所別：光機電工程研究所碩士班 甲組(機電系統控制組)
機械工程學系碩士班 丁組(系統)
生物醫學工程研究所碩士班

科目：工程數學及程式設計
工程數學(含程式設計)

一、(25%=5%+5%+10%+5%)

1.

(a) Solve the initial value problem $y' + y^2 = 1,\ y(0) = 0$. (5%)

(b) Find the general solution of the differential equation (5%)

$$\frac{dy}{dx} = \frac{-y\cos x - \sin y}{x\cos y + \sin x}$$

2. Find the general solution of the differential equation (10%)

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

3. Consider the eigenvalue problem

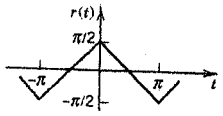
$$(p(x)y')' + \{q(x) + \lambda r(x)\}y = 0,\quad \alpha < x < \beta$$
$$p(\alpha) = p(\beta),\ y(\alpha) = y(\beta),\ y'(\alpha) = y'(\beta)$$

where $p \geq 0$, $q \leq 0$, and $r > 0$ are all real and continuous for $\alpha \leq x \leq \beta$.

(a) Show that eigenfunctions corresponding to distinct eigenvalues are orthogonal with respect to the weight function $r(x)$. (5%)

二、(25% = 9%+9%+7%)

1. Find the Fourier series of the periodic function $r(t)$ of period $p = 2\pi$, as shown below. (9%)



2. Mathematically prove that the eigenvalues of a symmetric matrix are real. (9%)

3. It has been known that $curl(\nabla f)$ is a zero vector for any twice continuously differentiable scalar function f. Physically explain why ? (7%)

注意：背面有試題

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三、工程數學(25% = 12%+13%)

1. Use the Laplace transform to solve

$$\frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial t^2}, \quad 0 < x < 3, \quad t > 0$$

$$u(0,t) = 0, \quad u(3,t) = 0, \quad t > 0$$

$$u(x,0) = \sin\frac{\pi x}{3}, \quad \left.\frac{\partial u}{\partial t}\right|_{t=0} = 0 \qquad (12\%)$$

2. Evaluate $\int_0^{\pi} \frac{\cos 2\theta}{2-\cos\theta} d\theta$. (13%)

四、程式設計(25%=10%+15%)

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。

1.請寫出一迴圈，計算 y=a×x，其中 a=10，x 由 10 到 50，請用 for 迴圈寫出程式，所有變數均請宣告。 (10%)

2.對於任意一整數 n，試寫出一段程式判斷 n 是否爲質數。若 n 爲質數，則變數 Flag 之值爲「1」，否則 Flag 爲「0」。假設 n 之值已知，程式中無需管其輸入方式，所有變數均請宣告。 (15%)