國立彰化師範大學 97 學年度碩士班招生考試試題

系所：電機工程學系碩士班　　科目：工程數學

☆☆請在答案紙上作答☆☆　　共 1 頁，第 1 頁

1. (30%) Solve the following differential equations

   (a) $xy' = \frac{y^2}{x} + y, \qquad y(1) = -1$ (10%)

   (b) $x^2y'' - 5xy' + 9y = x \cdot \ln x$ (10%)

   (c) $y''' + 8y = 0$ (10%)

2. (20%) Given $f(t) = \begin{cases} t, & 0 \le t < 1 \\ 0, & 1 \le t < 2 \end{cases}$ and $f(t) = f(t+2)$

   (a) Find the Laplace transform of $f(t)$. (10 %)

   (b) Find the Fourier series of $f(t)$. (10 %)

3. (20%) Evaluate the following line integrals in a complex plane. ($i = \sqrt{-1}$)

   (a) $\int_C e^{iz} dz$, C is any smooth curve from $(\pi, 0)$ to $(0, \frac{\pi}{2})$. (10 %)

   (b) $\oint_C \frac{4iz - 1}{2\sin z} dz$, $C : |z| = 6$. (10 %)

4. (10%) $A = \begin{bmatrix} 6 & -1 & 3 \\ 0 & 1 & -4 \\ 2 & 2 & -3 \end{bmatrix}$, find A^{-1}.

5. (20%) $\vec{F} = \frac{-y}{x^2 + y^2} \vec{a}_x + \frac{x}{x^2 + y^2} \vec{a}_y + z\vec{a}_z$

   (a) Evaluate the line integral $\oint_C \vec{F} \cdot d\vec{\lambda}$, C is a circle of radius 3 at $z = 0$ plane. (10 %)

   (b) Evaluate the surface integral $\oint_S \vec{F} \cdot d\vec{s}$, S is a closed cylindrical surface bounded by $0 \le r \le 3$,

   $0 \le \phi \le 2\pi$, $0 \le z \le 1$. (10%)