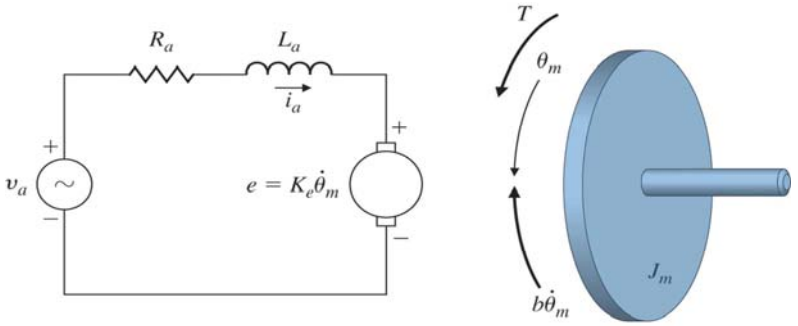
國立彰化師範大學 101 學年度碩士班招生考試試題

系所： 機電工程學系　　組別： 甲組　　科目： 自動控制

☆☆請在答案卷上作答☆☆　　

1. (1) **Find** the differential equation for a DC motor with the equivalent electric circuit shown below. Assume that the rotor has inertia J_m and viscous friction coefficient b. (10%) (2) **Write** the transfer function between input $V_a(s)$ and output $\Theta_m(s)$ when the effect of the inductance is negligible. (10%) [Figure by courtesy of Franklin's Feedback control of dynamic systems]



(a)　　(b)

2. **Find** the impulse response of following system and **make** a plot of it. (20%)

$$G(s) = \frac{2s+1}{s^2+2s+5}$$

3. Make a **Root Locus** plot (10 %) and **Nyquist** plot (5 %) for a single-loop feedback control system has the loop transfer function as follows. Find the range of K and indicate the position of the roots for system marginal stability. (5%)

$$L(s) = \frac{K}{s(s+2)(s+10)}$$

4. **Bode plot** for following transfer function. (25%)

$$G(s) = \frac{50(0.1s+1)}{s(0.5s+1)[1+0.6(s/50)+(s/50)^2]}$$

5. Consider the following systems:

$$\dot{x} = \begin{bmatrix} 3 & 0 \\ 0 & -1 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u, \quad \dot{z} = \begin{bmatrix} 3 & 0 \\ 0 & 1 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u$$

(1) Are the above systems **controllable** ? (8%)
(2) Are the above systems **stabilizable** ? (7 %)