

國立臺北科技大學 104 學年度碩士班招生考試

系所組別：3110、3120、3150

土木工程系土木與防災碩士班甲、乙、戊組

第三節 工程數學 試題

第一頁 共一頁

注意事項：

1. 本試題共 5 題，配分共 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。
4. 計算條件若有不足，請自行作合理假設。

一. Solve the following differential equations: (4 x 10%)

1. $\frac{dy}{dx} = e^{y-x} \sec(y)(1+x^2)$ $y(0) = 0$

2. $6y' - 2y = xy^4$ $y(0) = -2$

3. $\frac{dy}{dx} = \frac{1-x-y}{x+y}$ $y(0) = 2$

4. $y''' - 6y'' = 3 - \cos x$

二. Given that

$$y_1(x) = e^x \quad \text{and} \quad y_2(x) = x + 1$$

form a fundamental set of solutions for the corresponding homogeneous differential equation of the following equation, find its general solution: (16%)

$$xy'' - (x+1)y' + y = x^2$$

三. If $A = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$, and $x = \begin{bmatrix} 3 \\ 2 \\ 5 \end{bmatrix}$, determine: (4 x 5%)

1. $y = Ax$;
2. $y = A^6 x$;
3. $\det(A^{23})$;
4. A^{-1} .

四. Figure Q4 shows that R is the closed region bounded by the planes $x=0$, $y=0$, $z=0$, and $3x + 2y + 6z = 6$, evaluate (12%)

$$I = \iiint_R yz^2 dV$$

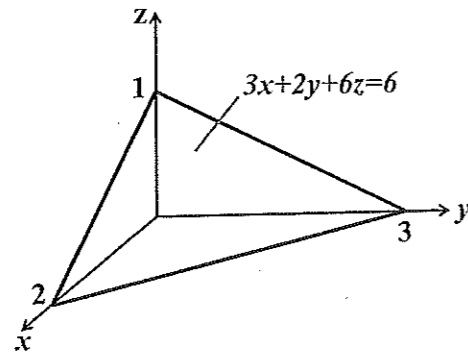


Fig Q4.

五. Solve the following integral equation using the Laplace Transform: (12%)

$$y'(t) = 1 - \sin t - \int_0^t y(\tau) d\tau, \quad y(0) = 0$$