Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (NEW) EXAMINATION – WINTER 2023

Subject Code:3131906 Date:25-01-2024

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)**	What is a machine? Giving Example, Differentiate between a machine and a structure.	**03**
	(b)	Explain the terms: 1. Higher Pair, 2. Inversion, 3. Constrain motion, 4. Degree of Freedom	**04**
	(c)	Sketch and explain any two inversions of a double slider crank chain.	**07**
Q.2	**(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 direction?	**03**
	(b)	Prove that the three bodies move relatively to each other, they have three instantaneous centres and lies on a straight line.	**04**
	(c)	Derive an expression for the magnitude and direction of Coriolis component of acceleration.	**07**
		OR	
	(c)	For the configuration of a slider crank mechanism shown in Fig.1. Determine: (i) the acceleration of the slider (ii) the acceleration of point E (iii) the angular acceleration of the link AB. The crank OA rotates at 200 r.p.m. clockwise. OA = 500 mm, AB = 1500 mm, AE = 450 mm.	**07**

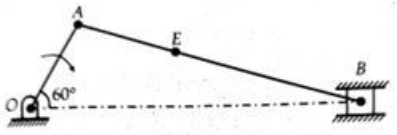

Fig.1

Q.3	**(a)**	Explain what do you understand by ‘initial tension in a belt’.	**03**
	(b)	The width of a belt is 15 cm and the maximum tension per cm width is not to be exceeded 140 N. the ratio of tensions on the two sides is 2.25, the diameter of the driver is 1.05 m and it makes 220 r.p.m, find the power that can be transmitted.	**04**
	(c)	Explain two position synthesis of four bar chain mechanism by pole method.	**07**
		OR	
Q.3	**(a)**	Explain the phenomena of slip and creep in a belt drive.	**03**
	(b)	Discuss relative merits and demerits of belt, rope and chain drive for transmission of power.	**04**

(c) A four-bar mechanism is used to generate the function $y = 1/x$ for the range $1 \leq x \leq 3$. Find the three-precision position from Chebyshev spacing, if the initial values of the crank angle and follower angle is 30° and 200° respectively. Take $\Delta\theta = \Delta\varphi = 90°$. Find the corresponding values of θ and φ. **07**

Q.4 **(a)** Write a short note on internal expanding shoe brake. **03**

(b) State the law of **04**

(i) Static friction (iii) Solid Friction

(ii) Dynamic Friction (iv) Fluid Friction

(c) From the following data draw the profile of a cam in which the follower moves with S.H.M. during ascent while it moves with uniform accelerated motion during descent: **07**

Lift of follower = 4 cm; Least radius of cam = 5 cm;

Angle of ascent = 48°; Angle of dwell between ascent and descent = 42°; Angle of descent = 60°; The diameter of roller = 3 cm; Distance between line of action of the follower and the axis of cam = 2 cm.

OR

Q.4 **(a)** Distinguish between brakes and clutches. **03**

(b) A multiplate clutch has three pairs of contact surfaces. The outer and inner radii of the contact surfaces are 100 mm and 50 mm respectively. The axial spring force is limited to 1 kN. Assuming uniform wear, find the power transmitted at 1500 rpm. Take $\mu = 0.35$. **04**

(c) Classify and elaborate the types of followers with a neat sketch. **07**

Q.5 **(a)** Define the term: Circular pitch, Backlash, Pressure angle. **03**

(b) What do you understand by gear train? Discuss the various types of gear train. **04**

(c) Two gear wheels of 10 cm and 15 cm pitch diameters have involute teeth of 1.6 DP and pressure angle 20°. The addenda are 3 mm. Determine (i) length of path of contact (ii) contact ratio, and (iii) angle turned by the pinion, while any pair of teeth is in contact. **07**

OR

Q.5 **(a)** Prove that the velocity of sliding is proportional to the distance of the point of contact from the pitch point. **03**

(b) What do you understand by the term 'interference' as applied to gears? **04**

(c) In an epicyclic gear train as in Fig.2, the arm A is fixed to shaft S. The wheel B having 100 teeth rotates freely on the shaft S and wheel F with 150 teeth is separately driven. If the arm A runs at 200 rpm and wheel F at 100 rpm in the same direction, find (a) Number of teeth on wheel C, (b) speed of wheel B. **07**

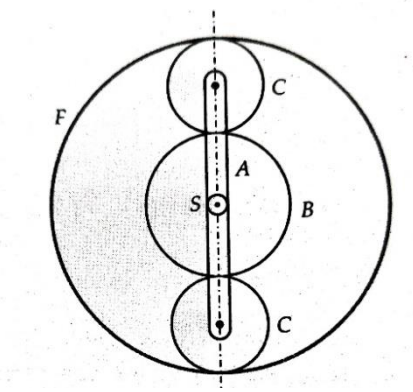

Fig.2

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