

國立成功大學

111學年度碩士班招生考試試題

編 號： 116

系 所： 工程科學系

科 目： 工程數學

日 期： 0220

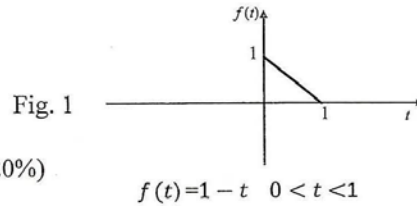
節 次： 第 3 節

備 註： 不可使用計算機

※ 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. Solve the initial problem  $y' = \frac{y}{x} - \frac{(y-x)^3}{x}$ ,  $y(2) = 3$  (20%)

2. As Fig. 1, please find the Fourier sin transform and plot the graphs of amplitude spectrum ( $|F_s(w)|$ ) (10%)



3. Using the Laplace transform solves the ODE (20%)

$$y'' + 4y' + 5y = f(t); \quad y(0) = 0, \quad y'(0) = 0$$

(1) Use convolution theorem to represent the solution of any  $f(t)$  (以迴旋積分型式表示)

(2) If  $f(t) = \delta(t-2)$ , solve the solution.

PS:  $\delta(t-2)$  is a **Delta function**

4. Solve the P.D.E. (20%)

$$\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2} - 6x; \quad u(0, t) = u(1, t) = u_t(x, 0) = 0; \quad u(x, 0) = x^3$$

5. Given  $A = \begin{bmatrix} 6 & -3 \\ 4 & -1 \end{bmatrix}$ , please find  $e^{\sin(A)}$ . (10%)

6. Please find the following: (20%)

(1) Prove that  $\frac{1}{2} \nabla(\mathbf{Q} \cdot \mathbf{Q}) = (\mathbf{Q} \cdot \nabla)\mathbf{Q} - (\nabla \times \mathbf{Q}) \times \mathbf{Q}$

(2) For  $\phi = x^2 y z^3$ , find  $(\nabla \phi \cdot \nabla) \nabla \phi$