

Duration: 3 hours

Max Marks: 80

Note: Attempt **any 4** questions  
 Figures to the right indicate full marks  
 Assume data wherever required and mention it clearly  
 Drawing sheet are provided to solve graphical method

Q1 (i)

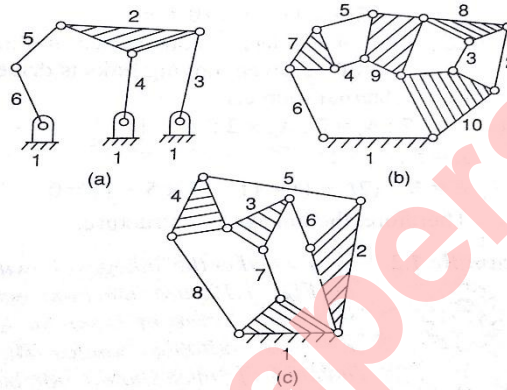


Figure 1

For the kinematic linkages shown in figure. 1 Calculate the following

1. The no. of binary links
2. The number of ternary links
3. The number of total links
4. The no. of joints or pairs
5. The No. of Degree of freedom

15

(ii) Inflection circle and its properties

5

Q2 (i) Design a four bar linkage to meet the following specifications:-

Crank	Position	Angular velocity	Angular acceleration
Input	$\theta = 90^\circ$	$\omega_2 = 3 \text{ rad/sec}$	$\alpha_2 = 0 \text{ rad/sec}^2$
Output	$\phi = 90^\circ$	$\omega_4 = 1.5 \text{ rad/sec}$	$\alpha_4 = \text{rad/sec}^2$

10

(ii) Explain the following  
 a. Classification of Mechanisms  
 b. Equivalent mechanisms

10

Q3 The coordinates of six poles corresponding to four successive finite positions ( $P_1, P_2, P_3, P_4$ ) of a moving plane are as follows:-  
 $P_{12}(50, 94), P_{13}(71, 65), P_{14}(38, 63)$   
 $P_{23}(62, 42), P_{24}(00, 45), P_{34}(118, 0)$  20  
 Select one of the opposite pole quadrilateral and construct circle point curve for the first position of the coupler (Take minimum 8 points other than poles). Select the circle point C at  $P_{24}$  and locate the corresponding center point  $C_0$ . all coordinates are in mm.

Q4 Design four bar linkages to generate the function  $y = x^{1/2}$  for the range  $x = 2$  to  $x = 6$ . The input and output sectors of angles are  $60^\circ$  and  $90^\circ$  respectively. Determine angle co-ordination. Take three accuracy points 20

Q5 Synthesize the aligned slider crank mechanism satisfying the following conditions:-

Input crank rotation	Slider motion
$\phi_{12} = 30^\circ$	$S_{12} = 78mm$
$\phi_{13} = 74^\circ$	$S_{13} = 112mm$
$\phi_{14} = 88^\circ$	$S_{14} = 168mm$

20

Using overlay techniques

Q6 Write short notes on (Any Two)

- (i) Short note on the following 10
  - (a) Lower pairs and higher pairs with sketches. (b). Crubler Criterion (c) Degrees of freedom
- (ii) Explain double points in coupler curves 10
- (iii) Derive two point coupler curvature equation 10

\*\*\*\*\*