Seat No.: ________ Enrolment No.___________

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV • EXAMINATION – SUMMER • 2014

Subject Code: 143401 **Date: 16-06-2014**

Subject Name: Machines and Mechanisms

Time: 10:30 am - 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.**

Q.1 **(a)** Explain Kutzback criterion & Grubler's criterion for plane mechanism. **07**

(b) Explain with sketches various Inversion of Four bar 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 : **07**

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.

OR

(b) Explain with sketches various Inversion of single slider crank chain. **07**

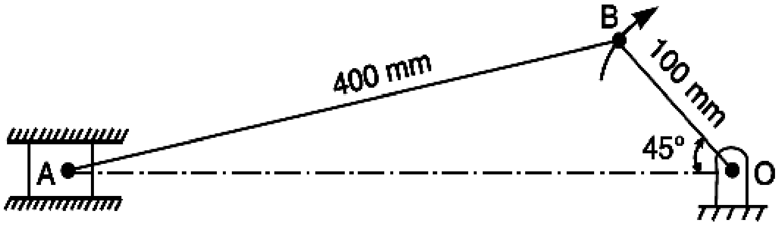
Q.3 **(a)** Sketch and explain the Geneva Mechanism. **07**

(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**

OR

Q.3 **(a)** Locate all the instantaneous centres of the slider crank mechanism as shown in Fig. The lengths of crank OB and connecting rod AB are 100 mm and 400 mm respectively. If the crank rotates clockwise with an angular velocity of 10 rad/s, find: **07**

1. Velocity of the slider A, and
2. Angular velocity of the connecting rod AB.



	(b)	Sketch and explain the Ratchet & Pawl Mechanism.	**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: 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.	**07**
		OR	
Q.4	**(a)**	Draw the displacement, velocity and acceleration diagrams for a follower when it moves with uniform acceleration and retardation. Derive the expression for velocity and acceleration during outstroke and return stroke of the follower.	**07**
	(b)	A cam is to give the following motion to a knife-edged follower: 1. Outstroke during 60° of cam rotation; 2. Dwell for the next 30° of cam rotation; 3. Return stroke during next 60° of cam rotation, and 4. Dwell for the remaining 210° of cam rotation. The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when the axis of the follower passes through the axis of the cam shaft.	**07**
Q.5	**(a)**	Discuss gyroscopic effect in ship and aircraft.	**07**
	(b)	Discuss gyroscopic effect in motor cycle and car.	**07**
		OR	
Q.5	**(a)**	Explain in details D'Alembert's principle.	**07**
	(b)	Write a short note on primary and secondary balancing. Explain why only a part of the unbalanced force due to reciprocating masses is balanced by revolving mass.	**07**

****