

國立成功大學

113學年度碩士班招生考試試題

編 號：80

系 所：資源工程學系

科 目：工程數學

日 期：0201

節 次：第 3 節

備 註：不可使用計算機

系 所：資源工程學系

考試科目：工程數學

考試日期：0201，節次：3

第 1 頁，共 1 頁

※ 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. (20%)

(a) If $\frac{dy}{dx} = y + x^2$, $y(0) = 1$, find $y(x)$, $x > 0$. (10%)

(b) If $\frac{d^2y}{dx^2} + y = \cos(x)$, $y(0) = 0$, $y'(0) = 0$, find $y(x)$, $x > 0$. (10%)

2. (20%)

(a) Calculate the Laplace transform of $\exp(3t-2)$. (10%)

(b) Find the inverse Laplace transform of $\frac{s+2}{(s+1)s}$. (10%)

3. (20%)

(a) $[A] = \begin{bmatrix} 1 & 1 & 1 & 2 \\ 1 & 1 & 2 & 1 \\ 1 & 2 & 1 & 1 \\ 2 & 1 & 1 & 1 \end{bmatrix}$

(a-1) find the row reduced echelon form of $[A]$. (5%)

(a-2) find the rank and nullity of $[A]$. (5%)

(b) Find the eigenvalues and the corresponding eigenvectors of $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$. (10%)

4. (20%)

(a) Find the curl of $3x^2y^3\vec{i} - 2y^3z^2\vec{j} + x^3z^2\vec{k}$ at $(2, -1, 1)$. (5%)

(b) Find the directional derivatives of $f(x, y, z) = \frac{xy^2}{z^3}$ at $(3, 2, 1)$ in the direction of $2\vec{i} + 2\vec{j} + 1\vec{k}$. (5%)

(c) State the Green's theorem in a plane. (5%)

(d) State the Stoke's theorem. (5%)

5. (20%)

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

(10%)

(b) Find the Fourier transform of the function $f(t) = \begin{cases} ke^{-at}, & t > 0 \\ 0, & t < 0 \end{cases}$ where k and a are some real positive constants. (10%)