Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV • EXAMINATION – WINTER • 2014

Subject Code: 143401 Date: 22-12-2014

Subject Name: Machines and Mechanisms

Time: 02:30 pm - 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.**

Q.1	**(a)**	Explain with sketches various Inversion of single slider bar mechanism.	**07**
	(b)	Explain Kutzback criterion & Grubler's criterion for plane mechanism.	**07**
Q.2	**(a)**	What is the condition for correct steering? Sketch and discuss the two main types of steering gears.	**07**
	(b)	The crank and connecting rod of a theoretical steam engine are 0.5 m and 2 m long respectively. The crank makes 180 r.p.m. in the clockwise direction. When it has turned 45° from the inner dead centre position, determine : 1. velocity of piston, 2. angular velocity of connecting rod, 3. velocity of point E on the connecting rod 1.5 m from the gudgeon pin, 4. velocities of rubbing at the pins of the crank shaft, crank and crosshead when the diameters of their pins are 50 mm, 60 mm and 30 mm respectively, 5. Position and linear velocity of any point G on the connecting rod which has the least velocity relative to crank shaft.	**07**
		OR	
	(b)	Explain with sketches various Inversion of double slider crank chain.	**07**
Q.3	**(a)**	Sketch and explain the Geneva Mechanism.	**07**
	(b)	Sketch and explain the Ratchet & Pawl Mechanism.	**07**
		OR	
Q.3	**(a)**	State and prove the law of gearing. Show that involute profile satisfies the conditions for correct gearing.	**07**
	(b)	The cutter of a broaching machine is pulled by square threaded screw of 55 mm external diameter and 10 mm pitch. The operating nut takes the axial load of 400 N on a flat surface of 60 mm internal diameter and 90 mm external diameter. If the coefficient of friction is 0.15 for all contact surfaces on the nut, determine the power required to rotate the operating nut, when the cutting speed is 6 m/min.	**07**
Q.4	**(a)**	Draw the displacement, velocity and acceleration diagrams for a follower when it moves with simple harmonic motion. Derive the expression for velocity and acceleration during outstroke and return stroke of the follower.	**07**

(b) 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 the line of stroke of the follower passes through the axis of the cam shaft, and The radius of the base circle of the cam is 40 mm.

OR

Q.4 **(a)** Derive from first principles an expression for the effort required to raise a load with a screw jack taking friction into consideration. **07**

(b) Describe with a neat sketch the working of a single plate friction clutch. **07**

Q.5 **(a)** Discuss gyroscopic effect in Aircraft. **07**

(b) Discuss gyroscopic effect in Motor cycle. **07**

OR

Q.5 **(a)** Explain in details D'Alembert's principle. **07**

(b) Explain why only a part of the unbalanced force due to reciprocating masses is balanced by revolving mass. **07**

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