國立臺灣海洋大學一００學年度研究所碩士班暨碩士在職專班入學考試試題

考試科目： 工程數學

系所名稱： 河海工程學系碩士班大地工程組(大地工程領域)、河海工程學系碩士班水資源與環境工程組、河海工程學系碩士班海洋工程組、河海工程學系碩士班結構工程組

※可使用計算器

1.答案以橫式由左至右書寫。2.請依題號順序作答。

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1. Solve the following ODE：(10%)

$$\left(-y/x^2+2\cos 2x\right)dx+\left(1/x-2\sin 2y\right)dy=0.$$

2. Solve the linear first-order ODE：(10%)

$$y'-y=e^{2x}.$$

3. Find a general solution of the following ODE：(10%)

$$y''-6y'-7y=0.$$

4. Solve the following inhomogeneous ODE：(10%)

$$y''+3y'+2y=30e^{2x}.$$

5. Solve the initial value problem by the Laplace transform：(10%)

$$y''+4y'+5y=\left[1-u\left(t-10\right)\right]e^{t}-e^{10}\delta\left(t-10\right),$$
$$y\left(0\right)=0,\quad y'\left(0\right)=1.$$

6. $\begin{cases} 2X_1 + 6X_2 + X_3 = 7 \\ X_1 + 2X_2 - X_3 = -2 \\ 5X_1 + 7X_2 - 4X_3 = 3 \end{cases}$ (20%)

(1) Write the system of equations in matrix form AX=B

(2) Calculate the eigen-values and eigen-vectors of matrix A

(3) Calculate the determinant of matrix A

(4) Find the Inverse matrix, A^{-1}

(5) Solve $X=A^{-1}B$

7. $f(t)=\begin{cases} Sin(2t) & for \quad 0 \le t < 2\pi \\ 0 & for \quad t < 0 \ and \ for \ t \ge 2\pi \end{cases}$ (15%)

$$H(t-a)=\begin{cases} 1 & for \quad t \ge a \\ 0 & for \quad t < a \end{cases}$$

(1) Plot the figure of f(t)

(2) Expressed f(t) in terms of the Heaviside function H(t)

(3) Fine the Fourier series of f(t)

(4) Fine the Fourier Transform of f(t)

8. $f(t)=\begin{cases} 2t & for \quad -2\pi \le t < 2\pi \\ 0 & for \quad t < -2\pi \ and \ for \ t \ge 2\pi \end{cases}$ (15%)

(1) Plot the figure of f(t)

(2) Fine the Fourier series of f(t)

(3) Fine the value of f(t = 2) by using the first 5 terms of the Fourier series