

# 逢甲大學104學年度碩士班考試入學試題

編號：048 科目代碼：222

科目	工程數學	適用 系所	電子工程學系	時間	100 分鐘
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※請務必在答案卷作答區內作答。

共 1 頁第 1 頁

一、Solve the following ordinary differential equation. (10%)

(1)  $y''(t) - 7y'(t) + 6y(t) = 2t$

(2)  $y''(t) + 6y'(t) + 8y(t) = \sin 3t$

二、Laplace transformation of the function  $f(t)$  is defined as

$$F(s) = L\{f(t)\} = \int_0^{\infty} f(t)e^{-st} dt \text{ and } f(t) = L^{-1}\{F(s)\}$$

1. Please determine (25%)

(a)  $L\{e^{5t}\}$

(b)  $L\{e^{3t} \times \sin(5t)\}$

(c)  $L^{-1}\left\{\frac{s}{s(s+1)}\right\}$

(d)  $L^{-1}\left\{\frac{s}{s^2 + 4s + 2}\right\}$

(e)  $L^{-1}\left\{\frac{1}{s^2 + 4s + 2} e^{-5s}\right\}$

2. By using Laplace transformation to solve (10%)

(a)  $y''(t) + 5y'(t) + 4y(t) = \delta(t), y(0) = 0, y'(0) = 0$

(b)  $y''(t) + 4y'(t) + 3y(t) = e^{-2t}, y(0) = 0, y'(0) = 1$

三、Find the eigenvalues and the corresponding eigenvectors. (15%)

$$A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 2 & 1 \\ 0 & 0 & -3 \end{bmatrix}$$

四、 $T: R^3 \rightarrow R^3$  is a linear transformation such that (10%)

$T(1,0,0) = (2,-1,4)$

$T(0,1,0) = (1,5,-2)$

$T(0,0,1) = (0,3,1)$

Find  $T(2,3,-1)$ .

五、Let  $f(x) = x, -\pi \leq x \leq \pi$ , the Fourier series will be  $f(x) = \sum_{n=1}^{\infty} K_n \sin(nx)$ .

(10%) (a) Determine the general form of  $K_n$ ;

(5%) (b) Plot the curve for  $f_1(x) = \sum_{n=1}^3 K_n \sin(nx)$ .

六、Solve the boundary value problem at below, (15%)

$$\frac{\partial^2 y}{\partial t^2} = 3 \frac{\partial^2 y}{\partial x^2} \text{ for } 0 < x < 4, t > 0,$$

$$y(0,t) = y(4,t) = 0 \text{ for } t > 0$$

$$y(x,0) = 2 \sin(\pi x), \frac{\partial y}{\partial t}(x,0) = 0 \text{ for } 0 < x < 4$$