

ECE 488 Midterm

Q-1- Find the root locus plot (with full details) of the transfer function

$$G_0(s) = \frac{K(s+2)(s+4)}{(s-2)(s-4)}. \quad \text{(40 points)}$$

Q-2- The state space representation of a system is shown by the equations

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} A & B \\ C & D \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} K \\ L \end{bmatrix} u$$

$$y = \begin{bmatrix} K & L \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Find the transfer function of the system. **(25 points)**

Q-3- Using the Routh-Hurwitz method, find the number of open right half plane roots of $G_0(s) = s^5 - s^4 + 2s^3 + 2s^2 - s + 1$. **(15 points)**

Q-4- The transfer function of a system is given by the formula

$$G_0(s) = \frac{4s^3 + 6s^2 + 8s + 3}{(s^2 + 1)(s^2 + 2s + 2)}.$$

This system is fed by an impulsive input. Find the output obtained in time domain. **(20 points)**