

國立彰化師範大學104學年度碩士班招生考試試題

系所： 車輛科技研究所、
機電工程學系

選考丙

科目： 自動控制

☆☆請在答案紙上作答☆☆

共 2 頁，第 1 頁

1. Please state the following terminologies. (30%)
 - (1) Controllable system; (5%)
 - (2) Observable system; (5%)
 - (3) Phase margin; (5%)
 - (4) BIBO (bounded-input bounded-output) stability; (5%)
 - (5) Bandwidth; (5%)
 - (6) Pole in left half plane. (5%)
2. Find the Laplace transform of $e^{-t} \sin 3t + 2e^{-t} \cos 3t$. (15%)
3. Consider a spring-mass-damper cart system as shown in Figure P3. M denotes the mass, B denotes the viscous friction coefficient, K denotes the spring constant, x denotes the displacement of the mass, and T denotes the applied force on the mass. The positive directions of x and T are also assigned as in Figure P3, respectively. Assume there is no friction force between wheel and road. Determine
 - (1) The dynamical equation of the system; (5%)
 - (2) The transfer function between T (input) and x (output) (5%)
 - (3) The undamped natural frequency of the system; (5%)
 - (4) The damping ratio of the system. (5%)

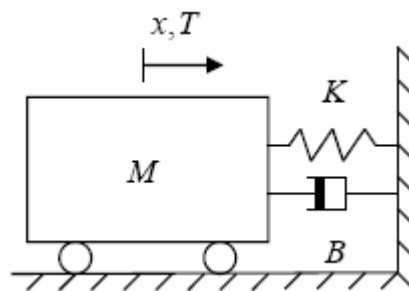


Figure P3.

4. Determine the range of K if the system is stable with the characteristic equation $s^4 + 3s^3 + 3s^2 + 2s + K = 0$. (15%)
Hint: Routh-Hurwitz criterion.
5. Plot the Bode plot of the system $\frac{5}{s(s+1)(s+5)}$. (10%)

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共 2 頁，第 2 頁

6. Determine whether the following systems are state controllable.

$$(1) \begin{pmatrix} \dot{x}_1 \\ \dot{x}_2 \end{pmatrix} = \begin{pmatrix} -1 & 2 \\ 1 & 1 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} + \begin{pmatrix} 1 \\ 0 \end{pmatrix} u; (5\%)$$

$$(2) \begin{pmatrix} \dot{x}_1 \\ \dot{x}_2 \end{pmatrix} = \begin{pmatrix} -1 & 0 \\ 1 & 1 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} + \begin{pmatrix} 0 \\ 1 \end{pmatrix} u. (5\%)$$