

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-III • EXAMINATION – WINTER • 2014****Subject Code: 2131906****Date: 30-12-2014****Subject Name: Kinematics of Machines****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) Define and discuss: kinematic link, kinematic pair, and kinematic chain. **07**  
 (b) Sketch and explain Whitworth quick return mechanism. **07**

- Q.2** (a) Describe Klein's construction with an example. **07**  
 (b) The crank of a slider crank mechanism rotates clockwise at a constant speed of 300 rpm. The crank is 150 mm and connecting rod is 600 mm long. Determine **07**
1. Linear velocity and acceleration of midpoint of connecting rod
  2. Angular velocity and angular acceleration of the connecting rod, at a crank angle of  $45^\circ$  from inner dead centre position.

**OR**

- (b) A crank and rocker mechanism ABCD has the following dimensions. **07**  
 AB = 0.75m, BC = 1.25m, CD = 1m, AD = 1.5m, E is the midpoint of the coupler link BC. AD is the fixed link. Crank AB has a angular velocity of 20 rad/s counter clockwise and deceleration of  $280 \text{ rad/s}^2$  at the instant angle DAB =  $60^\circ$  find
1. Instantaneous linear velocity and acceleration of midpoint E of link BC.
  2. Instantaneous angular velocity and acceleration of link CD.

- Q.3** (a) Explain the Freudenstein's Equation for four bar chain mechanism. **07**  
 (b) Design a four bar mechanism with input link 'a', coupler link 'b' and output link 'c'. angles  $\theta$  and  $\Phi$  for three successive position are given in table below: **07**

	1	2	3
$\theta$	$20^\circ$	$35^\circ$	$50^\circ$
$\Phi$	$35^\circ$	$45^\circ$	$60^\circ$

Using Freudenstein's Equation find out other link lengths b, c and d. assume link length a = 1.

**OR**

- Q.3** (a) Explain two position synthesis of four bar chain mechanism by relative pole method **07**  
 (b) A double Hooke's joint is used to connect 2 shafts in the same plane and the Intermediate shaft is inclined at an angle of  $20^\circ$  to both the shafts. If driving shaft Rotates of 250rpm, find maximum and minimum speed of intermediate and driven shafts. **07**
- Q.4** (a) Enlist different type of gear train .Explain compound gear train with neat sketch **07**  
 .Also derive the equation of the velocity ratio for compound gear train.

- (b) An Epicyclic gear train is composed of fixed annular wheel “A” having 300 teeth. Meshing with A is wheel X which drives wheel Z through idle wheel Y, wheel Z being concentric with A. wheels X and Y are carried on an arm E which revolves clockwise at 120 rpm about the axis of A and Z. if the wheel X and Z have 50 and 80 teeth respectively .Determine the number of teeth on Y. and rpm of Y. **07**

**OR**

- Q.4** (a) Derive an expression for the length of path of contact for two involutes profile gear in mesh. **07**
- (b) A pair  $20^\circ$  involute gears has module of 5 mm. the pinion has 20 teeth and gear has 60 teeth. Addendum on the pinion and gear wheel in terms of module is 1. Find the followings. **07**
- (i) Number of pairs in contact
  - (ii) Angle turned through by the pinion and gear wheel for one pair in contact.

- Q.5** (a) Classify followers and explain with neat sketch. **07**
- (b) Draw the cam operating knife edge follower from following data **07**
- (i) Follower to move out through distance of 20mm during  $120^\circ$ .
  - (ii) Follower to dwell for next  $60^\circ$ .
  - (iii) Follower to return to its initial position during  $90^\circ$ .
  - (iv) Follower to dwell for remaining cam rotation

The cam rotates at 500rpm .The minimum radius of cam is 40mm and line of follower is offset 15mm from the axis of the cam and displacement to take place with uniform acceleration and retardation both inward and outward stroke .

**OR**

- Q.5** (a) Derive the condition for correct steering. Sketch and show the Davis steering mechanism and discuss their advantages. **07**
- (b) What is straight line motion mechanism & give its classification. Explain any one in brief. **07**

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