Seat No: _____ Enrollment No: _____

# PARUL UNIVERSITY

## FACULTY OF ENGINEERING & TECHNOLOGY

### M.Tech. Winter 2019-20 Examination

**Semester: 1** **Date: 19/12/2019**
**Subject Code: 203217135** **Time: 10:30 AM to 1:00 PM**
**Subject Name: Analysis and Synthesis of Mechanisms** **Total Marks: 60**

**Instructions:**
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

**Q.1** A) Explain types of errors. **(05)**

B) What is Chebychev spacing? What is its significance? **(05)**

C) Explain the terms Function Generation, Path Generation and Motion Generation. **(05)**

**Q.2** **Answer the following questions**. (Attempt any three) (Each five mark) **(15)**

A) Explain Graphical method for determining three precision points.

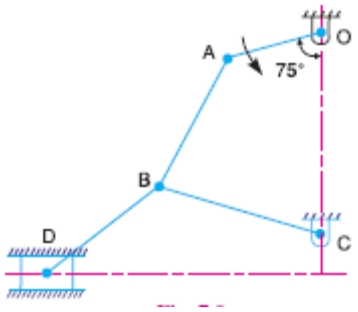
B) Prove Freudenstein's equation for four bar mechanism.

C) Explain Cubic of stationary curvature briefly.

D) What do you understand by coupler curves? Describe the method of obtaining the co-ordinates of a coupler point in a slider crank mechanism.

**Q.3** A) What is Kinematic Pair? Give Classification. **(07)**

B) In fig shown below the angular velocity of the crank OA is 600 r.p.m. Determine the linear velocity of the slider D and the angular velocity of the link BD, when the crank is inclined at an angle of 75° to the vertical. The dimensions of various links are : OA = 28 mm ; AB = 44 mm ;BC= 49 mm ; and BD = 46 mm. The centre distance between the centres of rotation O and C is 65 mm. The path of travel of the slider is 11 mm below the fixed point C. The slider moves along a horizontal path and OC is vertical. **(08)**

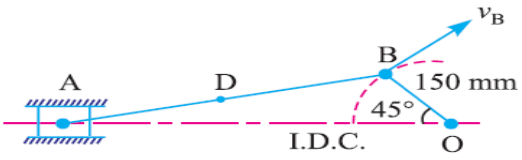



**OR**

B) Synthesis a four bar mechanism for the following position of input and output link. **(08)**

$$\theta_1 = 36.02775^0, \phi_1 = 65.0274^0$$
$$\theta_2 = 75^0, \phi_2 = 101.7636^0$$
$$\theta_3 = 113.97^0, \phi_3 = 143.2664^0$$

**Q.4** A) The crank of a slider crank mechanism rotates clockwise at a constant speed of 300 rpm. The crank is 150 mm and the connecting rod is 600 mm long. Determine 1) linear velocity and acceleration of the midpoint of the connecting rod and 2) angular velocity and angular acceleration of the connecting rod at a crank angle of from the inner dead centre position. **(07)**




**OR**

A) Synthesis a slider crank mechanism for the following position of slider and crank. **(07)**

$$S = 0.9215m, \theta = 30^0$$

$$\dot{S} = -2.23m/\sec, \omega_2 = 20rad/\sec$$

$$\ddot{S} = -83.84m/\sec^2, \alpha_2 = 10rad/\sec^2$$

Draw the mechanism by using Freudenstien's equation.

B) A four bar mechanism is to be designed, by using three precision points, to generate the function **(08)**

$y = x^{1.5}$ , for the range $1 \leq x \leq 4$ .

Assuming 30° starting position and 120° finishing position for the input link and 90° starting position and 180° finishing position for the output link, find the values of x, y, θ and ϕ corresponding to the three precision points.