

所別：機械工程學系碩士班 丁組(系統) 科目：工程數學(含程式設計)
戊組(生醫)

光機電工程研究所碩士班

Ordinary Differential Equation (25 %)

1. Assuming that the radium decomposes at a rate proportional to the amount present, in how many years will half the original amount be lost if 10% disappears in 263 years. (9%)
2. (a) Show that $y_1 = x$ and $y_2 = x^2$ are both linearly independent solutions of $x^2 y'' - 2xy' + 2y = 0$ (4%)
(b) Find the particular solution for which $y(1) = 3$ and $y'(0) = 5$. (4%)
3. Compute by direct evaluation of the integral the Laplace transform $L[f(x)]$
(a) $f(x) = \sin 3x$ (4%)
(b) $f(x) = \begin{cases} 1 & 0 \leq t < 1 \\ 0 & t > 1 \end{cases}$ (4%)

Linear Algebra & Vector Calculus (25 %)

4. Find the surface integrate $\iint_S \mathbf{F} \cdot \mathbf{n} dA$, when $\mathbf{F} = [x^2, 0, 2y^2]$, S is the portion of the plane $3x + 2y + z = 6$ in the first octant ($x \geq 0, y \geq 0, z \geq 0$). (15%)
5. Consider the matrix \mathbf{A} , Determine matrices \mathbf{Q} and \mathbf{D} such that $\mathbf{Q}^{-1}\mathbf{A}\mathbf{Q} = \mathbf{D}$ is diagonal. (10%)

$$\mathbf{A} = \begin{bmatrix} 1 & 1 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & 2 \end{bmatrix}$$

Fourier Analysis, Partial Differential Equation and Complex Analysis (25 %)

6. Find the Fourier series of

$$f(x) = \begin{cases} 0 & -2 < x < 0 \\ x & 0 \leq x < 1 \\ 1 & 1 \leq x < 2 \end{cases} \quad (10\%)$$

注意：背面有試題

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7. (a) Use separation of variables to find the product solutions of

$$k \frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}, \quad k > 0 \quad (5\%)$$

- (b) Find the temperature $u(x, t)$ in a rod of length 2 if the initial temperature is

$$f(x) = \begin{cases} x & 0 < x < 1 \\ 0 & 1 < x < 2 \end{cases} \quad \text{throughout and if the ends } x = 0 \text{ and } x = 2 \text{ are insulated. (10\%)}$$

程式語言 (25 %)

8. 以下題目請使用 C、Basic 或 Fortran 程式語言回答，並且所有題目必須使用相同的程式語言回答。

(a) 有三個變數 A、B、C，分別為整數、雙精度實數與布林運算；另外 D 為一維矩陣，元素個數 10 個，資料型態為字元，請分別宣告。(4%)

(b) 階乘 $n!$ 定義為 $n! = 1 \times 2 \times 3 \times \dots \times n$ ，請寫出一程式碼計算 $n!$ ，所有變數均請宣告。(6%)

(c) 如下圖，x 由 0.0 到 8.0，增量為 0.2，請寫出一具有迴圈的程式，計算 y 值，請將 y 值儲存於一矩陣 A 內，所有變數均請宣告。(15%)

