UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December, 2020

Course: Theory of Machines   **Semester: V**
Program: B.Tech – Mechanical   **Time: 3 hours**
Course Code: MECH2006   **Max. Marks: 100**
No. of Pages: 03
Note:
1. The paper consists of 3 sections A, B and C.
2. For Section A, type your answers in the browser directly
3. For Sections B and C, scan and upload your answers.

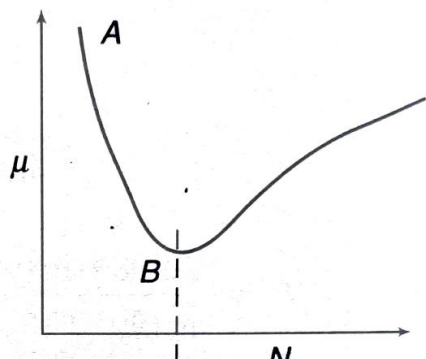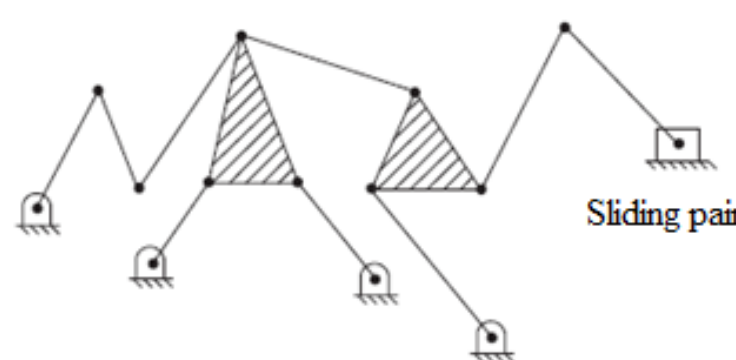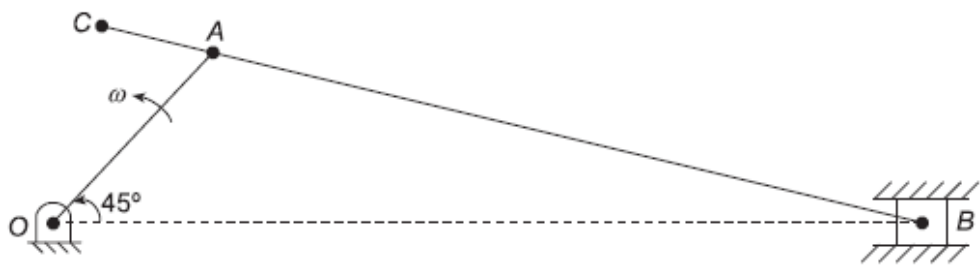|	**Section A**		
Q1.	Explain the term undercutting as applicable to gears	**5**	**CO1**

Q2.	Define following terms:
	   a. Kinematic Mechanism
	   b. Kinematic chain
		5	**CO1**

Q3.	Define film friction. Interpret the plot between coefficient of friction with speed as shown in Fig.1 below Fig.1 – Plot of coefficient of friction with speed	**5**	**CO1**
Q4.	Determine the degrees of freedom of the mechanism as shown in Fig.2 Fig.2 – Mechanism	**5**	**CO1**
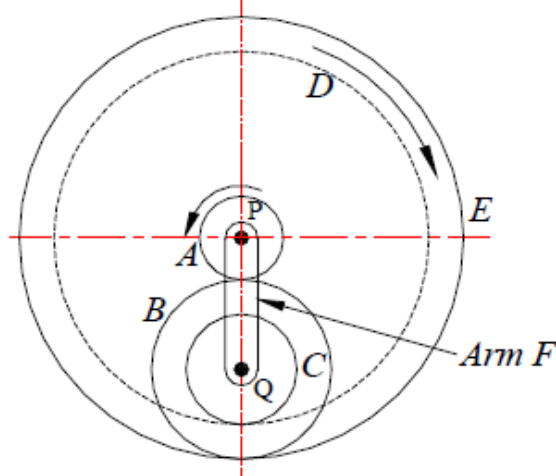
Q5.	Explain in brief the application of cam and follower arrangement in any three machines.	5	CO1
Q6.	Explain Coriolis acceleration component with examples of mechanisms where it is applicable.	5	CO1

Section B

Q1.	For the slider-crank mechanism shown in Fig.3 below, determine the velocity of the point C on the link AB when the crank OA rotates at 180 rpm counterclockwise. OA = 500 mm, AB = 1500 mm and AC = 250 mm.	10	CO2

Fig.3 – Crank-Slider Mechanism

Q2.	Consider the data given in Q7 and determine the accelerations of the point C and slider B.	10	CO2
Q3.	In a compound epicyclic gear train as shown in the Fig.4, gear A and an annular gears D & E are free to rotate on the axis P, B and C is a compound gear rotate about axis Q. Gear A rotates at 90 rpm CCW and gear D rotates at 450 rpm CW. Evaluate the speed and direction of rotation of arm F and gear E. Gears A, B and C are having 18, 45 and 21 teeth respectively. All gears having same module and pitch.	10	CO4

Fig.4 – Compound Epicyclic Gear Train

Q4.	Two 20° full-depth involute spur gears having 30 and 48 teeth are in mesh. The pinion rotates at 840 rpm. The module is 4 mm. If the interference is just avoided, determine (i) the addenda on the wheel and the pinion, (ii) the path of contact, (iii) the maximum velocity of sliding at engagement and disengagement of a pair of teeth, and (iv) contact ratio.	10	CO3
Q5.	A new multi-plate clutch transmitting 52 kW of power has a speed of 1500 rpm. The outer radius of friction surfaces is 120 mm and it is 1.25 times the inner radius. The coefficient of friction between the friction surfaces is 0.15. The axial intensity of pressure is limited to 150 kN/m^2. Determine the number of plates required to transmit the required power.	10	CO3

	Section C		
Q1.	Draw the profile of a cam in which a radial knife edge follower is raised with uniform acceleration and deceleration and is lowered with simple harmonic motion. Use the following data: Least radius of cam = 60 mm Lift of follower = 45 mm Angle of ascent = 60° Angle of dwell between ascent and descent = 40° Angle of descent = 75° **OR** Draw the profile of the cam when the roller follower moves with cycloidal motion as given below: (a) Outstroke with maximum displacement of 44 mm during 180° of cam rotation. (b) Return stroke for the next 150° of cam rotation. (c) Dwell for the remaining 30° of cam rotation. The minimum radius of the cam is 20 mm and the diameter of the roller is 10 mm. The axis of the roller follower passes through the cam shaft axis.	**20**	**CO3**