國立成功大學

110學年度碩士班招生考試試題

編　號：82

系　所：資源工程學系

科　目：工程數學

日　期：0202

節　次：第 3 節

備　註：不可使用計算機

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※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. (16%)

(a) If $\frac{d^2y}{dx^2}+y=\cos x,\quad y(0)=0,\ y(\pi)=0$, find $y(x)$, $0<x<\pi$?

(b) If $\frac{dy}{dx}=y+x,\qquad y(0)=1$, find $y(x)$?

2. (16%)

(a) Calculate the Laplace transform of $\sin(at+b)$ where a and b are real constants.?

(b) Find the inverse Laplace transform of $\frac{1}{s^2+4}e^{-3s}$?

3. (18%)

(a) Decompose following matrix:

$$\begin{bmatrix}1 & 4 & 2\\ 4 & 25 & 26\\ 2 & 26 & 44\end{bmatrix}=\begin{bmatrix}l_{11} & 0 & 0\\ l_{21} & l_{22} & 0\\ l_{31} & l_{32} & l_{33}\end{bmatrix}\begin{bmatrix}1 & u_{12} & u_{13}\\ 0 & 1 & u_{23}\\ 0 & 0 & 1\end{bmatrix}$$

(b) $[A]=\begin{bmatrix}2 & -1 & 1 & 0\\ 0 & 3 & 3 & 6\\ 1 & 4 & 5 & 9\\ 0 & 1 & 0 & 2\end{bmatrix}$

(b-1) find the rank of [A]?

(b-2) find the trace of [A]?

(b-3) find the determinant of [A]?

(c) Find the eigenvalues and the corresponding eigenvectors of $\begin{bmatrix}1 & 0 & 0\\ 0 & 0 & 1\\ 0 & 1 & 0\end{bmatrix}$?

4. (15%)

(a) Find the divergence and (b) curl of $x^2y\vec{i}+3\vec{j}-x\vec{k}$ at (1, 2, 3)?

(c) Find the gradient of xy^2-$3z^3$ at (1, -2, 4)?

5. (20%)

(a) Determine the Fourier series expansion of the periodic function: $f(x)=\begin{cases}0, & -1\le x\le 0\\ x, & 0\le x\le 1\end{cases}$ with a fundamental period 2?

(b) Find the Fourier integral of the function $f(x)=e^{-|x|}$?

6. (15%)

Give an example of applications relating to 1st order ordinary differential equation?