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M.E. (Mechanical - Design Engineering)
ANALYSIS AND SYNTHESIS OF MECHANISMS
(2013 Pattern) (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) In a four bar linkage,   **[10]**

  $\theta_2 = 60°$ $\phi_4 = 90°$

  $\omega_2 = 3$ rad/sec $\alpha_2 = -1$ rad/sec^2

  $\omega_4 = 2$ rad/sec $\alpha_4 = 0$ rad/sec^2

  Determine dimensions of the link if fixed link is of 100 mm length.

Q2) A mechanism is shown in fig. 01. Determine angular velocity of O_6D and link BCD. Take $\omega_2 = 10$ rad/sec.   **[10]**
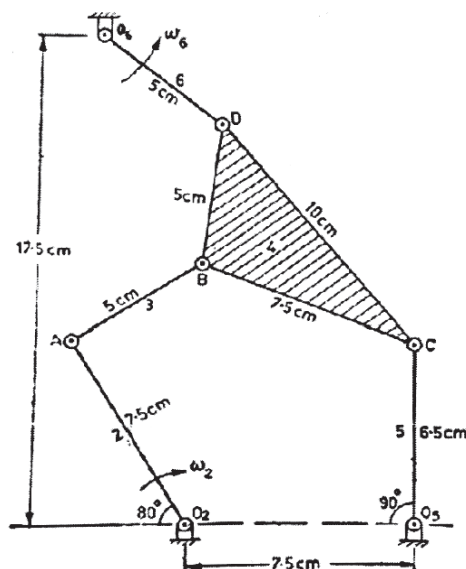

Fig. 01

P.T.O.

Q3) A four bar mechanism is shown in the Fig. 02. The dimensions are AD=AB=60 mm BC = CD = 25 mm. AD is the fixed link and E is midpoint of BC. Determine the centre of curvature of the point E. **[10]**
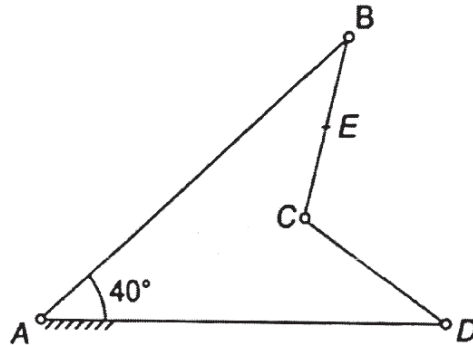

Fig. 02

Q4) a) What is elastic linkage model? Explain with neat sketches. **[5]**

b) Write element mass, stiffness and system matrices for a beam element modeling an elastic linkage. **[5]**

Q5) a) Consider a planar robot consisting of three moving links of lengths L_1, L_2 and L_3. Write Denavit - Hartenberg parameters for the robot and express position of output link in terms of these parameters. **[7]**

b) What is inverse kinematics? **[3]**

Q6) Synthesize a four bar mechanism to generate a function $y = 3x + 3$ where $0 \leq x \leq 4$. Assuming initial and final positions of input link as 30° and 150° respectively, whereas for output link 40° and 150° respectively. Determine x, y, θ, ϕ corresponding to three precision positions. The grounded link is horizontal and of 10 cm in length. The crank is of 45 mm in length. Use three precision positions. **[10]**

Q7) a) Explain the following: **[3]**
   i) Function generation.
   ii) Path generation.
   iii) Motion generation.

b) State any two forms of Euler - Savary equation and derive any one of them from the other. **[7]**

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