GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER– IV (New) EXAMINATION – WINTER 2019

Subject Code: 2142504   **Date: 16/12/2019**

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.

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Q.1	**(a)**	Write a short note on Mobility of Mechanisms.	**03**
	(b)	Differentiate Machine, Mechanism and Structure.	**04**
	(c)	Write down the Classification of Kinematic Pairs and explain with neat diagram and suitable example.	**07**
Q.2	**(a)**	Describe Pantograph	**03**
	(b)	State and explain the Steering Gear Mechanism	**04**
	(c)	In 4 bar chain ABCD, AD is fixed and is 150 mm long. The crank is 40mm long and rotate 120 rpm in clockwise while the link CD = 80 mm oscillates about D. BC and AD are in equal length. Find angular velocity of link CD when the angle BAD = 60^0	**07**
		OR	
	(c)	In four stroke cycle engine, the crank is 100 mm and the obliquity ratio is 4.5. the engine speed is 800 rpm. Determine by klein's construction, the velocity and acceleration of the piston when the crank is 45^0 from i.d.c	**07**
Q.3	**(a)**	State the principle of Klein's Construction	**03**
	(b)	Write a short note on Coriolis Component of Acceleration with neat diagram.	**04**
	(c)	PQRS is a four bar chain with link PS fixed. The lengths of the links are PQ = 62.5 mm ; QR = 175 mm ; RS = 112.5 mm ; and PS = 200 mm. The crank PQ rotates at 10 rad/s clockwise. Draw the velocity and acceleration diagram when angle QPS = 60° and Q and R lie on the same side of PS. Find the angular velocity and angular acceleration of links QR and RS	**07**
		OR	
Q.3	**(a)**	Define; a) Angle of Repose, b) Static friction, c) Pivot friction	**03**
	(b)	What are the phases of kinematic synthesis? Explain any one phase.	**04**
	(c)	What is a kinematic synthesis of mechanisms? Derive Freudenstein's equation.	**07**
Q.4	**(a)**	Define; a) Dynamic friction, b) Sliding friction, c) Rolling friction	**03**
	(b)	Determine the maximum, minimum and average pressure in plate clutch when the axial force is 4 kN. The inside radius of the contact surface is 50 mm and the outside radius is 100 mm. Assume uniform wear.	**04**
	(c)	Derive the condition for transmitting the maximum power in a flat belt drive.	**07**
		OR	
Q.4	**(a)**	Write a short note on Band Brake.	**03**
	(b)	What do you understand by 'gear train'? Discuss the various types of gear trains.	**04**
	(c)	A bicycle and rider of mass 100 kg are travelling at the rate of 16 km/h on a level road. A brake is applied to the rear wheel which is 0.9 m in diameter and this is the only resistance acting. How far will the bicycle travel and	**07**

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how many turns will it make before it comes to rest ? The pressure applied on the brake is 100 N and μ = 0.05.

Q.5	**(a)**	State the Law of Gearing	**03**
	(b)	Explain briefly the differences between simple, compound, and epicyclic gear trains	**04**
	(c)	An Epicyclic train of gears is arranged as shown in Figure. How many revolutions does the arm, to which the pinions B and C are attached, Make:	**07**

1. When A makes one revolution clockwise and D makes half a revolution anticlockwise, and

2. When A makes one revolution clockwise and D is stationary ? The number of teeth on the gears A and D are 40 and 90 respectively
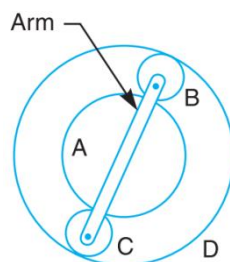
OR

Q.5	**(a)**	Define; a) Base Circle, b) Pitch Circle, c) stroke.	**03**
	(b)	State and explain Laws of Friction	**04**
	(c)	A cam is to be designed for a knife edge follower with the following data :	**07**

1. Cam lift = 40 mm during 90° of cam rotation with simple harmonic motion.

2. Dwell for the next 30°.

3. During the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion.

4. Dwell during the remaining 180°.

Draw the profile of the cam when

(a) The line of stroke of the follower passes through the axis of the cam shaft, and

(b) the line of stroke is offset 20 mm from the axis of the cam shaft. The radius of the base circle of the cam is 40 mm. Determine the maximum velocity and acceleration of the follower during its ascent and descent, if the cam rotates at 240 r.p.m.

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