國立嘉義大學 104 學年度
生物機電工程學系碩士班(乙組)招生考試試題

科目：自動控制（※使用工程用計算機）

1. Consider the mass-spring system depicted in Figure 1. Determine a differential equation to describe the motion of the mass, m. Obtain the system response to an initial displacement $\boldsymbol{x(0)}$=1. Assume motion only in the vertical plane. (25%)

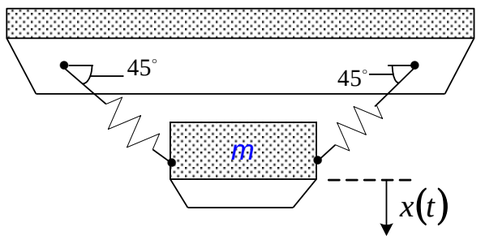

Figure 1

2. For the system of Figure 2 sketch the root locus and find the following:

   (a) Plot root locus diagram. (10%)

   (b) Asymptotes. (5%)

   (c) Breakaway points. (5%)

   (d) The range of K for stability. (5%)

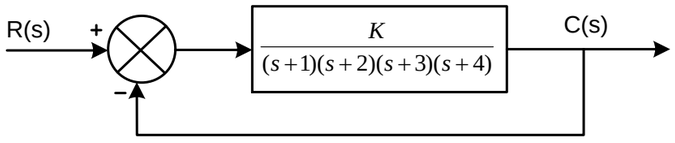

Figure 2

3. A unity feedback system of the second order is shown in Figure 3.

   (a) Find the natural frequency ω_n. (5%)

   (b) Find the damping ratio ς. (5%)

   (c) Find the peak time $T_p = \dfrac{\pi}{\omega_n\sqrt{1-\varsigma^2}}$. (5%)

   (d) Find the settling time $T_s = \dfrac{4}{\varsigma\omega_n}$. (5%)

   (e) Find the percent overshoot $\%OS = e^{-\varsigma\pi/\sqrt{1-\varsigma^2}} \times 100$. (5%)

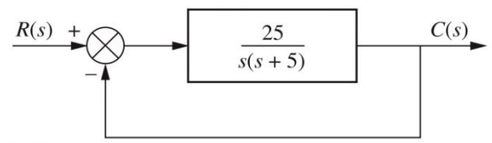

Figure 3

4. Consider the root locus shown in Figure 4 and its associated characteristic equation $(s+1)(s+2)+k(s-3)(s-5)=0$.

   (a) Rewrite the characteristic equation in the form of $1+kG(s)H(s)=0$. (9%)

   (b) Find the poles and zeros. (8%)

   (c) Find the break-away and break-in points. (8%)

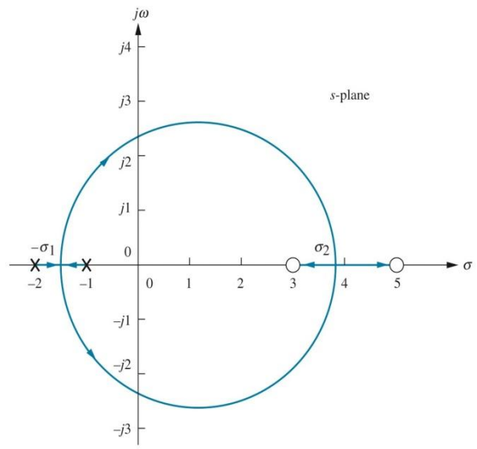

Figure 4