Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– III EXAMINATION – SUMMER 2020

Subject Code: 3131906 **Date:04/11/2020**

Subject Name: Kinematics and Theory of Machine

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.**

			MARKS
Q.1	**(a)**	Define the following terms: (1) Module of gear (2) Pressure angle in cam-profile (3) Self-locking brake.	**03**
	(b)	Define the following terms (1) Lower pair (2) Higher pair (3) successfully constrained motion (4) completely constrained motion	**04**
	(c)	Explain the working principle of any quick return mechanism with net sketch.	**07**
Q.2	**(a)**	Explain the relation between linear and angular terms: displacement, velocity and acceleration	**03**
	(b)	In a crank and slotted lever quick return mechanism, the distance between the fixed centers is 300 mm and the length of the driving crank is 150 mm. Determine the ratio of the time taken on the cutting and return strokes	**04**
	(c)	The crank of a slider crank mechanism rotates clockwise at a constant speed of 10 rad/s. The crank OA is 150 mm and connecting rod AB is 600 mm long. Determine the acceleration of connecting rod AB, acceleration of slider B. When crank is at 45^{o} from inner dead center position.	**07**
		OR	
	(c)	A four-bar mechanism ABCD, the length of the various links is given as AB =190 mm, BC = CD =280 mm, AD = 500 mm. ∠BAD = 55^{0}. The crank rotates at 10 rad/s in the clock wise direction. Determine... (a) the acceleration of link BC and CD and (b) the angular acceleration of link BC and CD.	**07**
Q.3	**(a)**	Explain Rigid link, Flexible link and Fluid link with example.	**03**
	(b)	State and prove 'Aronhold Kennedy's Theorem' of three instantaneous centers.	**04**
	(c)	Synthesize a four-bar mechanism to meet the following instantaneous conditions for input output links: $\theta_2 = 60^0$, $\theta_4 = 90^0$ $\omega_2 = 3$ rad/sec, $\omega_4 = 2$ rad/sec $\alpha_2 = -1$ rad/sec^2, $\alpha_4 = 0$	**07**

OR

Q.3 **(a)** Define rubbing velocity at a pin joint. What will be the rubbing velocity at pin joint when the two links move in the same and opposite directions? **03**

(b) Explain in brief Function, Path & Motion Generation **04**

(c) Design a four-bar chain mechanism, governed by the function $y= 2x^2$ for the range $2 \leq x \leq 4$ **07**
Assuming θ vary between 40^0 and 120^0 for the input link and ϕ vary between 60^0 and 132^0 for the output link. Find the value of x , y , ϕ and φ corresponding to three precision point.

Q.4 **(a)** What do you understand by the term "interference" as applied to the gear? **03**

(b) Bridges and roof of workshop uses structure element, justify with reason. **04**

(c) Draw the cam profile operating knife edge follower from following data **07**
(i) Follower to move out through distance of 40mm during 100°
(ii) Follower to dwell for next 80°.
(iii) Follower to return to its initial position during 90°.
(iv) Follower to dwell for remaining cam rotation
The cam shaft rotates at 900rpm. The minimum radius of cam is 50mm and line of follower is offset 15mm from the axis of the cam and displacement to take place with uniform acceleration and retardation for both inward and outward stroke.

OR

Q.4 **(a)** Define the following terms: (1) Dry friction (2) Film friction (3) Limiting angle of friction **03**

(b) Find maximum velocity and acceleration for outward and return stroke for the data given in above problem 4(c) and draw the displacement, velocity and acceleration diagram. **04**

(c) Explain with sketches the different types of cams and followers **07**

Q.5 **(a)** Show that velocity ratio for compound belt drive is given by **03**
$$\frac{N_2}{N_1} x \frac{N_4}{N_3} = \frac{d_1}{d_2} x \frac{d_3}{d_4}$$

(b) Derive an expression for the length of path of contact for two involutes profile gear in mash. **04**

(c) The pressure angle of two gear in mesh is 20^0 and have a module of 10mm. The number of teeth on pinion are 24 and on gear 60. The addendum of pinion and gear is same and equals to one module. Determine ... **07**
(a) the number of pairs of teeth in contact
(b) the angle of action of the pinion and gear.

OR

Q.5 **(a)** Explain the phenomena of slip and creep in a belt drive. **03**

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

(c) Find the power transmitted by a belt running over a pulley of 600mm diameter at a speed of 200 rpm. The coefficient of friction between belt and the pulley is 0.25, angle of lap 160° and maximum tension in the belt is 2500 N. **07**