GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–IV (NEW) EXAMINATION – SUMMER 2021

Subject Code:2142504   **Date:09/09/2021**
Subject Name:Theory of Machines
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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	How machine can be different than structure.	**03**
	(b)	What is an inversion of mechanism? Explain any ONE inversion of Double slider crank chain mechanism with neat sketch.	**04**
	(c)	In a four bar chain ABCD, AD is fixed and 150 mm long. The crank AB is 40 mm long and rotates at 120 rpm 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**
Q.2	**(a)**	What do you mean by dimensional synthesis of a pre-conceived type mechanism	**03**
	(b)	Explain the terms: Function Generation, Path Generation and Motion Generation.	**04**
	(c)	What is Chebychev spacing? What is its significance? Also write Freudenstein's equation.	**07**

OR

	(c)	A hooke's joint connects two shafts whose axes intersects at 18°. The driving shaft rotates at uniform speed of 210 rpm. The driven shaft with attached masses has a mass of 60 kg and radius of gyration of 120 mm. Determine the (i) torque required at the driving shaft if a steady torque of 180 N.m resists rotation of the driven shaft and the angle of rotation is 45° (ii) Angle between the shafts at which the total fluctuation of speed of the driven shaft is limited to 18 rpm.	**07**
Q.3	**(a)**	Determine the condition for maximum efficiency in screw jack.	**03**
	(b)	What is the effect of centrifugal tension on the tight and slack sides of belt drive? Show that it is independent on the tight and slack-side tensions and depends only on the velocity of the belts over the pulley.	**04**
	(c)	A bicycle and rider, travelling at 12 km/h on a level road, have a mass of 105 kg. A brake is applied to the rear wheel which is 800 mm in diameter. The pressure on the brake is 80 N and the coefficient of friction is 0.06. Find the distance covered by a bicycle and number of turns of its wheel before coming to rest.	**07**

OR

Q.3	**(a)**	What is a brake? What is the difference between a brake and a clutch?	**03**
	(b)	Do you recommend the uniform pressure theory or uniform wear theory for the friction torque of a bearing? Explain	**04**

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(c)	A leather belt is required to transmit 7.5 kW from a pulley 1.2 m in diameter running at 250 r.p.m. The angle embraced is 165° and the coefficient of friction between the belt and pulley is 0.3. If the safe working stress for the leather belt is 1.5 Mpa, density of leather is 1 Mg/m^3 and thickness of belt 10 mm, determine the width of the belt taking centrifugal tension into account.		**07**

Q.4 **(a)** Explain which gears are used when two shafts are (i) parallel (ii) perpendicular (iii) non-parallel and non-intersecting. **03**

(b) Give comparison between involute and cycloidal gears by stating its advantage and dis-advantage. **04**

(c) The number of teeth of each of the two equal spur gears in mesh are 40. The teeth have 20° involute profile and the module is 6 mm. If the arc of contact is 1.75 times the circular pitch, find the addendum. **07**

OR

Q.4 **(a)** Prove that Train Value and Speed Ration are reciprocal to each other in simple gear train. **03**

(b) Draw schematic diagram of Epicyclic Gear Train. What are the special advantages of epicyclic gear train? **04**

(c) In epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 rpm in the clockwise 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 rpm in the clockwise direction, what will be the speed of gear B? **07**

Q.5 **(a)** Enlist three types of motion a follower may have during its travel. **03**

(b) What is Prime Circle and Base Circle of Cam? In which follower it remains same. **04**

(c) A cam is to be designed for knife edge follower data: **07**
1. Cam Lift= 40 mm during 90° of cam rotation with SHM
2. Dwell for the next 30°
3. During 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 of the follower passes through the axis of the cam shaft. The radius of the base circle of the cam is 40 mm.

OR

Q.5 **(a)** What is the fundamental equation for correct steering? Only draw steering gear mechanism. **03**

(b) What is coriolis component of acceleration? Show all four possible cases w.r.t. slider and rotating link. **04**

(c) The mean diameter of a square threaded screw jack is 50 mm. The pitch of the thread is 10 mm. The coefficient of friction is 0.15. What force must be applied at the end of a 0.7 m long lever, which is perpendicular to a longitudinal axis of the screw to raise a load of 20 kN and to lower it? **07**

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