

國立彰化師範大學 100 學年度碩士班招生考試試題

系所：車輛科技研究所

科目：自動控制

☆☆請在答案紙上作答☆☆

共 1 頁，第 1 頁

1. Find the inverse Laplace transform of $F(s) = \frac{s+3}{s^2+3s+2}$. (20%)
2. Consider a spring-mass-damper system as shown in Figure P2. M denotes the mass, B denotes the viscous friction coefficient, K denotes the spring constant, $x(t)$ denotes the displacement of the mass, and $F(t)$ denotes the applied force on the mass. The positive directions of $x(t)$ and $F(t)$ are also assigned as in Figure P2.

(1) Find the dynamic equation of this system (10%);

(2) Find the transfer function of this system in which the input is $F(t)$ and the output is $x(t)$. (5%)

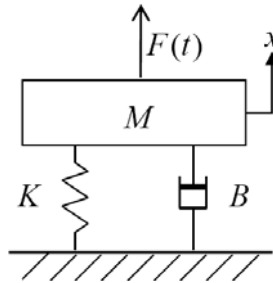


Figure P2.

3. If the characteristic equation is $s^2 + 2\zeta\omega_n s + \omega_n^2 = 0$ for a second order system, ζ and ω_n are defined as the damping ratio and undamped natural frequency of this system, respectively. Find the damping ratios (ζ) and the undamped natural frequency (ω_n) of the following transfer functions.
 - (1) $\frac{1}{0.25s^2 + 0.25s + 1}$; (5%)
 - (2) $\frac{1}{4s^2 + 4s + 1}$; (5%)
 - (3) $\frac{1}{25s^2 + 12.5s + 1}$. (5%)
4. Find the range of K that makes the system stable with the characteristic equation $s(s+1)(s+2) + K = 0$. (20%)
5. Please state the following terminologies.
 - (1) BIBO stability; (5%)
 - (2) Controllable; (5%)
 - (3) Step response; (5%)
 - (4) Steady state; (5%)
 - (5) Transfer function; (5%)
 - (6) Second-order system. (5%)