

**國立嘉義大學九十四學年度
土木與水資源工程學系碩士班招生考試試題**

科目：工程數學

(如有條件不足之情形，請自行假設。)

1. Find the general solution for the following equation: (20%)

$$(2x + 4)^2 y'' - 4(2x + 4)y' + 8y = 4 \ln(2x + 4)$$

2. (a) Derive the Laplace Transformation from Fourier Transformation. (10%)

(b) Describe the difference between Laplace Transformation and Fourier Transformation from physical view. (10%)

3. $\vec{F} = e^x \cos y \vec{i} - e^x \sin y \vec{j} + z^2 \vec{k}$. Determine whether \vec{F} is conservative in the entire space? (10%) If it is, find a potential function and evaluate $\int_C \vec{F} \cdot d\vec{r}$. Where C is the path from (0, 0, 2) to (1, $\pi/4$, 1) in the space, \vec{r} is the position vector for any point on C. (10%)

4. (a) $f(t) = \begin{cases} \sin t, & 0 < t < 2\pi \\ 0, & t > 2\pi \end{cases}$ find Laplace Transform of $f(t)$. (10%)

(b) $F(s) = \ln\left(\frac{s^2 + 1}{s^2 + 9}\right)$, find the Inverse Laplace Transform. (10%)

5. Use the residue theorem to evaluate $\oint_{\Gamma} \frac{z}{1 + z^2} dz$, where Γ the circle

$|z| = 4$ (oriented positively). (20%)