Problem 1

In the system of Figure (1), $x(t)$ is the input displacement and $u(t)$ is the output angular displacement. Assume that the masses involved are negligibly small and that all motions are restricted to be small; therefore, the system can be considered linear. The initial conditions for x and u are zeros, or $x(0) = 0$ and $u(0) = 0$. Find the transfer function of the system. Then obtain the response $u(t)$ when $x(t)$ is a unit-step input.

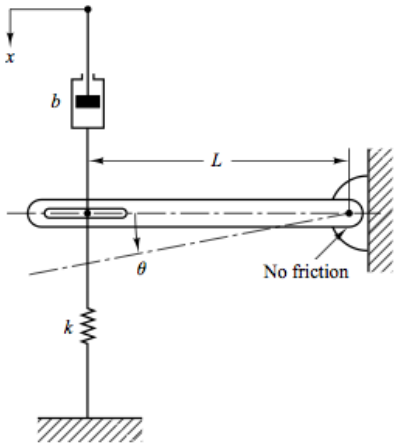

FIGURE 1 – Mechanical system for problem 1

Problem 2

When the system shown in Figure (2)(a) is subjected to a unit-step input, the system output responds as shown in Figure (2)(b). Determine the values of K and T from the response curve.

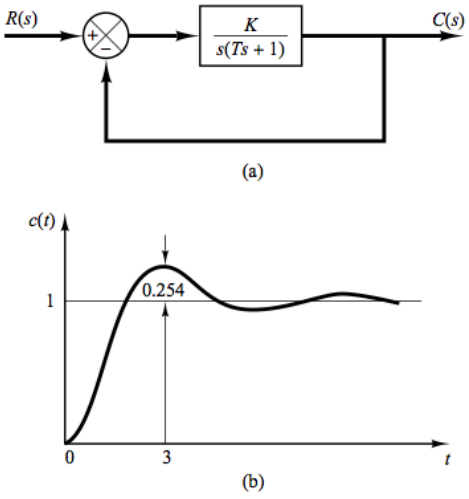

FIGURE 2 – Control system for problem 2

Problem 3

Determine the range of K for stability of the system shown in figure (3)

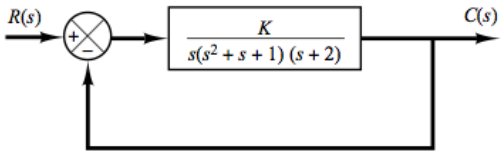

FIGURE 3 – Control system for problem 3

Problem 4

Find the steady-state errors for inputs of $u(t)$, $tu(t)$, and $\frac{1}{2}t^2u(t)$ to the system shown in figure (4). The function $u(t)$ is the unit step.

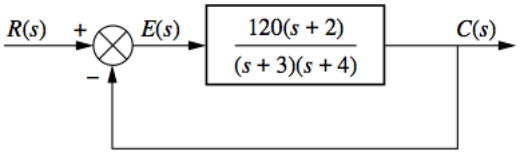

FIGURE 4 – Control system for problem 4