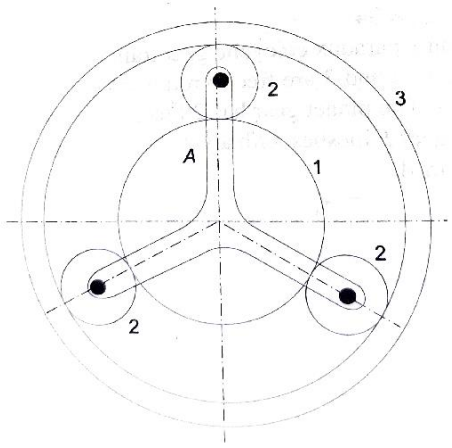
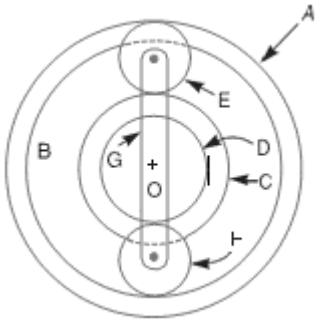
SECTION A

S. No.		Marks	CO
Q-1	Distinguish between a chain structure and a mechanism.	**4**	**CO1**
Q-2	Explain briefly the differences between simple, compound and epicyclic gear trains.	**4**	**CO1**
Q-3	Why is balancing necessary for rotors of high speed engines? Write a short note on static and dynamic unbalance in machinery.	**4**	**CO1**
Q-4	What is instantaneous centre of rotation? Show all the Instantaneous centre of a four bar mechanism.	**4**	**CO1**
Q-5	What do you mean by gyroscopic couple? write a relation for its magnitude.	**4**	**CO1**

SECTION B

Q-6	Determine the number of degrees of freedom of the mechanism shown in Figures below.  	**10**	**CO2**
Q-7	In the slider crnk mechanism as shown, the crank 2 makes 80 rpm in clockwise direction. Determine the linear velocity of slider and angular velocity of connecting rod 3. Also find out the linear linear velocity of point Q on connecting rod. Lengths of crank and connecting rod are 8 cm and 32 cm respectively.	**10**	**CO2**

			
Q-8	A pair of 20 degree involute spur gear having 30 and 50 teeth respectively of module 4 mm are in mesh, the smaller gear rotates at 1000 rpm. Determine a) Sliding velocities at engagement and disengagement of a pair of teeth and b) The contact ratio, take addendum = 1 module. OR Determine the minimum number of teeth required on a pinion, in order toavoid interference which is to gear with, 1. a wheel to give a gear ratio of 3 to 1 ; and 2. an equal wheel. The pressure angle is 20° and a standard addendum of 1 module for the wheel may be assumed.	**10**	**CO3**
Q-9	Four masses 150 kg, 250 kg, 200 kg and 300 kg are rotating in the same plane at radii of 0.25 m, 0.2 m, 0.3 m, and 0.35 m respectively. Their angular location is 40°, 120°, and 250° from mass 150 kg, respectively measured in counter-clockwise direction. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.25 m.	**10**	**CO4**
SECTION C			
Q-10	The pitch circle diameter of the annular gear in the epicyclic gear train shown in figure is 425 mm and the module is 5 mm. when the annular gear 3 is stationary, the spindle A makes one revolution in the same sense as the sun gear 1 for every 6 revolutions of the driving spindle carrying the sun gear. All the planet gears are of same size. Determine the number of teeth on all the gears	**20**	**CO3**

	 OR In an epicyclic gear train, the internal wheels A and B and compound wheels C and D rotate independently about axis O. The wheels E and F rotate on pins fixed to the arm G. E gears with A and C and F gears with B and D. All the wheels have the same module and the number of teeth are : TC = 28; TD = 26; TE = TF = 18. *a)* Find the number of teeth on A and B ; *b)* If the arm G makes 100 r.p.m. clockwise and A is fixed, find the speed of B ; and *c)* If the arm G makes 100 r.p.m. clockwise and wheel A makes 10 r.p.m. counter clockwise ; find the speed of wheel B. 		
Q-11	A disc cam with base circle radius of 50 mm is operating a roller follower with SHM. The lift is 25 mm, angle of ascent 120°, dwell 90°, return 90°, and dwell during the remaining period. The roller radius is 10 mm. Draw the cam profile when the line of reciprocation of follower passes through the cam axis.	**20**	**CO4**