國立雲林科技大學 115 學年度 碩士班招生考試試題

系所：電子系

科目：工程數學(2)

1. (10%) Solving $x\frac{dy}{dx} = x^2 + 3y$

2. (10%) Solve the differential equation $y'' + 4y = 2\sin x$

3. (10%) Solve the differential equation $y' = -\frac{2xy+\cos x}{x^2+\sin y}$

4. (20%) A differential equation system $\begin{cases} y_1' = 1y_1 - 3y_2 \\ y_2' = 4y_1 - 6y_2 \end{cases}$ with $y_1(0) = 2$ and $y_2(0) = 1$

   (a) (10%) Solving the differential equation system.
   (b) (05%) Plot its phase portrait.
   (c) (05%) Analyze the stability of this system.

5. (15%) Perform the indicated operation, give that:

$$A=\begin{bmatrix} 3 & 1 & 0 \\ 0 & 2 & 3 \end{bmatrix} \quad B=\begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 3 \end{bmatrix} \quad C=\begin{bmatrix} 0 & 1 \\ 1 & 0 \\ 2 & -1 \end{bmatrix} \quad D=\begin{bmatrix} 2 & 2 \\ -1 & 4 \\ 0 & 1 \end{bmatrix}$$

   (a) $(A+B)^T$ (b) (2A-B)(C+D) (c) If $2X-(A-B)=0$, Find X

6. (15%) Evaluation of these determinants。

$$\text{(a)}\begin{vmatrix} \sin n\theta & -\cos n\theta \\ \cos n\theta & \sin n\theta \end{vmatrix} \quad \text{(b)}\begin{vmatrix} -2 & 0 & 0 \\ 3 & 1 & 0 \\ 1 & 3 & 5 \end{vmatrix} \quad \text{(c)}\begin{vmatrix} 2 & 1 & 1 & 1 \\ 1 & 2 & 1 & 1 \\ 1 & 1 & 2 & 1 \\ 1 & 1 & 1 & 2 \end{vmatrix}$$

7. (10%) If $\begin{bmatrix} 1 \\ 2 \end{bmatrix} = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix}$, Please find $\begin{bmatrix} x \\ y \end{bmatrix}$

8. (10%) Find the eigenvalues and eigenvectors of A.

$$A=\begin{bmatrix} 2 & 0 & -2 \\ 0 & 4 & 0 \\ -2 & 0 & 5 \end{bmatrix}$$