Duration: **3 hours**   Max Marks: **80**
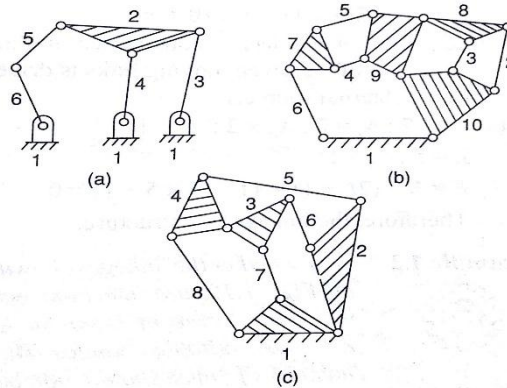
Note: Attempt **any 4** questions
         Figures to the right indicate full marks
         Assume data wherever required and mention it clearly
         Drawing sheet are provided to solve graphical method

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:-

10

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

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

10

Q3   The coordinates of six poles corresponding to four successive finite positions $(P \quad P \quad P \quad P)$ of a moving plane are as follows:-

$P_{12}(50, \quad 94)$, $P_{13}(71 \quad 65)$, $P_{14}(38. \quad 63)$
$P_{23}(62, \quad 42)$, $P_{24}(00, \quad 45)$, $P_{34}(118. \quad 0)$

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.   20

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 60^0 and 90^0 respectively. Determine angle co-ordination. Take three   20
accuracy points

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

Input crank rotation	Slider motion
$\phi_{12} = 30^0$	$S_{12} = 78mm$
$\phi_{13} = 74^0$	$S_{13} = 112mm$
$\phi_{14} = 88^0$	$S_{14} = 168mm$

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

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