

國立虎尾科技大學 109 學年度第 2 學期博士班資格考試題

系別：動力機械工程系機械與機電工程博士班

第 1 頁 共 2 頁

科目：自動控制

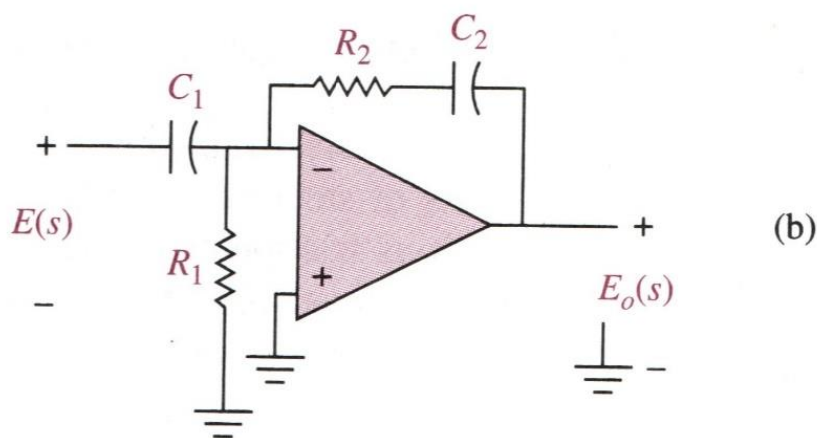
注意事項：

- (1) 本試題共有 5 題，每題 20 分，合計一百分。
- (2) 請依序作答於答案卷上並註明題號，若未註明選答題號及超過規定題數時，謹採計作答順序較前之題目計分。
- (3) 可使用計算機與 close book

1. Solve the following differential equations by means of the Laplace transform.
Assume zero initial conditions.

$$\frac{d^2 f(t)}{dt^2} + 5 \frac{df(t)}{dt} + 4f(t) = e^{-2t}u_s(t)$$

2. Find the transfer functions $E_o(s)/E(s)$ for the circuits shown in Fig.(b)



3. For each of the characteristic equations of feedback control systems given, determine the range of K so that the system is asymptotically stable. Determine the value of K so that the system is marginally stable and the frequency of sustained oscillation if applicable.

$$s^3 + 20s^2 + 5s + 10K = 0$$

4. The state equations of a linear time-invariant system are represented by

$$\frac{dx(t)}{dt} = \mathbf{A}x(t) + \mathbf{B}u(t)$$

Find the state transition matrix $\phi(t)$, the characteristic equation, and the eigenvalues of A for the following cases.

$$A = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -2 & 1 \\ 0 & 0 & -2 \end{bmatrix} \quad B = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$$

5. Find the steady-state errors of the following single-loop control system for a unit-step input, a unit-ramp input, and a parabolic input, $(t^2/2)u_s(t)$. For system that include a parameter K, find its value so that the answers are valid.

$$M(s) = \frac{s+1}{s^4+16s^3+48s^2+4s+4} \quad K_H = 1$$