Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) - EXAMINATION – SUMMER 2017

Subject Code: 2142504 **Date: 12/06/2017**

Subject Name: 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.**

			MARKS
Q.1		**Short Questions**	**14**
	1	The motion of a piston in the cylinder of a steam engine is an example of (a) completely constrained motion (b) incompletely constrained motion (c)successfully constrained motion (d) none of these	**1**
	2	The component of the acceleration, parallel to the velocity of the particle, at the given instant is called (a) radial component (b) tangential component (c) coriolis component (d) none of these.	**1**
	3	The Direction of linear velocity of any point on a link with respect to another point on the same link is (a) Parallel (b) Perpendicular (c) 45° (d) none	**1**
	4	The coriolis component of acceleration is taken into account for (a) slider crank mechanism (b) four bar chain mechanism (c) quick return mechanism (d) none of these	**1**
	5	In a pantograph, all the pairs are (a) turning pairs (b) sliding pairs (c) spherical pairs (d) self closed pairs	**1**
	6	The frictional torque transmitted by a disc or plate clutch is same as that of (a) flat pivot bearing (b) flat collar bearing (c) conical pivot bearing (d) trapezoidal pivot bearing	**1**
	7	The velocity ratio of two pulleys connected by an open belt or crossed belt is (a) directly proportional to their diameters (b) inversely proportional to their diameters (c) directly proportional to the square of the diameters (d) inversely proportional to the square of their diameters	**1**
	8	The type of gears used to connect two non-parallel non-intersecting shafts are (a) spur gear (b) helical gear (c) spiral gears (d) none of these	**1**
	9	In a simple gear train, if the number of idle gears is odd, then the motion of driven gear will (a) be same as that of driving gear (b) be opposite as that of driving gear (c)depend upon the number of teeth on the driving gear	**1**

(d) none of the above

	10	The angle between the direction of the follower motion & a normal to pitch curve is called (a) pitch angle (b) prime angle (c) base angle (d) pressure angle	**1**
	11	The synthesis in a mechanism deals with (a) the determination of output & input angles of mechanism (b) the determination of dimensions of the links in a mechanism (c) the determination of displacement, velocity & acceleration of links in a mechanism (d) none of the above	**1**
	12	A circle drawn with centre as the cam centre and radius equal to the distance between the cam centre and the point on the pitch curve at which the pressure angel is maximum, is called (a) base circle (b) pitch circle (c) prime circle (d) none of these	**1**
	13	When the axes of first and last gear are co-axial, then gear train is known as (a) simple gear train (b) compound gear train (c) reverted gear train (d) epicyclic gear train	**1**
	14	The module is the reciprocal of (a) diametral pitch (b) circular pitch (c) pitch diameter (d) none of these	**1**
Q.2	**(a)**	Differentiate between completely constrained motion and incompletely constrained motion.	**03**
	(b)	Sketch & explain any ONE inversion of single slider crank chain.	**04**
	(c)	In a four bar chain ABCD, AD is fixed & 145 mm long. The crank AB is 40 mm long & rotates at 120 rpm clockwise, while the link CD = 80 mm oscillates about D. BC & AD are of equal length. Find the velocity of CD when angle BAD = 60°.	**07**
		OR	
	(c)	The crank & connecting rod of a theoretical steam engine are 0.5 m & 2 m long respectively. The crank makes 190 rpm in the clockwise direction .When it has turned 45° from the inner dead centre position, determine velocity of piston.	**07**
Q.3	**(a)**	With the help of neat sketch, explain the concept of “Limiting Friction”	**03**
	(b)	Considering Uniform Pressure derive the expression for total frictional torque in flat pivot bearing.	**04**
	(c)	What are straight line mechanisms? Describe any one type of exact straight line mechanism with the. help of a sketch	**07**
		OR	
Q.3	**(a)**	Why a roller follower is preferred over knife –edge follower?	**03**
	(b)	Define the following terms with reference to cam (i) Base Circle (ii) Pitch Circle (iii) Pressure Angle (iv) Stroke of the follower	**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 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.	**07**

Q.4	**(a)**	In the context of synthesis differentiate between structural error and mechanical error.	**03**
	(b)	What is the difference between function generation and path generation?	**04**
	(c)	Derive Freundenstein's equation for four bar chain mechanism considering displacement analysis.	**07**

OR

Q.4	**(a)**	What are the specific advantages of epicyclic gear trains?	**03**
	(b)	In which gear train the motion of the first gear and the last gear is "Like"? Why?	**04**
	(c)	In a epicyclic gear train, an arm carries two gears A & B having 36 an 45 teeth respectively. If the arm rotates at 150 rpm in the anticlockwise direction about 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)**	Despite of one disadvantage Involute teeth profile is preferred for manufacturing gears above cyclical teeth profile. Why?	**03**
	(b)	With the usual notation prove that product of circular pitch and diametral pitch is π.	**04**
	(c)	A pinion having 30 teeth drives a gear having 80 teeth. The profile of gears is involute with 20° pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact and arc of contact.	**07**

OR

Q.5	**(a)**	What is centrifugal tension in a belt? How does it affect the power transmitted?	**03**
	(b)	Differentiate between self energizing brakes and self locking brake.	**04**
	(c)	A shaft rotating at 200 rpm drives another shaft at 300 rpm & transmits 6 kW through a belt. The belt is 100 mm wide and 10 mm thick wide. The distance between the shafts is 4m. The smaller pulley is 0.5 m in diameter. Calculate the stress in the belt, if an open belt drive is there. Take $\mu = 0.3$.	**07**

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