Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (NEW) EXAMINATION – SUMMER 2024

Subject Code:3131906 Date:06-07-2024

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)**	Define (1) Higher Pair (3) Structure (3) kinematic Link	**03**
	(b)	State and explain Grashof's law of mechanism.	**04**
	(c)	What do you know about inversion? Explain inversion of single slider crank mechanism with sketch.	**07**
Q.2	**(a)**	Explain how velocities of slider and connecting rod are obtain in slider crank mechanism	**03**
	(b)	Explain briefly dimensional synthesis.	**04**
	(c)	Design a four-bar mechanism to co-ordinate the input and output angles as follows: (hint: use Freudenstein's equation) Input angles = 15°, 30°, and 45°; Output angles = 30°, 40°, and 55°.	**07**
		OR	
	(c)	The crank and connecting rod of a theoretical steam engine are 0.5 m and 2 m long respectively. The crank makes 180 r.p.m. in the clockwise direction. When it has turned 45° from the inner dead centre position, determine: 1. The velocity of the piston, 2. Angular velocity of connecting rod, 3. The velocity of point E on the connecting rod 1.5 m from the gudgeon pin, 4. Velocities of rubbing at the pins of the crankshaft, crank and crosshead when the diameters of their pins are 50 mm, 60 mm and 30 mm respectively, 5. Position and linear velocity of any point G on the connecting rod which has the least velocity relative to the crankshaft.	**07**
Q.3	**(a)**	Define for cam (1) Prime Circle (2) Pitch Circle (3) Pressure Angle	**03**
	(b)	Give classification of follower in different way.	**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 SHM. 2.Dwell for the next 30°. 3.During the next 60° of cam rotation, the follower returns to its original position with SHM. 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 camshaft. The radius of the base circle of the cam is 40 mm.	**07**
		OR	
Q.3	**(a)**	State advantages and disadvantages of chain drive.	**03**
	(b)	Explain various motion of follower.	**04**
	(c)	Explain path function generation and motion function generation.	**07**

Q.4	**(a)**	What you know about sun and planet wheel? Explain with neat sketch.	**03**
	(b)	Explain slip and creep in belt drive.	**04**
	(c)	Derive formula of length of belt for cross belt drive with usual notation	**07**

OR

Q.4	**(a)**	What is degree of freedom? Write kutzbach and grubler's criterion to plain mechanism	**03**
	(b)	Elaborate function of fast and loose pulley with neat sketch.	**04**
	(c)	A 100 mm wide and 10 mm thick belt transmits 5 kW of power between two parallel shafts. The distance between the shaft centers is 1.5 m and the diameter of the smaller pulley is 440 mm. The driving and the driven shafts rotate at 60 rpm and 150 rpm respectively. The coefficient of friction is 0.22. Find the stress in the belt if the two pulleys are connected by an open belt drive.	**07**

Q.5	**(a)**	Draw and label main components of cone clutch.	**03**
	(b)	State and explain types of gear train with sketch.	**04**
	(c)	What you know about band brake? explain with neat sketch also state its advantages and disadvantages.	**07**

OR

Q.5	**(a)**	Explain laws of friction	**03**
	(b)	What are straight line mechanisms? Also explain watt's mechanism with line diagram	**04**
	(c)	Two involute gears in mesh have a 20° pressure angle. The gear ratio is 3 and the number of teeth on the pinion is 24. The teeth have a module of 6 mm. The pitch line velocity is 1.5 m/s and the addendum equal to one module. Determine the angle of action of a pinion (the angle turned by the pinion when one pair of teeth is in the mesh) and the maximum velocity of sliding.	**07**

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