

國立臺北科技大學 107 學年度碩士班招生考試

系所組別：1111、1112

機械工程系機電整合碩士班甲組

第一節 工程數學 試題

第一頁 共一頁

注意事項：

1. 本試題共 5 題，每題 20 分，共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. Please solve the following differential equation: (20%)

(1) $x^2 y'' + xy' - y = \frac{1}{x+1}$ (10%)

(2) $y'' + 4y = 2 \cos 3x + 3 \sin 3x$ with $y(0) = 3$ and $y'(0) = 2$ (10%)

2. Using the Laplace transform to solve the initial value problem (20%)

$$y'' + 2ty' - 4y = 1, \quad y(0) = y'(0) = 0$$

3. (1) Use Gauss elimination to solve the following system equation (10%)

$$\begin{cases} 2x_1 + 6x_2 + x_3 = 7 \\ x_1 + 2x_2 - x_3 = -1 \\ 5x_1 + 7x_2 - 4x_3 = 9 \end{cases}$$

(2) Write set of linear equations in (1) as $\mathbf{Ax} = \mathbf{c}$. Find \mathbf{A}^{-1} and use this to solve for \mathbf{x} . (10%)4. (1) To prove that $\mathbf{F} = (y^2 \cos x + z^3)\mathbf{i} + (2y \sin x - 4)\mathbf{j} + (3xz^2 + 2)\mathbf{k}$ is a **conservative field**. (5%)(2) To find the **potential function** $\phi(x, y, z)$ of \mathbf{F} . (10%)(3) To find the **work** done by \mathbf{F} along the curve C from $(0, 0, 0)$ to $(\pi, 2, 4)$ and C is described as $x(\theta) = \theta - \sin \theta$, $y(\theta) = 1 - \cos \theta$, $z = 4 \sin \frac{\theta}{2}$. (5%)

5. Please solve the following PDE. (20 points)

PDE $\frac{\partial u(x,t)}{\partial t^2} = \frac{\partial^2 u(x,t)}{\partial x^2}$

BC $u(0,t) = u(\pi,t) = 0$

IC $\frac{\partial u}{\partial t} \Big|_{t=0} = 0$, $u(x,0) = \sin x - \sin 2x$