

大同大學 九十二 學年度研究所碩士班入學考試試題

考試科目: 工程數學

所別: 電機工程研究所

第1/1頁

註: 本次考試 不可以參考自己的書籍及筆記; 不可以使用字典; 不可以使用計算器。

1. Find the particular solution of the differential equation: $y'' + 4y = \sin(2x)$. [16%]

2. Determine the current $i(t)$ in the *LRC*-circuit. [18%]

Inductance: $L = 0.1$ Henry

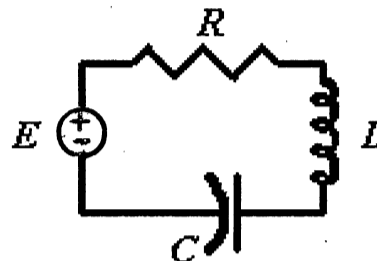
Resistance: $R = 20 \Omega$ (Ohms)

Capacitance: $C = 1.5625$ mF (mili-Farad)

Electromotive force (Volts):

$$E(t) = \begin{cases} 160t & 0 < t < 0.01 \\ 1.6 & t \geq 0.01 \end{cases}$$

Initial conditions: $i(0) = i'(0) = 0$



3. Given the data:

i	1	2	3	4
(x_i, y_i)	(0, 1)	(1, 3)	(2, 4)	(3, 4)

Find the least squares straight line (in the form of $y = a + bx$) fit to these four points. [16%]

4. Let $T: R^2 \rightarrow R^2$ be the linear operator defined by the equations $\begin{cases} w_1 = 2x_1 + x_2 \\ w_2 = 3x_1 + 4x_2 \end{cases}$

(a) Show that T is one-to-one. [9%]

(b) Find $T^{-1}(w_1, w_2)$. [9%]

5. The Fourier transform of $f(t)$ is defined as $F(\omega) = \int_{-\infty}^{\infty} f(t)e^{-j\omega t} dt$.

(a) Find the Fourier transform of $e^{-\beta t}U(t)$, where β is a positive real constant and $U(t)$ is the unit step function. [8%]

(b) Prove that the Fourier transform of $\frac{d}{dt}f(t)$ is $j\omega F(\omega)$. [8%]

6. In a certain assembly plant, the percentages of products made by the four machines, A, B, C, and D, are 10%, 25%, 40%, and 25%, respectively. It is known from past experience that the product defective rates for these four machines are 3%, 4%, 3%, and 2%, respectively. Now, suppose that a finished product is randomly selected and found to be defective, what is the probability that it was made by the machine D? [6%]

7. A particular type of circuit boards contains 10 diodes and the probability for each diode being defective is 0.05. Suppose that the circuit board will work if there is at most one defective diode.

(a) What is the probability that the circuit board will not work? [5%]

(b) Determine the mean and variance of the random variable representing the number of the defective diodes on a circuit board. [5%]