110ME02

國立臺北科技大學 110 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. 本試題共七題，每題 10-15 分，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
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. Use the integrating factor method to solve the following ordinary differential equation.

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

(10%)

2. Solve for the following ordinary differential equation

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

(15%)

3. Use the undetermined coefficient method to solve the following ordinary differential equation

$$y'' + y = \cos(x)$$

(15%)

4. Use the Lagrange method (variation parameter method) to solve the same ordinary differential equation shown in problem 3.

$$y'' + y = \cos(x)$$

(15%)

5. Using the Laplace transform to solve the following initial value ordinary differential problem.

$$y'' + 8y' + 16y = t^2 e^{-4t}$$
$$y(0) = 1, \quad y'(0) = -4$$

(15%)

6. Use the Laplace transform to solve the following ordinary differential equation.

$$y'' + 4y = f(t)$$
$$y(0) = y'(0) = 1$$
$$f(t) = \begin{cases} 0\ , 0 \le t < \pi \\ 3\cos(t)\ , \ t \ge \pi \end{cases}$$

(15%)

7. An elastic string of length L with fixed ends is released from rest (zero initial velocity) from an initial position given as a function of $y = f(x)$. The initial-boundary value problem for the position function $y(x,t)$ is

$$\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2} \quad \text{for } 0 < x \le L, t > 0$$
$$y(0,t) = y(L,t) = 0, t \ge 0$$
$$y(x,0) = f(x)$$
$$\frac{\partial y}{\partial t}(x,0) = 0$$

Please solve for the function of the position function $y(x,t)$
(15%)