

國立臺灣海洋大學 103 學年度研究所碩士班招生考試試題

考試科目：工程數學

系所名稱：輪機工程學系碩士班

1. 答案以橫式由左至右書寫。2. 請依題號順序作答。

1. [10%] Solve the initial value problem:

$$x' + x \tan t = \sin 2t, \quad x(0) = 1$$

2. [15%] Solve the nonhomogeneous Euler-Cauchy equation:

$$x^3 y''' - 3x^2 y'' + 6xy' - 6y = x^4 \ln x$$

3. [25%] Solve the partial differential equation:

$$\frac{\partial u}{\partial t} = 2 \frac{\partial^2 u}{\partial x^2}$$

$$\text{boundary condition: } u(x=0, t) = 0 \quad u(x=1, t) = 0$$

$$\text{initial condition: } u(x, t=0) = x$$

4. Solve the following initial value problem with Laplace transform. 10%

$$y''(t) - 5y'(t) + 6y(t) = e^{-t} \quad \text{with } y'(0) = y(0) = 0$$

5. Find the inverse of the following matrix. 10%

$$\mathbf{A} = \begin{bmatrix} 2 & 2 & 3 \\ -2 & 1 & 1 \\ 3 & 1 & 1 \end{bmatrix}$$

6. Find the eigenvalues of the following matrix, and the corresponding eigenvectors. 15%

$$\mathbf{B} = \begin{bmatrix} 3 & 0 & 0 \\ 1 & -2 & -8 \\ 0 & -5 & 1 \end{bmatrix}$$

7. Find the Fourier series of the following function on the interval. 15%

$$f(x) = x^2 - x + 3, \quad -2 \leq x \leq 2$$