

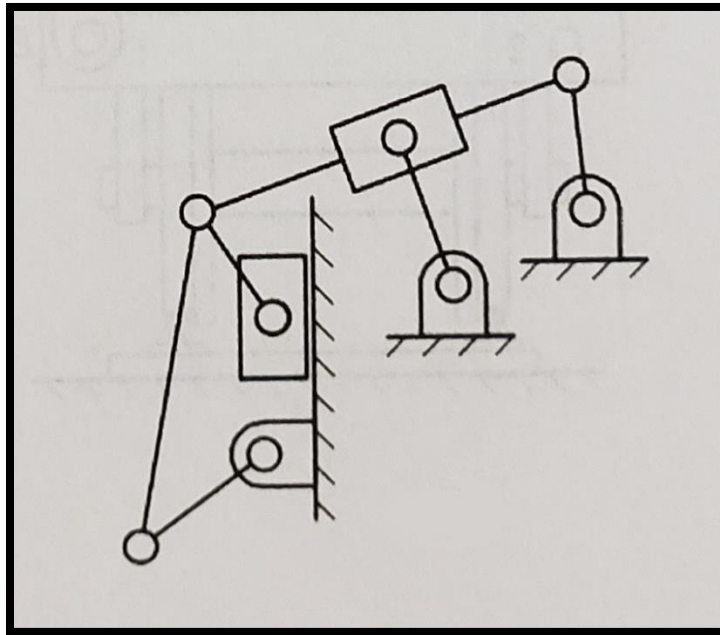
ME 3320 Midterm

Fall 2021

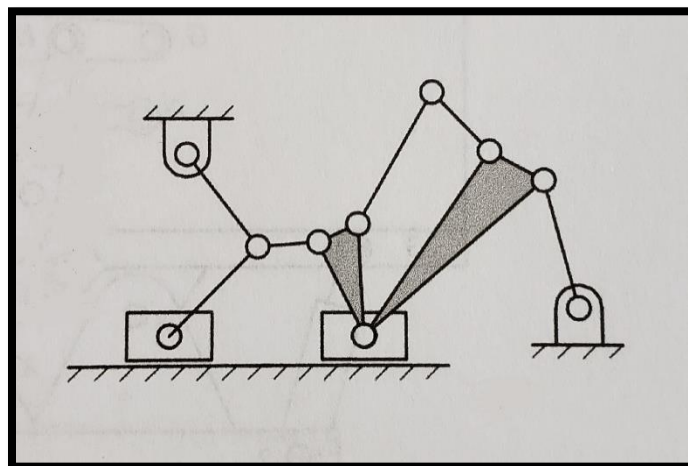
Total: 110 Points (10 points extra credit)

Problem-1: Find the D.O.F. for the following mechanisms (20 Points)

a)

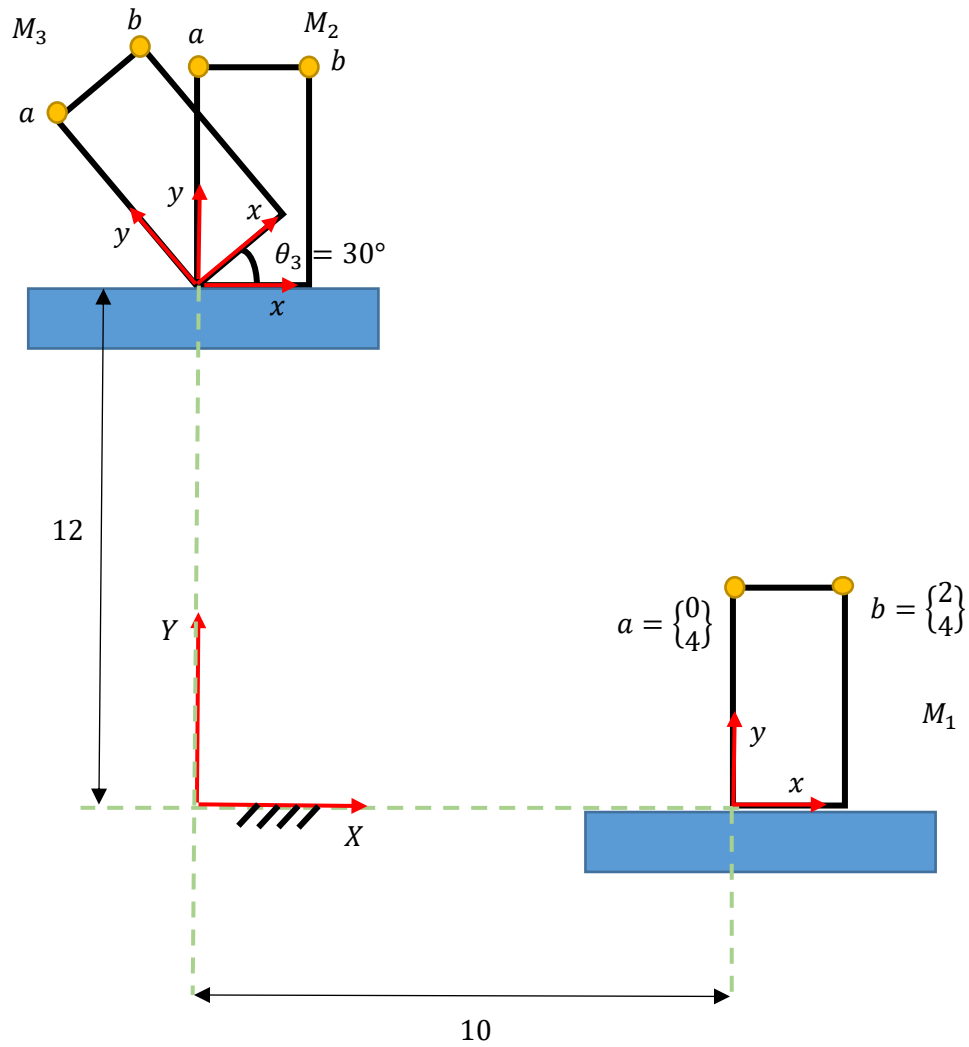


b)



Problem-2: Design a four-bar linkage to move the object through three positions shown in the figure. Using points “a” and “b” on the object for moving pivot. **(40 Points)**

- Graphical synthesis in the plane **(20 Points)**
- Algebraic synthesis in the plane (**Only** find pivot “O” based on moving pivot “a”) **(20 Points)**



Problem-3: (50 Points)

Follower displacement function: Design a displacement function.

The follower must:

- Dwell at $y = 2$ cm for 90°
- Rise 3 cm for 45° with continuous velocity
- Dwell at $y = 5$ cm from 135° to 225°
- Return (fall) to $y = 2$ cm from 225° to 270° with continuous displacement
- Dwell for the remaining 90° of cam rotation.

a. Write the boundary conditions and choose the degree of the polynomial to satisfy them.

Solve for the coefficients of the polynomial for the **rise**. **(10 Points)**

b. Write the boundary conditions and choose the degree of the polynomial to satisfy them.

Solve for the coefficients of the polynomial for the **return**. **(10 Points)**

c. Write the equations of $y = y(\theta)$ for each section of the displacement function. **(10 Points)**

d. Write the equations of the velocity, acceleration and jerk as a function of θ and the constant angular velocity of the cam, ω . **(10 Points)**

e. Plot the displacement, velocity, acceleration, and jerk functions (with hand). **(10 Points)**