B.E. (Mechanical Engineering) Seventh Semester (C.B.S.)

Elective – I : Synthesis of Mechanisms

P. Pages : 3

TKN/KS/16/7559

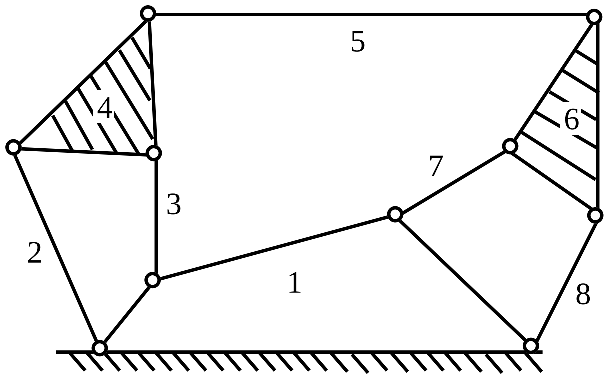
Time : Three Hours

Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.
12. Use drawing sheets for all graphical solutions.
13. Retain all construction lines.

1. a) What is kinematic synthesis? Explain the different methods of synthesis. **7**

b) Find the mobility of the mechanism shown in the figure. **6**



OR

2. a) Derive & Explain Cognate – Robort – Chebyshev theorem. **7**

b) Explain function Generation, Path generation and body guidance in brief. **6**

3. Synthesize a function generator to solve the equation : **13**

$y = \frac{1}{x}$ over the range $1 \le x \le 2$.

using three precision position by choosing. Chebyshev spacing.

OR

4. Explain in brief **any two.** **13**

i) Bobillier Construction.

ii) Hartmann's Construction.

iii) Eular – Savary equation.

5. Synthesize a four bar linkage to give the following values. For the angular velocities and accelerations. **14**

$$\omega_2 = 200\,\text{rad/s},\ \ \omega_3 = 85\,\text{rad/s},\ \omega_4 = 130\,\text{rad/s},$$

$$\alpha_2 = 0\,\text{rad/s}^2,\ \alpha_3 = -1000\,\text{rad/s}^2,\ \alpha_4 = -1600\,\text{rad/s}^2$$

by Bloch's method of synthesis.

OR

6. a) Explain & Derive Freudenstein's equation for analytical synthesis. **7**

b) Explain matrix method approach for analytical linkage synthesis. **7**

7. a) Explain the Powell's search method in optimal synthesis of a planer mechanism. **7**

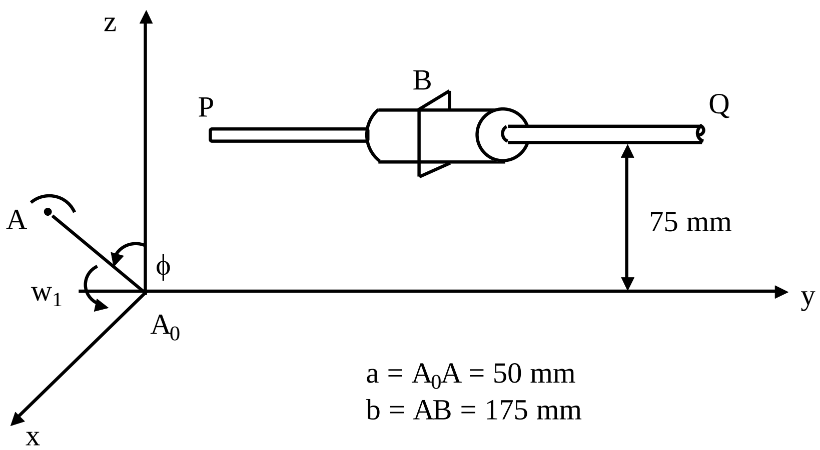
b) Discuss the formulation for the task of kinematic synthesis of a planer mechanism. **6**

OR

8. a) Explain and Derive the least Square approximation method of a Planer Mechanism. **9**

b) Explain Spatial mechanism in brief. **4**

9. Figure shows a Crank A_0A rotating in the x – y plane at a constant angular velocity $\omega_1 = 10\,\text{rad/s}$ and driving the slider B on a rod PQ by means of the link AB. The rod is in the Y – Z plane and parallel to A_0Y. Calculate the velocity of the slider and the angular velocity of the link AB when $\phi = 90^\circ$. **13**



a = A_0A = 50 mm
b = AB = 175 mm

OR

10. a) Explain Kinematic analysis for linkage for RSSR mechanism. **7**

b) Describe kinematic analysis for linkage for RCCC mechanism. **6**

11. a) Explain procedure and steps involved in kinematic synthesis in robotic application. **7**

b) Explain the identification of task of mechanism for robot. **7**

OR

12. For the Microbot model TCM five – axis robot shown in figure, find the transformation matrix T_{16} relating the position of the tool co-ordinate system to the ground co-ordinate system when the joint actuators are set to the values $\phi_1 = 30^\circ$, $\phi_2 = 60^\circ$, $\phi_3 = -30^\circ$, $\phi_4 = \phi_5 = 0^\circ$. Also find the absolute position of tool point which has co-ordinate $x_6 = y_6 = 0$, $z_6 = 62.5\,\text{mm}$. **14**

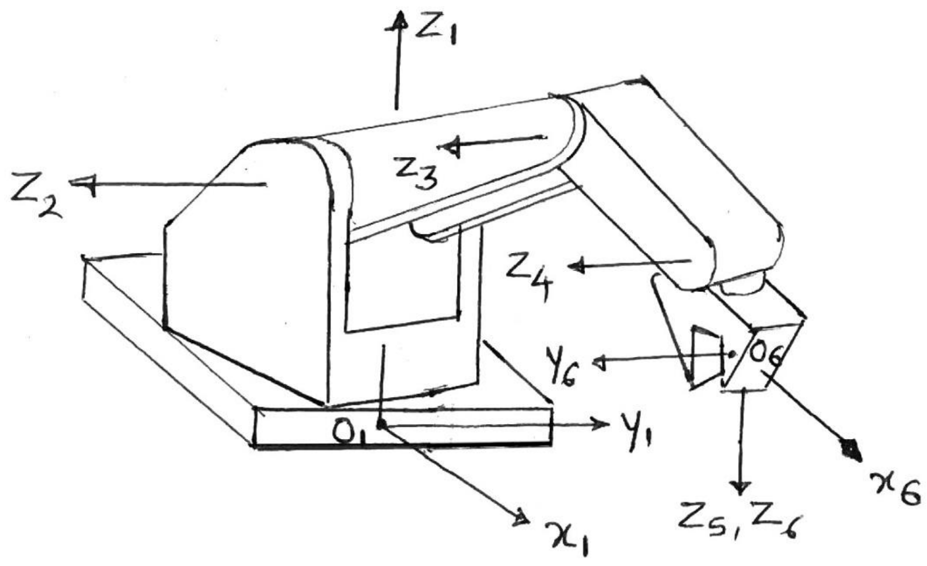


Fig. : The Microbot model TCM five axis robot

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