

國立臺北科技大學 111 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

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注意事項：

1. 本試題共 5 題，每題 20 分，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
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 the differential equation:

(1) $2\sin y dx + \cos y dy = 0$, $y(0) = \frac{\pi}{2}$ (10 pts)

(2) $xy' + y - e^x = 0$, $y(1) = e$ (10 pts)

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

$y'' + 4y' + 3y = e^t$; $y(0) = 0$, $y'(0) = 2$

3. Consider the vector field $\vec{F} = 3x^2(y^2 - 4y)\vec{i} + (2x^3y - 4x^3)\vec{j}$ (1) To prove that \vec{F} is a **conservative field**. (5 points)(2) To find the **potential function** $\phi(x, y, z)$ of \vec{F} (10 points)(3) To find **the work** done by \vec{F} along the curve C from $(-1, 1)$ to $(2, 2)$. C can be any curve. (5 points).

4. (1) Use Gauss elimination to solve the following system equation (10 pts)

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

(2) Write set of linear equations in (1) as $\mathbf{Ax} = \mathbf{c}$. Find \mathbf{A}^{-1} and use this to solvefor \mathbf{x} . (10 pts)

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