Consider a two degree-of-freedom model of a truck. The two degrees of freedom are the vertical motion of the center of mass, \( y_c \), and the rotation of the chassis about the center of mass, \( \theta \).

Assume the truck is initially at rest. When the engine starts, it exerts a clockwise moment in the \( \theta \) direction modeled as a Dirac delta function, \( \delta(t) \).

1. Derive the equations of motion in matrix form for the system, in terms of \( m, c_1, c_2, k_1, k_2, l_1, \) and \( l_2 \).

2. Now let \( m=4,000 \text{ kg}, I_c=2,560 \text{ kg m}^2, k_1=k_2=20,000 \text{ N/m}, l_1=0.9 \text{ m}, l_2=1.4 \text{ m}, c_1=c_2=2,000 \text{ N s/m} \). Using Matlab, solve the undamped eigenvalue problem to find the natural frequencies and modes of the system. Normalize the modes so that the maximum value in each mode is 1. Determine the modal matrix of the system.

3. Using Matlab to perform the matrix multiplication, rewrite the equations of motion in terms of modal coordinates, \( \eta_1 \) and \( \eta_2 \).
   a. What is the damping ratio for each mode?
   b. Find the solution for the uncoupled equations.

4. Transform the modal coordinates back into the physical coordinates, \( y_c \) and \( \theta \).

5. Using Matlab, plot \( y_c \) and \( \theta \) as a function of time for \( 0 \leq t \leq 5 \text{ sec} \).

Please include the Matlab script or command line inputs, as well as the Matlab outputs with your assignment.