

## 逢甲大學96年度產業研發碩士專班【秋季班】試題

科目	工程數學	適用系所	積體電路與通訊產業研發碩士專班	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、Consider the following differential equation (15%)

$$y'' + 4y' + 13y = 2e^{-3t} \quad y(0) = 0, y'(0) = 1$$

1. Solve the differential equation. (7%)
2. Verify your answer in (1) by Laplace transform. (8%)

二、Consider the following complex function (15%)

$$f(z) = 2z^2 + 3z + 5 \quad \text{and let } z = x + iy$$

1. Show that  $f'(z) = 4z + 3$  (5%)
2. Determine  $u(x, y)$  and  $v(x, y)$ , such that  $f(z) = u(x, y) + iv(x, y)$ . (5%)
3. Verify your answer in (1), in  $xy$ -plane. (5%)

三、Consider the following matrix (20%)

$$A = \begin{bmatrix} 3 & 3 \\ 1 & 5 \end{bmatrix}$$

1. Find  $A^{-1}$  (5%)
2. Find the eigenvalues of  $A$  (5%)
3. Determine  $A^n$  (10%)

四、Expand the following function in Legendre series  $f(x) = \begin{cases} -1 & -1 < x < 0 \\ 1 & 0 < x < 1 \end{cases}$  (15%)

$$\text{where } P_0(x) = 1, P_1(x) = x, P_2(x) = \frac{1}{2}(3x^2 - 1) \text{ and } P_3(x) = \frac{1}{2}(5x^3 - 3x)$$

五、Let  $\vec{F} = 3xy\hat{a}_x - y^2\hat{a}_y + xz\hat{a}_z$ , find  $\int_C \vec{F} \cdot d\vec{l} = ?$  (where  $C$  locates in  $xy$ -plane and satisfies  $y = 2x^2$  from  $(0,0)$  to  $(1,2)$ ) (15%)

六、Using Laplace transformation to solve the following partial differential equation (20%)

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}, \quad u(x,0) = 3 \sin 2\pi x, \quad u(0,t) = 0, \quad u(1,t) = 0, \quad 0 < x < 1, \quad t > 0$$