

國立彰化師範大學 102 學年度碩士班招生考試試題

系所：電機工程學系

科目：工程數學

☆☆請在答案紙上作答☆☆

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1. Solve the following differential equations.

(a) $y'' + 2y' + y = e^{-2x}$ (10%)

(b) $x^2 y' = y^2 - xy$ (10%)

(c) $(2x^3 + 3y)dx + (3x + y - 1)dy = 0$ (10%)

2. A periodic function is defined as $f(x) = \begin{cases} 1 & 0 < x < 1 \\ -1 & -1 < x < 0 \end{cases}$, $f(x) = f(x+2)$

(a) Find the Fourier series of $f(x)$. (10%)

(b) Use the result in (a) to show that $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} \cdots = \frac{\pi}{4}$. (5%)

3. Find Fourier transform of the function $f(t) = te^{-3t}u(t)$, where $u(t)$ is the unit step function. (10%)

4. Evaluate the surface integral $\oiint_S (x-z)dydz + (2y-z)dzdx - (2x-y)dxdy$ on the surface of the sphere $S: x^2 + y^2 + z^2 = 9$. (10%)

5. Find the eigenvalues and eigenvectors of the matrix $A = \begin{pmatrix} 0 & 1 \\ -\frac{1}{8} & \frac{3}{4} \end{pmatrix}$. (10%)

6. Assume $f(t)$ is a causal function and its Laplace transform is $F(s) = \frac{(s+3)}{(s^3 + 3s^2 + 6s + 4)}$, find $f(t)$. (10%)

7. Find the least squares regression line for points (1,1), (2,2), (3,4), (4,4), and (5,6). Then find the sum of squared error for this regression line. (15%)