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**M.E. (Mechanical Design Engineering)**  
**ANALYSIS AND SYNTHESIS OF MECHANISMS**  
**(2013 Course) (Semester - II)**

*Time : 3 Hours]**[Max. Marks :50**Instructions to the candidates:*

- 1) *Answer any five questions .*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data whenever necessary.*

**Q1) a)** Design a four bar mechanism which will satisfy the following precision conditions [7]

$$\omega_1 = 8 \text{ rad/sec}$$

$$\alpha_1 = 0 \text{ rad/sec}^2$$

$$\omega_2 = 1 \text{ rad/sec}$$

$$\alpha_2 = 20 \text{ rad/sec}^2$$

$$\omega_3 = 6 \text{ rad/sec}$$

$$\alpha_3 = 0 \text{ rad/sec}^2$$

Also draw the mechanism.

b) Write a short note on Dyad. [3]

**Q2)** A mechanism is shown in Fig. 01, the dimensions of different link are as given below  $O_2A = 7.5 \text{ cm}$ ,  $AB = 5 \text{ cm}$ ,  $BC = 7.5 \text{ cm}$ ,  $O_5C = 6.5 \text{ cm}$  (is vertical)  $CD = 10 \text{ cm}$   $BD = 5 \text{ cm}$   $O_6D = 5 \text{ cm}$  Angle  $O_2AB = 110^\circ$ , Angle  $ABC = 115^\circ$  Angle  $O_6DB = 117^\circ$   $\omega_2 = 10 \text{ rad/sec}$  (Clockwise). Using relative velocity method determine angular velocity of link  $O_6D$  ( $\omega_6$ ) [10]

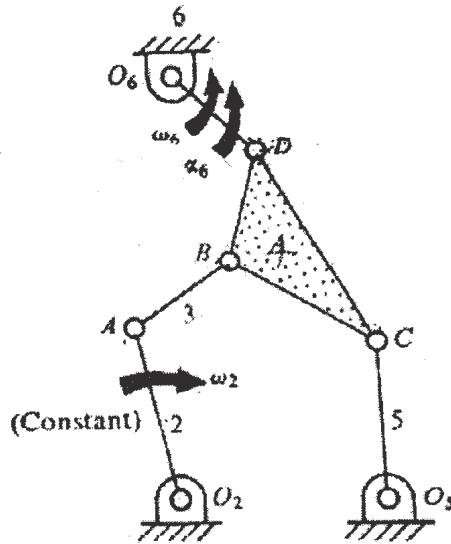


Fig. 01

**Q3)** Write short note on any two of the following: [10]

- Auxiliary Point Method for Mechanism Analysis.
- Cubics of Stationary Curvature.
- Branch and Order Defect.

**Q4)** a) What are 'Elastic mechanisms'? Discuss the dynamic analysis of elastic mechanism. [5]

b) Explain the effect of inertia on force analysis of mechanism. [5]

**Q5)** A straight line mechanism is shown in Fig. 0.2. Find the inflection circle for the motion of the coupler. Also determine radius of curvature of coupler point B  $O_2A = AC = AB = 100\text{mm}$ . [10]

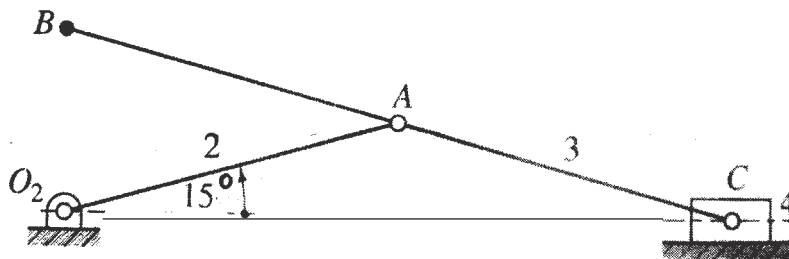


Fig. 02

**Q6)** Synthesize a four bar mechanism to generate a function  $y = x^2 - x$  where  $1 \leq x \leq 4$ . Assuming initial and final positions of input link at  $30^\circ$  and  $120^\circ$  respectively whereas for output link  $70^\circ$  and  $160^\circ$  respectively. Determine  $x$ ,  $y$ ,  $\theta$   $\phi$  corresponding to three precision positions. The grounded link is horizontal and of 100 mm length, input link is 40 mm long. [10]

**Q7) a)** Explain Matrix method of analysis of spatial mechanisms. [5]

b) Explain in detail Hartmann construction. [5]

*EEE*