Assignment 10

The professor demonstrates the steps to set up the initial conditions for the problem:

1. The given differential equation is given by the charge on the capacitor, which is:
   \[ \frac{dQ}{dt} = \frac{V}{C} \]
   where \( V \) is the voltage across the capacitor and \( C \) is the capacitance.

2. The initial condition is given by the charge at time \( t = 0 \) as:
   \[ Q(0) = Q_0 \]

3. Using integration, the charge function is:
   \[ Q(t) = Q_0 + \frac{V}{C} t \]

4. To find the voltage function, integrate the charge function:
   \[ V(t) = \frac{Q(t) - Q_0}{C} = \frac{1}{C} \int Q(t) \, dt = \frac{1}{C} \int \left( Q_0 + \frac{V}{C} t \right) \, dt = \frac{Q_0}{C} + \frac{V}{C^2} t \]

5. The voltage function is:
   \[ V(t) = \frac{Q_0}{C} + \frac{V}{C^2} t \]

6. Differentiate the charge function to find the current function:
   \[ I(t) = \frac{dQ}{dt} = \frac{V}{C} \]

7. The current function is:
   \[ I(t) = \frac{V}{C} \]

8. The professor explains the steps to set up the boundary conditions:
   - At the left edge of the beam, the charge is zero.
   - At the right edge of the beam, the charge is zero.

9. The boundary conditions are:
   - At \( x = 0 \):
     \[ Q(x = 0) = 0 \]
   - At \( x = L \) (where \( L \) is the length of the beam):
     \[ Q(x = L) = 0 \]

10. The professor demonstrates the steps to set up the differential equation for the beam:
    - The deflection of the beam is given by the deflection equation.
    - The boundary conditions are used to solve the differential equation.

11. The deflection equation is:
    \[ y''(x) = - \frac{q(x)}{EI} \]
    where \( y''(x) \) is the second derivative of the deflection function, \( q(x) \) is the load function, and \( EI \) is the flexural rigidity of the beam.

12. The boundary conditions are:
    - At \( x = 0 \):
      \[ y''(x = 0) = 0 \]
    - At \( x = L \):
      \[ y''(x = L) = 0 \]

13. The professor demonstrates the steps to set up the differential equation for the beam:
    - The deflection of the beam is given by the deflection equation.
    - The boundary conditions are used to solve the differential equation.

14. The deflection equation is:
    \[ y''(x) = - \frac{q(x)}{EI} \]
    where \( y''(x) \) is the second derivative of the deflection function, \( q(x) \) is the load function, and \( EI \) is the flexural rigidity of the beam.

15. The boundary conditions are:
    - At \( x = 0 \):
      \[ y''(x = 0) = 0 \]
    - At \( x = L \):
      \[ y''(x = L) = 0 \]

16. The professor demonstrates the steps to set up the differential equation for the beam:
    - The deflection of the beam is given by the deflection equation.
    - The boundary conditions are used to solve the differential equation.

17. The deflection equation is:
    \[ y''(x) = - \frac{q(x)}{EI} \]
    where \( y''(x) \) is the second derivative of the deflection function, \( q(x) \) is the load function, and \( EI \) is the flexural rigidity of the beam.

18. The boundary conditions are:
    - At \( x = 0 \):
      \[ y''(x = 0) = 0 \]
    - At \( x = L \):
      \[ y''(x = L) = 0 \]