Assume any required data.
Answer the following questions:

Q1:

A: Define the path generation types.

B: Data: Free choice for three prescribed positions of coupler point 'P' link r_p = AP considering r_p = 4.5 cm, R_1 = 3.5 cm and θ_1 = 0.0°.
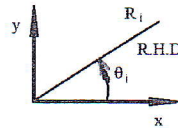
Required:
1. Construct 4b planar mechanism by graphical synthesis method.
2. Study this mechanism (name, γ's, ϕ_4 and T_R).
3. Show how to reconstruct such mechanism in condition that $p_1p_2p_3$ produces straight portion.

Q2:

A: Define function generation problem.

B: Data: Four prescribed positions for the output link R_4 "θ_4" and their correspond for the input link R_2 "θ_2" are as:

Position	1	2	3	4
θ_2°	45	84	128	163
θ_4°	74	92	117	135

Required:
1. Construct 4b planar mechanism using graphical synthesis method.
2. Study this mechanism (name, γ's, ϕ_4 and T_R).
3. Reconstruct such mechanism so that T_R = 0.8 and find γ's.

Q3: Data:

The mechanism shown in Fig. (1) where:
R_3 = AB = $4R_2$, R_p = AP (coupler point link) = R_2,
y_c = y_p at θ_2 = 0°, θ_3 (at initial and final positions of slider B) = 80.406° and 84.26° respectively,
ω_2 = constant = 5 rad/s (R.H.D.).

Required:
1. Find R_2, e and S_t of slider B.
2. Compute R_4, x_p at θ_2 = 0° and x_c = 1.5 e
3. Find θ_2 at the extreme positions of sliders B and C.
4. Compute stroke of slider C and its velocity and acceleration at mid-stroke.

Fig. (1)

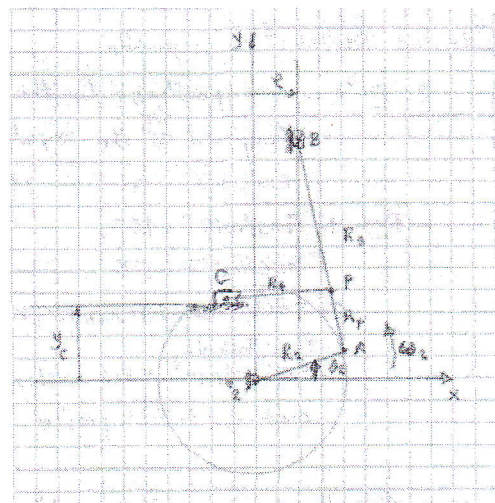## Q4:

A: Explain, with help of sketches, the following terms:
1. Main causes of machine vibration
2. Amplitude of vibration
3. Frequency
4. Waveform
5. Spectrum

B: Dimensions, section, and material properties of the members of an elastic four-bar mechanism are found in figure (2) and table (1). Investigate the natural frequencies of the mechanism.
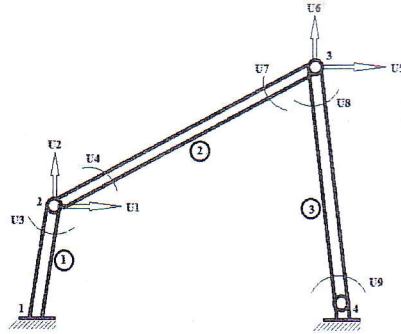

Fig. (2)

Table (1)

	Crank (2)	Coupler (3)	Follower (4)
Length (Li)	10.8 cm	27.94 cm	27.05 cm
Area (Ai)	1.077 cm^2	0.406 cm^2	0.406 cm^2
Area moment of inertia (Ii)	0.01616 cm^4	8.674 x10^{-4} cm^4	8.674 x10^{-4} cm^4
Distance between ground pivots(L1)	25.4 cm		
Weight of bearing assembly (W2 = W3)	0.42 N		
Modulus of elasticity (E)	7.1x10^7 KPa		
Weight density(ρ)	0.0266 N/cm^3		

Good Luck

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