# GUJARAT TECHNOLOGICAL UNIVERSITY
### BE - SEMESTER– III (NEW) EXAMINATION – SUMMER 2022

**Subject Code:3131906**                       **Date:18-07-2022**

**Subject Name:Kinematics and Theory of Machines**

**Time:02:30 PM TO 05:00 PM**               **Total Marks:70**

**Instructions:**
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

|  |  |  | MARKS |
|---|---|---|---|
| **Q.1** | **(a)** | Sketch and describe four bar chain mechanism. | **03** |
| | **(b)** | Explain the terms: 1. Lower pair 2. Higher pair 3. Kinematic link 4. Mechanism | **04** |
| | **(c)** | Compare and discuss: kinematic link, kinematic pair, and kinematic chain. | **07** |
| **Q.2** | **(a)** | Create displacement diagram for Simple Harmonic motion for desired dimensions. | **03** |
| | **(b)** | Draw the displacement, velocity and acceleration diagrams for a follower when it moves with Uniform acceleration and retardation | **04** |
| | **(c)** | A cam is to be designed for a knife edge 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°. Draw the profile of the cam when the line of stroke is offset 20 mm 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 | **07** |

**OR**

| | | | |
|---|---|---|---|
| | **(c)** | Draw the profile of the cam when the roller follower moves with cycloidal motion during out stroke and return stroke, as given below : 1. Out stroke with maximum displacement of 31.4 mm during 180° of cam rotation, 2. Return stroke for the next 150° of cam rotation, 3. Dwell for the remaining 30° of cam rotation. The minimum radius of the cam is 15 mm and the roller diameter of the follower is 10 mm. The axis of the roller follower is offset by 10 mm towards right from the axis of cam shaft. | **07** |
| **Q.3** | **(a)** | Explain the terms: Function Generation, Path Generation, Motion Generation | **03** |
| | **(b)** | Formulate freudenstein's equation. | **04** |
| | **(c)** | Locate all the instantaneous centres of the slider crank mechanism as shown in Fig. The lengths of crank OB and connecting rod AB | **07** |

are 100 mm and 400 mm respectively. If the crank rotates clockwise with an angular velocity of 10 rad/s, find: 1. Velocity of the slider A, and 2. Angular velocity of the connecting rod AB
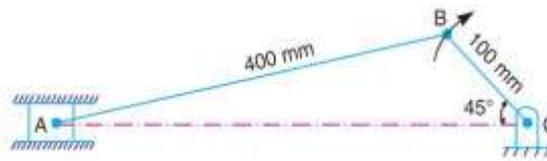


**OR**

| **Q.3** | **(a)** | State and prove 'Aronhold Kennedy's Theorem' of three instantaneous centres. | **03** |
|---|---|---|---|
| | **(b)** | Explain briefly dimensional synthesis. | **04** |
| | **(c)** | A four bar chain mechanism is to be designed, by using three precision point to generate the function $Y = X^{1.5}$ for the range $1 \le x \le 4$ Assuming $30^0$ starting position and $120^0$ finishing position for the input link and $90^0$ starting position and $180^0$ finishing position for the output link, find the value of x , y , ɵ and φ corresponding to three precision point. | **07** |

| **Q.4** | **(a)** | Differentiate between Involute and Cycloidal profile of gear tooth | **03** |
|---|---|---|---|
| | **(b)** | Define the term: 1. Pitch circle 2. Pitch Diameter 3. Pitch Point 4. Module | **04** |
| | **(c)** | In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 r.p.m. in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed makes 300 r.p.m. in the clockwise direction, what will be the speed of gear B? | **07** |
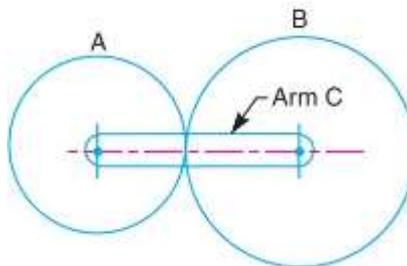


**OR**

| **Q.4** | **(a)** | Define the following terms: (1) Dry friction (2) Film friction (3) Limiting angle of friction | **03** |
|---|---|---|---|
| | **(b)** | Discuss the various types of the brakes | **04** |
| | **(c)** | A bicycle and rider of mass 100 kg are travelling at the rate of 16 km/h on a level road. A brake is applied to the rear wheel which is 0.9 m in diameter and this is the only resistance acting. How far will the bicycle travel and how many turns will it make before it comes to rest? The pressure applied on the brake is 100 N and μ = 0.05. | **07** |

| **Q.5** | **(a)** | Explain what do you understand by 'initial tension in a belt' | **03** |
|---|---|---|---|
| | **(b)** | Interpret the Phenomenon of "slip"& "creep" in a belt drive. | **04** |
| | **(c)** | Power is transmitted using a V-belt drive. The included angle of V-groove is 30°. The belt is 20 mm deep and maximum width is 20 mm. If the mass of the belt is 0.35 kg per metre length and | **07** |

maximum allowable stress is 1.4 MPa, determine the maximum power transmitted when the angle of lap is 140°. μ = 0.15.

**OR**

Q.5 **(a)** Show cone clutch with sketch. **03**

**(b)** Illustrate with the neat sketch the "sun and planet wheel." **04**

**(c)** Explain the condition for correct steering. Sketch and show the Davis steering mechanism and discuss their advantages. **07**

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