Name: Enrolment No:	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2021

Course : Theory of Machines — **Semester : V**
Program: B. Tech Automotive Design Engineering — **Duration : 03 hrs.**
Course Code : MECH2006 — **Max. Marks : 100**
Nos. of page(s) : 3

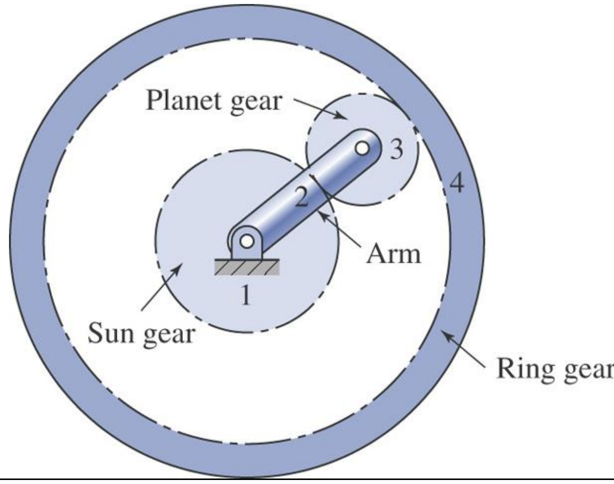
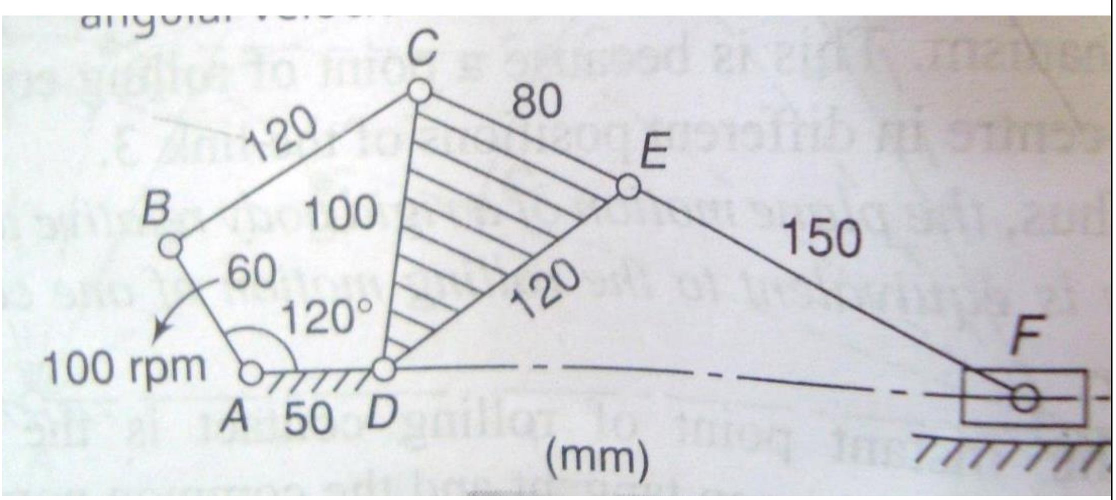
Instructions: Assume any missing data. All questions are compulsory. Write in your own handwriting and mention your Roll No., Date of examination and Subject on the top of your answer script. Use A3 size sheet to solve problems of velocity and acceleration.

SECTION A (20 marks)

S. No.		Marks	CO
Q 1	Explain with the help of sketches (i) reverted gear train (ii) compound gear train	**4**	**CO1**
Q 2	Give reasons (i) Two meshing gears should have same module. (ii) Pitch point divides the line joining two centers in fixed proportions. (iii) Indexing plate consists of concentric circles of different nos. of holes. (iv) Knife edge follower is rarely used in practice.	**4**	**CO1**
Q 3	State and prove Kennedy's theorem as applicable to instantaneous centers of rotation	**4**	**CO1**
Q 4	How the kinematic pairs are classified? Explain with examples.	**4**	**CO1**
Q 5	What are the centripetal and tangential components of acceleration? When do they occur? How are they determined?	**4**	**CO1**

SECTION B (40 marks)

S. No.		Marks	CO
Q 6	Explain the working of single plate clutch with the help of neat sketch.	**10**	**CO5**
Q 7	A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is Involute with 20° pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and contact ratio.	**10**	**CO4**
Q 8	Derive an expression for displacement, velocity and acceleration for cam follower when it moves with cycloidal motion, also draw y-θ, v-θ and f-θ diagrams. [where y, v and f are displacement, velocity and acceleration of cam follower respectively].	**10**	**CO3**

Q 9	An Epicyclic gear train is shown in Fig. given below. The number of teeth on **1** and **4** are 80 and 200. Determine the speed of arm **2** i) If **1** rotates at 100 rpm clockwise and **4** at 50 rpm counter clockwise. ii) If **1** rotates at 100 rpm clockwise and **4** is stationary.  	**10**	**CO4**
	SECTION-C (40 marks)		
Q 10	For the mechanism shown in Fig. (Given below), determine the velocities of the points C, E and F and the angular velocities of the link BC, CDE and EF.  	**20**	**CO2**

Q11	**Draw the cam profile for following conditions:** Follower type = Knife edged, in-line; lift = 50mm; base circle radius = 50mm; out stroke with SHM, for 600 cam rotation; dwell for 450 cam rotation; return stroke with SHM, for 900 cam rotation; dwell for the remaining period. Determine maximum velocity and acceleration during out stroke and return stroke if the cam rotates at 1000 rpm in clockwise direction. **OR** Cam is to be designed for a roller follower with the following data : 1. Cam lift = 40 mm during 90° of cam rotation with simple harmonic motion. 2. Dwell for the next 30°. 3. During the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion. 4. Dwell during the remaining 180°. 5. Roller radius= 10 mm Draw the profile of the cam when the line of stroke is passing from the axis of the cam shaft. The radius of the base circle of the cam is 40 mm. Determine the maximum velocity and acceleration of the follower during its ascent and descent, if the cam rotates at 240 r.p.m	**20**	**CO3**