國立臺南大學 103 學年度　**電機工程學系碩士班**　招生考試　工程數學　試題卷

每題 10 分，共十題，合計 100 分

1. Solve $y' = (-2x+1)y,\ y(0) = 2.$

2. Solve $x^2 y'' + xy' - y = 3x^2$.

3. Solve $y'' + 4y' + 3y = 2\delta(t-1),\ y(0) = 0,\ y'(0) = 0$.

4. Solve the initial value problem by a power series.
   $y'' + (1+x^2)y = 0, y(0) = 1, y'(0) = 0$.

5. Find the Fourier transform of the function $g(t) = \begin{cases} 1 & \text{if } -2 < t < 2 \\ 0 & \text{otherwise} \end{cases}$.

6. Find the eigenvalues of the matrix $\begin{bmatrix} 2 & 3 & 4 \\ 0 & 3 & 4 \\ 0 & 0 & 4 \end{bmatrix}$.

7. If λ denotes the eigenvalues of an arbitrary 2×2 matrix $\mathbf{A} = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, find the characteristic equation for the matrix **A**.

8. For the symmetric matrix $\mathbf{B} = \begin{bmatrix} 4 & 2 \\ 2 & 7 \end{bmatrix}$, find an orthogonal **S** such that $\mathbf{S^{-1}BS}$ is diagonal.

9. Evaluate $\int_0^\infty \frac{x^{1/3}}{x(x^2+1)}\,dx$

10. Given $F(s) = \frac{1}{s(s-4)^2}$, compute the Laplace Inverse Transform of $F(s)$.