

國立臺灣科技大學
九十四學年度碩士班招生考試試題

系所組別：電子工程系碩士班乙三組
科目：工程數學

總分 100分

注意：答案卷內，請依題號順序撰寫答案 (例如：第 1 頁寫第 1 題，第 2 頁寫第 2 題,...)

1. Find the general solution of $x^2y+y^3+xy^2y'=0$; $y(1)=1$ (10%)
2. Find the general solution of $y''+y'-2y=f(t)$; $y(0)=0, y'(0)=0$ with

$$f(t)=\begin{cases} 0 & \text{for } 0 \leq t < 6 \\ 2 & \text{for } t \geq 6 \end{cases}$$

(15%)

3. Let A be an nxn matrix. If $[A|I_n]$ can be reduced to $[I_n|B]$ with a series of elementary row operations, then $B=A^{-1}$. Prove it. (10%)

4. Let $A=\begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$ and $e^{At}=\begin{bmatrix} a+b \cdot e^{2t} & c+d \cdot e^{2t} \\ f+g \cdot e^{2t} & h+i \cdot e^{2t} \end{bmatrix}$. Find a,b,c,d,f,g,h,i. (15%)

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5. If $u(x, y) = 3xy^2 - x^3$, use Cauchy-Riemann equations to find a conjugate harmonic function $v(x, y)$. (20%)
6. Evaluate $\oint_C \frac{1}{z^2 - 4} dz$, where C is the circle $|z| = 4$. (10%)
7. Find $(1 - 2i)^9 e^{3i}$ in Cartesian form, where $i = \sqrt{-1}$. (10%)
8. A second-order differential equation that describes the function $v(t)$ is given as follows:
- $$\frac{d^2 v(t)}{dt^2} + 2.5 \frac{dv(t)}{dt} + v(t) = 0$$
- If $v(0) = 4$ and $\left. \frac{dv(t)}{dt} \right|_{t=0} = -5$, find the function $v(t)$. (10%)

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