

東海大學 101 學年度碩士班招生入學考試試題

考試科目：工程數學

應考系所：電機系

本試題共 頁：第 頁 (如有缺損或印刷不清者，應即舉手請監試人員處理)

以下各題，請任選四題書寫，每題 25 分：

1. From the Fig. 1. Determine $i(t)$ in Fig 1, when $L = 0.1 \text{ h}$, $R = 2 \Omega$, $C = 0.1 \text{ f}$, $i(0) = 0$, and, $E(t) = 120t - 120tU(t - 1)$

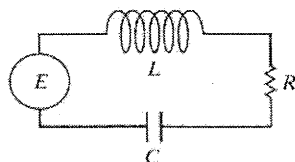


Fig. 1

Hint: $L \frac{di}{dt} + Ri(t) + \frac{1}{C} \int i(\tau) d\tau = E(t)$

2. Please find its complementary solution (y_c) based on the figure below :

$$y'' + xy' + (x^2 + 2)y = 0$$

3. Please find its nontrivial solution (非零解) based on the equation below :

$$u'' + \lambda u = 0, \quad u'(0) = u'(\ell) = 0$$

4. 請試證明以下兩式:

(a) $\mathcal{F}[f(t) \cos(\omega_0 t)](\omega) = \frac{1}{2} [\hat{f}(\omega + \omega_0) + \hat{f}(\omega - \omega_0)]$

(b) $\mathcal{F}[f(t) \sin(\omega_0 t)](\omega) = \frac{1}{2i} [\hat{f}(\omega + \omega_0) - \hat{f}(\omega - \omega_0)]$.

其中 $\cos(x) = \frac{1}{2}(e^{ix} + e^{-ix})$ and $\sin(x) = \frac{1}{2i}(e^{ix} - e^{-ix})$.

5. Please find the complex Fourier integral of the function below and determine what this integral converges to(收斂)?

$$f(x) = \begin{cases} \cos(x) & \text{for } 0 \leq x \leq \frac{\pi}{2} \\ \sin(x) & \text{for } -\frac{\pi}{2} \leq x < 0 \\ 0 & \text{for } |x| > \frac{\pi}{2} \end{cases}$$

6. In each of problems below are Exact (正合), please find its solution :

(a) A = ? $(Ax^2y + 2y^2)dx + (x^3 + 4xy)dy = 0$

(b) $y' = -\frac{2xy^3 + 2}{3x^2y^2 + 8e^{4y}}$