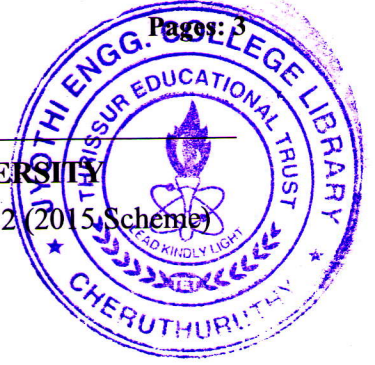


Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
 Fifth Semester B.Tech Degree (S,FE) Examination January 2022 (2015 Scheme)



**Course Code: ME301**

**Course Name: MECHANICS OF MACHINERY**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer any three full questions, each carries 10 marks.*

Marks

- |   |   |     |
|---|---|-----|
| 1 | a) Differentiate between mechanism and structure.   | (2) |
|   | b) Define Grashof's law? How the four-link mechanism is classified into different types based on this law.  | (4) |
|   | c) Define Instantaneous centre of rotation? Locate all the Instantaneous centres in a four-bar mechanism.   | (4) |
| 2 | a) Explain Peaucellier straight line motion mechanism with the help of a sketch.  | (4) |
|   | b) What do you mean by Inversion of mechanism? Explain the various inversions of double slider crank mechanism.   | (6) |
| 3 | a) State and prove Kennedy's theorem.   | (3) |
|   | b) With the aid of sketches derive the expressions for the velocity and acceleration of a follower when it moves with simple harmonic motion.   | (7) |
| 4 | a) Draw the displacement, velocity and acceleration diagram of follower executing cycloidal motion.   | (3) |
|   | b) The crank of the slider crank mechanism rotates at a constant speed of 300 r.p.m. The length of the crank OA is 120 mm and the connecting rod AB is 900 mm. 'D' is a point on the connecting rod AB such that AD = 400 mm. Determine velocity of D, angular velocity and angular acceleration of the connecting rod, at a crank angle of $60^\circ$ from the inner dead centre position. | (7) |

**PART B**

*Answer any three full questions, each carries 10 marks.*

- |   |   |      |
|---|---|------|
| 5 | a) A cam is to be designed for a knife edge follower with the following data:   | (10) |
|   | 1) Cam lift = 40 mm during $100^\circ$ of cam rotation with simple harmonic motion.   |      |
|   | 2) Dwell for the next $20^\circ$ 3) During the next $70^\circ$ of cam rotation, the follower returns to its original position with uniform acceleration and retardation |      |
|   | 4) Dwell during the remaining $170^\circ$ . Draw the profile of the cam when the line   |      |

of stroke is offset 25 mm to right from the axis of the cam shaft. The radius of the base circle of the cam is 50 mm. Determine the maximum velocity and maximum acceleration during the outstroke and return stroke. The speed of the cam is 300 rpm.

- 6 a) A symmetrical tangent cam with least radius of 50 mm operates a roller follower of radius 15 mm. The line of stroke of roller follower passes through the axis of cam. The angle between the tangential faces of the cam is  $60^\circ$ , speed of the cam shaft is 400 rpm and the lift of the follower is 20 mm. Determine the (i) main dimensions of the cam, (ii) acceleration of the follower at the beginning of lift and at the apex of the circular nose. (10)
- 7 a) Explain interference in involute gears? Suggest the methods to avoid it. (5)  
 b) Define arc of contact and deduce the expression to find its magnitude. (5)
- 8 a) Differentiate between involute gears and cycloidal gears. (4)  
 b) Two spur gears of involute tooth profile with pressure angle of  $20^\circ$  mesh externally and gives a velocity ratio of 3:1. The module is 4 mm and the addendum is equal to 1.12 module. If the pinion rotates at 180 rpm, determine the (i) minimum number of teeth on each wheel to avoid interference (ii) contact ratio. (6)

### PART C

*Answer any four full questions, each carries 10 marks.*

- 9 a) Explain the different types of gear train with the aid of neat sketches. (10)
- 10 a) In the epicyclic gear train shown in the figure below, the compound wheels A and B as well as internal wheels C and D rotates independently about the axis O. The wheels E and F rotate on the pins fixed to the arm 'a'. All the wheels are of same module. The number of teeth on wheels are  
 $T_A = 60, T_B = 64, T_E = T_F = 40$   
 Determine the speed of C if  
 (i) Wheel D fixed and arm 'a' rotates at 300 rpm clockwise  
 (ii) Wheel D rotates at 150 rpm counter-clockwise and arm 'a' rotates at 30 rpm clockwise (10)

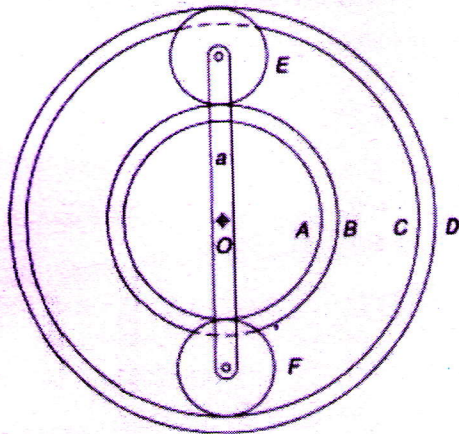


Figure 1

- 11 a) Explain the graphical method for obtaining the precision points. (4)  
 b) What do you mean by kinematic synthesis? Explain the various steps involved in the kinematic synthesis of mechanisms. (6)
- 12 a) What is Chebychev spacing? What is its significance? (4)  
 b) Explain the two position and three position synthesis of four bar mechanism. (6)
- 13 a) Derive an expression for Freudenstein's equation for the synthesis of mechanisms. (10)
- 14 a) Explain the following terms: (6)  
 (i) Function generation (ii) Path generation (iii) Motion generation  
 b) Explain the overlay method in synthesis of mechanism. (4)

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