國立臺灣科技大學 110 學年度碩士班招生試題

系所組別：材料科學與工程系碩士班乙組

科　　目：工程數學

(總分為 100 分)

1. Solve the differential equation (10%)

$$xy' + (1+x)y = e^{-x}\sin 2x$$

2. Use the given change of variable to find the general solution of the following differential equation in terms of Bessel functions. (10%)

$$9x^2y'' + 9xy' + (4x^{\frac{2}{3}} - 16)y = 0 \qquad z = 2x^{\frac{1}{3}}$$

3. Solve the differential equation (15%)

$$3y'' - 6y' + 30y = 15\sin x + \frac{e^x}{\cos 3x}$$

4. Solve the initial value problem by using the Laplace transform. (15%)

$y'' - 4y' + 4y = f(t)$; $y(0) = -2$, $y'(0) = 1$, with

$$f(t) = \begin{cases} 2 & 0 \le t < 3 \\ 4 & t \ge 3 \end{cases}$$

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5. Please find the half-range cosine and sine expansions of the given function.(15%)

$$\mathbf{f(x)}=\begin{cases} x, & 0<x<\pi/2 \\ \pi-x, & \pi/2\le x<\pi \end{cases}$$

6. Please use the method of undetermined coefficients to solve the given system. (15%)

$$X'=\begin{pmatrix} 4 & 1/3 \\ 9 & 6 \end{pmatrix}X+\begin{pmatrix} -3 \\ 10 \end{pmatrix}e^{t}$$

7. Evaluate $\oint_C (x^2-y^2)ds$, where C is given by $x = 6\cos t, y = 6\sin t, 0 \le t \le 2\pi$. (10%)

8. Find a value of x which the matrix $\mathbf{A}=\begin{pmatrix} 4 & -3 \\ x & -4 \end{pmatrix}$ is its own inverse. (10%)