Enrollment No./Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering - SEMESTER - III EXAMINATION - WINTER 2025

Subject Code: 3131906 **Date: 22-12-2025**

Subject Name: Kinematics and Theory 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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Identify difference between machine and structure.	**03**
	(b)	Define (1) kinematics (3) link (3) Mechanism (4) Lower pair	**04**
	(c)	What is degree of freedom? Explain Kutzbach Criterion and Grubler's Criterion for Plane Mechanisms	**07**
Q.2	**(a)**	Elaborate difference between type synthesis and number.	**03**
	(b)	Explain briefly function generation.	**04**
	(c)	Derive Freudenstein's Equation for Synthesis of four-bar mechanism.	**07**
		OR	
	(c)	Design a four-bar mechanism to co-ordinate the input and output angles as follows: Input angles = 15°, 30°, and 45° and Output angles = 30°, 40°, and 55°.	**07**
Q.3	**(a)**	List advantages and disadvantages of chain drive over belt drive.	**03**
	(b)	Explain slip and creep in belt drive.	**04**
	(c)	In a four bar chain ABCD, AD is fixed and is 150 mm long. The crank AB is 40 mm long and rotates at 120 r.p.m. clockwise, while the link CD = 80 mm oscillates about D. BC and AD are of equal length. Find the angular velocity of link CD when angle BAD = 60°.	**07**
		OR	
	(a)	Summaries liner velocity, angular velocity and liner acceleration.	**03**
	(b)	Explain reverted gear train with neat sketch.	**04**
	(c)	A pair of gears, having 40 and 20 teeth respectively, are rotating in mesh, the speed of the smaller being 2000 r.p.m. Determine the velocity of sliding between the gear teeth faces at the point of engagement, at the pitch point, and at the point of disengagement if the smaller gear is the driver. Assume that the gear teeth are 20° involute form, addendum length is 5 mm and the module is 5 mm. Also find the angle through which the pinion turns while any pairs of teeth are in contact.	**07**
Q.4	**(a)**	Explain various follower motion.	**03**
	(b)	What are epicyclic gear trains? state its special advantages.	**04**

	(c)	Derive formula for frictional torque transmitted by flat pivot bearing considering (1) uniform pressure distribution and (2) uniform wear condition with usual notations.	**07**

OR

	(a)	What is instantaneous center? also state its property.	**03**
	(b)	Explain method of finding velocity of point on link by relative velocity method.	**04**
	(c)	The crank of the slider-crank mechanism rotates clockwise at a constant speed of 300 RPM. The crank is 150 mm and the connecting rod is 600 mm long. Determine: Linear velocity and acceleration of the midpoint of the connecting rod, and Angular velocity and angular acceleration of the connecting rod, at a crank angle of 45° from the inner dead center position.	**07**
Q.5	**(a)**	Define (1) clearance (2) pitch Circle (3) Backless for gear.	**03**
	(b)	What do you understand by the term 'interference' as applied to gears?	**04**
	(c)	A cam, with a minimum radius of 50 mm, rotating clockwise at a uniform speed, is required to give a knife edge follower the motion as described below : 1. To move outwards through 40 mm during 100° rotation of the cam 2. To dwell for next 80° 3. To return to its starting position during next 90° and 4. To dwell for the rest period of a revolution i.e. 90°. Draw the profile of the cam when the line of stroke of the follower passes through the center of the cam shaft, and The displacement of the follower is to take place with uniform acceleration and uniform retardation.	**07**

OR

	(a)	State laws of static and dynamic friction.	**03**
	(b)	Explain single block or shoe brake with neat sketch.	**04**
	(c)	Derive formula for power transmitted by cross belt drive with usual notations.	**07**

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