

國立臺北科技大學

九十五學年度學士班二、三年級轉學生招生考試

四技三年級 電機工程系 專業科目 (一)

工程數學試題

填准考證號碼

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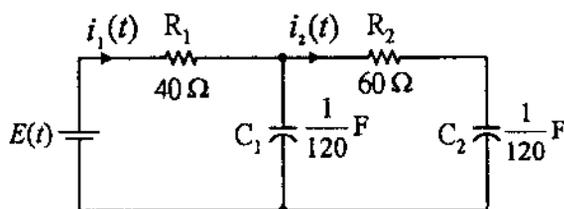
注意事項：

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。

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

$$x^3 y''' + x^2 y'' - 2xy' + 2y = x^2 \ln(x), \quad x > 0.$$

2. (20%) Solve for the currents $i_1(t)$ and $i_2(t)$ in the following circuit by the Laplace transform, assuming that both loop currents and the charges on the capacitors are initially zero and that $E(t) = 20 \text{ V}$.



3. Let $f(t) = t^2$ for $-\pi \leq t \leq \pi$.

(a) (10%) Write the Fourier series for $f(t)$ on $[-\pi, \pi]$.

(b) (10%) Use this above Fourier series to sum the series $\sum_{n=1}^{\infty} \frac{1}{n^2}$ and $\sum_{n=1}^{\infty} \frac{(-1)^n}{n^2}$.

4. The differential equation is $y'' + xy' - y = e^{5x}$.

(a) (10%) Find the recurrence relation of the differential equation.

(b) (10%) Use the recurrence relation to generate the first five terms of the Maclaurin series of the general solution.

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5. (a) (5%) Determine the vector field

$\vec{F}(x, y) = [2 \sinh(xy) + 2xy \cosh(xy)]\vec{i} + [2x^2 \cosh(xy)]\vec{j}$ whether it is conservative in the entire plane D .

(b) (10%) If it is, find the potential function.

(c) (5%) Then evaluate $\int_C \vec{F} \cdot d\vec{R}$ for C any path from the first point $(1, 0)$ to the second point $(2, 1)$.