Name: _____   ID: _____

1.) (10 pts) Please find the differential equation(s) that model the system shown in Fig. 3-37 in Ogata (page 98).

Name: _____   ID: _____

2.) **(10 pts)** Please find the differential equation(s) that model the electrical circuit shown in Fig. 3-40 in Ogata (page 99).

Name: _____   ID: _____

3.) (10 pts) Please find the differential equation(s) that model the electromechanical system shown in Fig. 3-42 in Ogata (page 99), which depicts an electric motor driving a load (J_L) with a gear ratio of n.

Name: _____   ID: _____

4.) Consider a standard mass-spring-dashpot system (Lecture 5) with the following parameters: $m = 1$ kg, $c = 6$ Ns/m, $k = 9$ N/m.

> **a) (10 pts)** Please design a Simulink model that represents this system and simulate this model for 10 sec for a constant force input of $F = 1$ N, with initial conditions of $y(0) = 0$ and $\dot{y}(0) = 0$.

> **b) (20 pts)** Please repeat the same simulation for the cases: (i) when $c = 1$ Ns/m, and (ii) when $c = 10$ Ns/m keeping all other parameters constant. What observations do you make?