

國立臺灣科技大學
八十七學年度碩士班招生考試試題

所 別： 電機工程技術研究所
學程別：

組別： 電力組

科目： 工程數學

1. Derive the general solution for the following differential equation:

$$y'' - 2y' - 8y = 40 \sin(2x) \quad (10\%)$$

2. Use the Laplace transform to solve the system of equations given below:

$$\begin{cases} x' - 2y' = 1 \\ x' + y - x = 0 \end{cases} ; x(0) = 0 \text{ and } y(0) = 1 \quad (10\%)$$

3. Determine the first 5 nonzero terms of the power series solution about $x = 0$ for the initial value problem shown below:

$$y'' - e^x y' + 2y = 1 ; y(0) = -3 \text{ and } y'(0) = 1 \quad (10\%)$$

4. Find the eigenvalues and eigenfunctions of the following problem

$$y'' + \lambda y = 0 ; y(0) = y(1) = 0, \lambda > 0 \quad (10\%)$$

5. Calculate the line integral of a vector function $\vec{A}(x, y, z) = y\hat{a}_x + e^x\hat{a}_y + xz\hat{a}_z$, along a straight line segment from $(0, 0, 0)$ to $(1, 2, 3)$, where \hat{a}_i 's are the unit base vectors in the rectangular coordinates.

(10%)

6. Prove the divergence theory for a vector function \vec{F} , that is, $\int_V \nabla \cdot \vec{F} dv = \oint_S \vec{F} \cdot d\vec{s}$, where s is the closed surface of the volume v . (10%)

7. Find the Fourier series of $f(x)$, where

$$\begin{aligned} f(x) &= 2e^{2x}, 0 \leq x \leq 1 \\ f(x) &= 2e^{-2x}, -1 \leq x \leq 0 \end{aligned} \quad (10\%)$$

8. Find the solutions for

$$\begin{aligned} 2X_1 + 4X_3 &= 0 \\ X_1 + X_2 + 2X_4 &= 1 \\ -X_2 + 3X_3 - X_4 &= 2 \\ -X_2 + 2X_3 - 3X_4 &= 1 \end{aligned} \quad (10\%)$$

9. Calculate $\oint_C \frac{dz}{z^2(z-2)(z-4)}$, where c is the counterclockwise curve of $|z| = 3$. (10%)

10. Calculate $\int_C (\bar{z}) dz$, the c is the straight line from 0 to $3-3i$. (10%)