KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF ELECTRICAL ENGINEERING

EE 380   CONTROL ENGINEERING

MAJOR EXAM I

TIME: 5:15 p.m.   November 8, 2009

NAME :	
I.D. # :	
SEC # :	

QUESTION #	SCORE	MAXIMUM
1.		20
2.		30
3.		25
4		25
TOTAL		100

Instructor: Dr. J. M. BAKHASHWAIN

1. Find the value of a for the following system

$$\dot{x} = \begin{pmatrix} a & a \\ a & a \end{pmatrix} x + \begin{pmatrix} 0 \\ 1 \end{pmatrix} u(t)$$

$$y = \begin{pmatrix} 1 & 0 \end{pmatrix} x$$

If $y(t) = 0.5(1 - e^t + te^t)$ for an input $u(t) = e^t$. Assume zero initial conditions
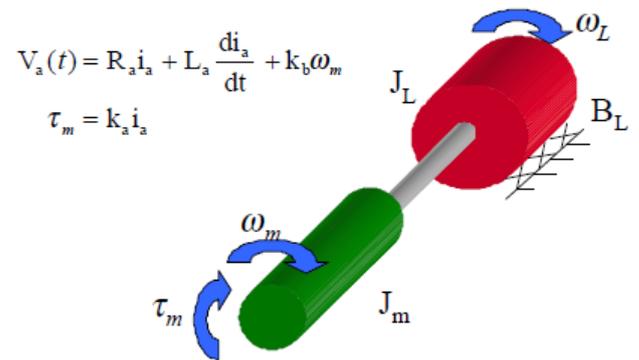
2. Draw the block diagram for armature controlled dc motor. Show that the transfer function is given by $\dfrac{\omega_m(s)}{V_a(s)} = \dfrac{a}{s^2 + bs + c}$
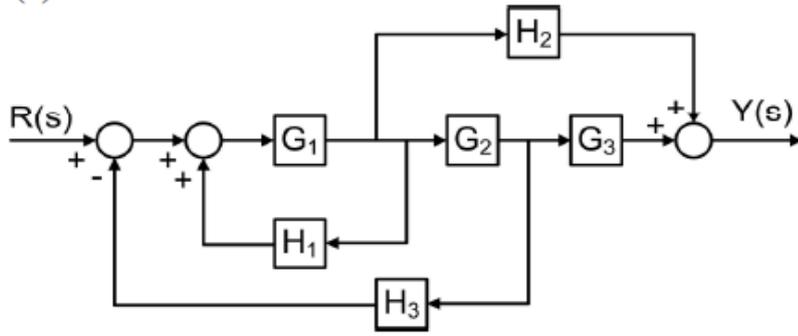
(i) Find a, b, and c

(ii) Find the state space representation when the state vector $x = \begin{pmatrix} i_a & \omega_m & \theta_m \end{pmatrix}^T$

$V_a(t) = R_a i_a + L_a \dfrac{di_a}{dt} + k_b \omega_m$

$\tau_m = k_a i_a$

3. Simplify the block diagram shown and obtain the closed-loop transfer
   function $\dfrac{Y(s)}{R(s)}$.

4. Using Mason's gain formula, find the transfer function for the shown signal flow graph