Dominator's Exam 3: __________________________

Your name

One 3×5 card and open mind permitted. No notes, palms or calculators.
Three great problems, with points noted.

Problem 1. (35 pts: 5,15,10,5) Watch this circuit quiver ...

The circuit of Figure 1 was not found on a napkin at McDonald's.

![Circuit Diagram](image)

Figure 1.

(a) Make a bond graph model. Show circuit variables in the bond graph clearly.

(b) Generate a set of system equations.

(c) Generate a set of state-space equations. Are they linear?

(d) Show how to find the eigenvalues. Does the RL value influence the result?
Problem 2. (30 pts: 5,10,5,10) *This network is a transforming experience.*

The network of Figure 2 is useful. We are interested in the power transfer from the source (the Vi port) to the load RL.

(a) Make a bond graph model.

(b) Find the load voltage (VL) as a function of the input voltage (Vi).

(c) Find an expression for the power delivered to the load as a function of Vi.

(d) What should N be to maximize the power delivered to the load?
Problem 3. (35 pts: 5,10,10,10)  This active circuit is a charmer.

Figure 3 shows the (top secret) model of an active circuit being considered for a Grammy award.

(a) Make a bond graph model.

(b) Generate a set of system equations. Include an equation to define the load voltage (VL).

(c) Reduce the model to a set of state-space equations. Retain an expression for the load voltage.

(d) Let the input voltage be constant (Vi). Find the load voltage (VL). Assume that $K \to \infty$. 

Figure 3.