1. For the control system as shown, its plant model is expressed as:

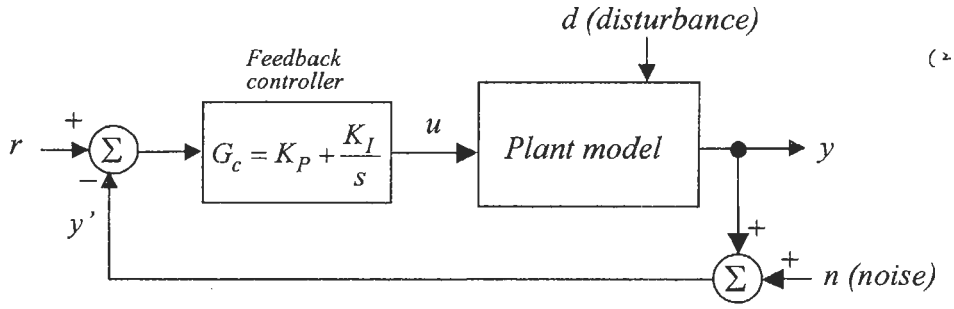
$$\dot{x} = -10x + 2u$$
$$y = x - 0.5d$$

(1) Find the parameters K_P and K_I of the controller to let the closed-loop poles be located at -10 and -8.

(2) Find the following closed-loop transfer functions:

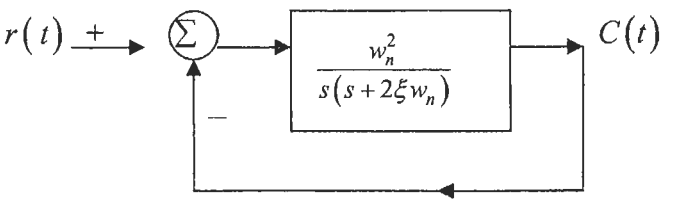
(a) $\left.\frac{y}{r}\right|_{d=0,n=0}$; (b) $\left.\frac{y}{d}\right|_{r=0,n=0}$; (c) $\left.\frac{y}{n}\right|_{r=0,d=0}$.

(3) Find the steady-state value of y due to unit-step disturbance change of d.



(25%)

2. Consider the following second-order system with ξ=0.6 and $w_n = 5$ rad/sec



Please calculate the rise time t_r, peak time t_p, maximum overhoot M_p, and setting time t_s for 2% criterion and 5% criterion (25%)

3. a) When is the input –output relation approach equivalent to state space approach?
   b) What is the difference between state space design method and Nyqusit criterion in classical design? (25%)

4. Consider the Bode plot and the possible transfer functions shown below. Determine the transfer function whose Bode plot is as shown. You must describe your reasons based on the observation of Bode plot to obtain full or partial grade. The possible transfer functions are as follows:
   $[(20s \pm 1)(0.02s \pm 1)]/[(5s + 1)(0.01s^2 + 0.05s + 1)]$,
   $[(20s \pm 1)(0.02s \pm 1)]/[(5s + 1)(0.01s^2 + 0.01s + 1)]$,
   $[(20s \pm 1)(0.02s \pm 1)]/[(5s + 1)(0.01s^2 + 0.2s + 1)]$. (25%)