

Total No. of Questions : 10]

SEAT No. :

**P4008**

[Total No. of Pages : 3

**[4860] - 104**

**M.E. (Mechanical) (Design Engineering) (Semester - II)**

**ANALYSIS AND SYNTHESIS OF MECHANISMS**

**(2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to the candidates :*

- 1) Answer any three questions from each section.*
- 2) Figures to the right indicate full marks.*
- 3) Neat diagram must be drawn whenever necessary.*
- 4) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) Assume suitable data, if necessary.*

**SECTION - I**

**Q1)** a) Explain in detail 'Inertia forces in linkages'. [8]

b) How elastic mechanisms can be analyzed? [8]

**Q2)** a) Derive the two forms of Euler Savary equations and with sketches explain their use. [8]

b) A slider crank mechanism has the following specifications :  
Crank length = 3 cm, Connecting rod length = 6 cm, Offset = 1 cm,  
Crank is at 30° angle with line of stroke of slider. Construct the inflection circle using Bobillier construction. Then locate the centre of curvature of the midpoint of the connecting rod and find its radius of curvature. [8]

**Q3)** Explain in detail the velocity-acceleration analysis of complex mechanisms by the normal acceleration and auxiliary point method. [16]

**P.T.O.**

- Q4)** a) Explain the concept of 'Transmission Angle' as an index of performance of a 4-bar linkage.  
How is the mechanical advantage of such a linkage related with its transmission angle? [8]
- b) State and Explain the Kutzbach criterion for a special mechanisms. Apply it to a Hook's joint to calculate its degree of freedom. [8]
- Q5)** Write a note on (ANY THREE) : [18]
- a) Types of errors
  - b) Precision Points for Function Generation
  - c) Cusp and Crunode
  - d) Branch and Order defects
  - e) Opposite pole quadrilateral.

## **SECTION - II**

- Q6)** Synthesize a function generator to solve the equation  $y = \frac{1}{x}$  over the range  $1 \leq X \leq 2$  using three precision positions. Draw the final sketch of linkages. [For input lever select  $30^\circ$  starting angle and  $90^\circ$  total swing angle, For the output lever select  $240^\circ$  starting angle with total swing angle of  $90^\circ$  travel] [16]
- Q7)** What is Dyad? Derive the standard form equation of Dyad. Then explain the steps involved in the synthesis of a 4 bar mechanisms with three accuracy points for the following type of problems. [16]
- a) Function generation
  - b) Rigid body guidance

- Q8)** a) Explain the concept of homogeneous transformation matrix and discuss its use in positional analysis of special mechanisms. [8]
- b) Find the Denavit-Hartenberg' parameter for Hook Joint. [8]
- Q9)** a) State and prove Robert-Chebyshev theorem. Comment on its use. [8]
- b) Discuss the Chebyshev spacing of accuracy points and its relation with the structural error of a synthesized mechanisms. [8]
- Q10)** Write a note on (ANY THREE) : [18]
- a) Hartmann construction.
- b) Effective use of computer in the design of mechanisms.
- c) Eulerian angles.
- d) Burmester points.
- e) Application of curvature theory to Dwell mechanisms.

