

國立臺北科技大學 103 學年度碩士班招生考試

系所組別：1112 機電整合研究所甲組

第三節 自動控制 試題 (選考)

第一頁 共一頁

注意事項：

1. 本試題共 5 題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. (20%) Consider a prototype second-order system that has a unit-step response with a maximum overshoot $M_p = e^{\frac{-\pi}{\sqrt{3}}}$ and overshoot time $t_p = \frac{2\pi}{\sqrt{3}}$. Determine the transfer function of the system.
2. (20%) Consider a feedback control system with the characteristic equation $s^2 + Ks + 4 = 0$. Sketch the root loci for when the control parameter K is varied from $-\infty$ to $+\infty$.
3. (20%) For a control system with a transfer function $\frac{100(s^2 + 0.2s + 1)}{s^2 + 2s + 100}$, sketch the Bode plot of the transfer function.
4. (20%) For a mechanical system with a dynamic equation $M\ddot{x}(t) + B\dot{x}(t) + K \sin(x(t)) = u(t)$, where M , B , and K are all constants and $u(t)$ denotes the driving force of the system, design a control law so that the mechanical system can track the desired path $x^d(t) = \sin(t)$ with a damping ratio of $\frac{\sqrt{2}}{2}$.
5. (20%) Consider an SISO system with the state equation $\dot{x}(t) = Ax(t) + bu(t)$, where $A = \begin{bmatrix} 0 & 2 \\ 0 & 0 \end{bmatrix}$ and $b = \begin{bmatrix} 0 \\ 2 \end{bmatrix}$. Determine the optimal feedback gain $K = [k_1 \ k_2]$ using the state feedback control law $u(t) = -Kx(t)$ such that the performance index $J = \int_0^{\infty} (x_1^2(t) + x_2^2(t) + 2u^2(t)) dt$ is minimized.