106 ME 02

國立臺北科技大學 106 學年度碩士班招生考試

系所組別：1120 機械工程系機電整合碩士班乙組

第一節　工程數學　試題

注意事項：

1. 本試題共 5 題，每題 20 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. Solve the following differential equation: (20%)

(a) $y' + \frac{1}{4}y = \frac{1}{4}(2-3x)y^5$ (10%)

(b) $y'' + 9y = 9\sec(3x)$ (10%)

2. Solve the following differential equation using Laplace transform: (20%)

$$xy'' + 2y' + (2-x)y = 2e^x, \qquad y(0) = 0$$

3. Consider this one dimensional heat transfer problem: (20%)

$$\frac{\partial \phi}{\partial t} = \alpha^2 \frac{\partial^2 \phi}{\partial x^2} \quad 0 < x < 10$$

with a boundary condition:

$$\frac{\partial \phi}{\partial x}(0,t) = \frac{\partial \phi}{\partial x}(10,t) = 0$$

(a) Find the solution of this problem (10%)

(b) Given $\phi(x,0) = x^2$, find $\phi(5, t \to \infty)$ (10%)

4. Determine the Fourier series of the function f(x): (20%)

$$f(x) = x^2 - x + 3$$

5. Evaluate the following integral: (20%)

(a)

$$\int_\gamma z\mathrm{Re}(z)dz, \text{ if } \gamma(t) = t - it^2 \text{ for } 0 \le t \le 3 \text{ (10\%)}$$

(b)

$$\int_0^\infty \frac{cos(x)}{x^2+1}dx \quad (10\%)$$