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मती - 014

## Design & Synthesis of Mechanism

P. Pages : 3

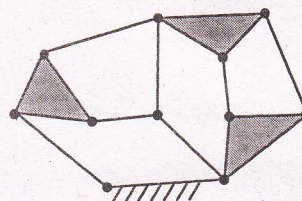
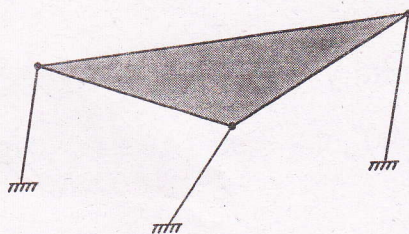
Time : Three Hours

Max. Marks : 100

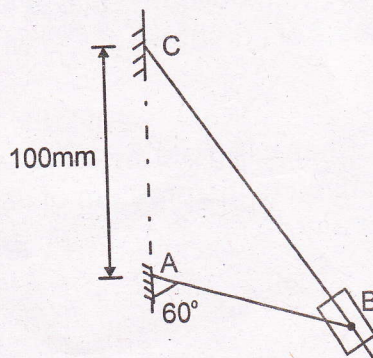
Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Answer **any five** questions.
5. Neat diagrams must be drawn wherever necessary.
6. Figures to the right indicate full marks.
7. Use of non programmable electronic pocket calculator is allowed.
8. Assume suitable data wherever necessary.

1. a) State whether the linkage shown in fig. are mechanisms with one degree of freedom, If not make suitable changes. The number of links should not be varied by more than one. 10



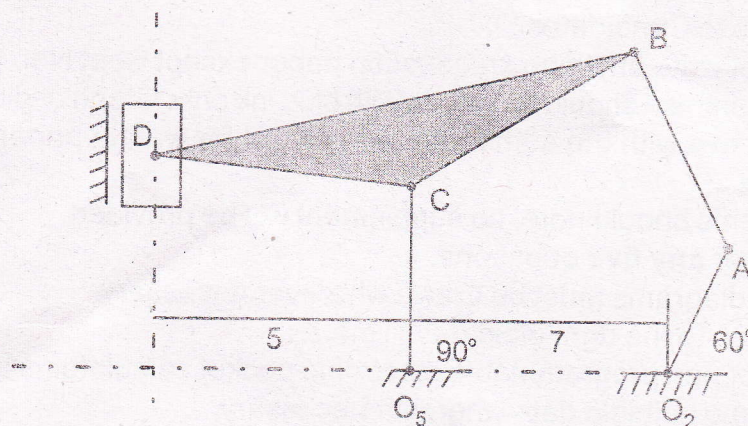
- b) For the mechanism shown in fig. Q. 3 a Using method of complex number, find sliding velocity of sliding block and angular velocity of link BC.  $AB = 200\text{mm}$ ,  $\omega_{AB} = 12.5 \text{ rad/sec}$ . 10





2. Determine the velocity and acceleration of slider D. Use following specifications  $O_2A = 2$ ,  $AB = 8.5$ ,  $BC = 7.5$ ,  $CD = 5.25$ ,  $O_5C = 7$ ,  $\omega_{O_2A} = 1 \text{ rad/sec}$ ; cw; const. Dimensions are in 'cm'.

20



3. a) Design a slider crank mechanism to co-ordinate three positions of input and output links as follows  
 $\Theta_1 = 20^\circ$ ,  $\Theta_2 = 35^\circ$ ,  $\Theta_3 = 50^\circ$ ,  $S_1 = 80\text{mm}$ ,  $S_2 = 60\text{mm}$ ,  $S_3 = 30\text{mm}$ . 10
- b) Proportionate four bar linkage to generate  $y = x^{1.5}$ , where  $1 \leq x \leq 4$ , using Chebyshev spacing, letting  $\theta_0 = 90^\circ$ ,  $\Phi_0 = 90^\circ$ ,  $\Delta\theta = 90^\circ$ ,  $\Delta\Phi = 90^\circ$ , Assuming length of fixed link = 1 unit. 10
4. a) Write difference between planar and spatial mechanism (Write three differences and two examples of each). 10
- b) Explain the concept of branch and order defects in mechanisms. 10
5. a) In a IC engine crank is 100mm, obliquity ratio is 4. When crank is at  $45^\circ$  from IDC, determine radius of curvature of CG which is at 100mm from big end centre. 10
- b) Describe a mechanism which will generate ellipse, Show how the Euler Savary equation can be used to the problem of determining the radius of curvature of an ellipse at any point. 10



6. Explain Robert Chebychev's theorem for four bar and slider crank mechanisms. For linkage specified below obtain alternative linkages so that the coupler point "C" traces the same coupler curve as it traces as coupler point of the given four bar linkage.  $A_0A = 25$ ,  $AB = 50$ ,  $B_0B = 35$ ,  $A_0B_0 = 60$ ,  $AC = 24$ ,  $BC = 40$  units. In the given configuration the input angle  $AA_0B_0 = 75^\circ$  CCW. 20
7. Write notes on any three. 20
- a) Two position synthesis of 4-bar and slider crank mechanisms.
  - b) Bobillier construction.
  - c) DH parameters for spatial mechanism.
  - d) Four-accuracy point synthesis.
  - e) Freudenstein's equation for slider cranks mechanism.

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