

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**BE - SEMESTER-III(New) EXAMINATION – SUMMER 2016**

**Subject Code:2131906****Date:09/06/2016****Subject Name:Kinematics of Machines****Time:10:30 AM to 01:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

		<b>MARKS</b>
<b>Q.1</b>	<b>Short Questions:</b>	<b>14</b>
	1 What is the number of degree of freedom (n) when the mechanism forms a structure?	
	2 In a kinematic chain, a quaternary joint is equal to how many binary joints?	
	3 Define Normal Pitch relating to helical gears.	
	4 What do you understand by Type Synthesis?	
	5 Which type of gear train is used to connect minute hand to hour hand in clock mechanism?	
	6 What is the product of diametral pitch and circular pitch?	
	7 Which type of gears are used to connect two non-parallel non-intersecting shaft?	
	8 Which condition should be fulfilled by pair of gears for correct gearing?	
	9 Define: Kinematic Chain	
	10 Which type of cam follower is extensively used in air-craft engines?	
	11 The size of cam depends upon (a) base circle (b) pitch circle (c) prime circle (d) pitch curve	
	12 Which type of pair has been made by the lead screw of a lathe with nut?	
	13 Which mechanism is used to enlarge or reduce the size of drawing?	
	14 Write down the equation about the relation between number of pairs (p) forming the kinematic chain and the number of links (l).	
<b>Q.2</b>	<b>(a)</b> Explain the terms: 1. Lower pair 2. Higher pair 3. Kinematic link	<b>03</b>
	<b>(b)</b> Sketch and describe four bar chain mechanism.	<b>04</b>
	<b>(c)</b> What are quick return motion mechanisms? Where are they used? Discuss the functioning of any one of them.	<b>07</b>
	<b>OR</b>	
	<b>(c)</b> A crank and slotted lever mechanism used in shaper has a center distance of 300 mm between the center of oscillation of the slotted lever and the center of rotation of the crank. The radius of the crank is 120 mm. Find the ratio of the time of cutting to the time of return stroke.	<b>07</b>
<b>Q.3</b>	<b>(a)</b> Give a neat sketch of the straight line motion “Hart	<b>03</b>

- Mechanism”.
- (b) In a Davis steering gear, the distance between the pivots of the front axle is 1.2 meters and the wheel base is 2.7 meters. Find the inclination of the track arm to the longitudinal axis of the car, when it is moving along a straight path. **04**
- (c) Explain the Freudenstein’s method of three point synthesis of mechanisms. **07**
- OR**
- Q.3** (a) What is the condition for correct steering? **03**
- (b) State and prove ‘Aronhold Kennedy’s Theorem’ of three instantaneous centres. **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  $1 \leq x \leq 4$  Assuming  $30^\circ$  starting position and  $120^\circ$  finishing position for the input link and  $90^\circ$  starting position and  $180^\circ$  finishing position for the output link, find the value of  $X$ ,  $y$ ,  $\theta$  and  $\phi$  corresponding to three precision point. **07**
- Q.4** (a) What do you understand by simple, compound, and epicyclic gear trains? **03**
- (b) Explain the term “Interference” as applied to gears? **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 if gear B? **07**
- OR**
- Q.4** (a) Explain the terms in relation to gears:  
(1) Module (2) Circular Pitch (3) Pressure Angle. **03**
- (b) State and prove the “Law of gearing” **04**
- (c) A pair of spur gears with involute teeth is to give a gear ratio of 4:1. The arc of approach is not to be less than the circular pitch and the smaller wheel is driver. The angle of the pressure is  $14.5^\circ$ . Find: (1) The least number of teeth that can be used on each wheel, and (2) The addendum of the wheel in terms of the circular pitch? **07**
- Q.5** (a) Define the following terms related to cam. **03**  
(i) Base circle  
(ii) Pitch circle  
(iii) Pressure angle
- (b) Draw the displacement, Velocity and Acceleration for follower when its moves with cycloidal motion. **04**
- (c) A cam drives a flat reciprocating follower in the following manner: **07**  
During first  $120^\circ$  rotation of the cam, follower moves outward through a distance of 20 mm with S.H.M. The follower dwells during next  $30^\circ$  of cam rotation. During next  $120^\circ$  rotation of the cam, the follower moves inward with S.H.M. The follower dwells for the next  $90^\circ$  of cam rotation. The minimum radius of the cam is 25 mm. Draw the profile of the cam.

**OR**

- Q.5**
- (a) Why a roller follower is preferred to that of a knife-edged followers. **03**
  - (b) Explain with sketches the different types of cams and followers. **04**
  - (c) Draw the displacement, velocity and acceleration diagrams for a follower when it moves with (i) Uniform acceleration and retardation (ii) Cycloidal motion. **07**

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