編號： 133、139、166

國立成功大學 109 學年度碩士班招生考試試題

系　　所：航空太空工程學系、民航研究所、能源工程國際碩士學位學程

考試科目：工程數學

考試日期：0210，節次：3

※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. For a differential equation $2xy' + y = 0$
   a. (2%) Show that $2xy' + y = 0$ can be written as $ydx + 2xdy = 0$
   b. (4%) Solve the differential equation using separable method
   c. (2%) Is this differential equation exact?
   d. (7%) If yes, solve. If not, look for an integrating factor and solve.

2. Solve the initial value problem, $y'' - 6y' + 9y = e^{3x}$,
   a. (3%) Solve the homogeneous solution
   b. (5%) Solve the nonhomogeneous solution
   c. (2%) Solve the initial problem, $y(0) = 1, y'(0) = 1$

3. (15%)
   Using Frobenius Method to solve $x^2y'' + (x^2 + x)y' - y = 0$. Try to identify the series as expansions of known functions. Show the details of your work.

4. (20%)
   Use Laplace inverse to solve the following equation:
   $$Y(s) = \frac{1.151\,s + 0.1774}{s^4 + 0.739\,s^3 + 0.921\,s^2}$$

5. (20%)
   $$\frac{\partial^2 T}{\partial x^2} + x = \frac{\partial T}{\partial t} \quad \text{in } 0 < x < 1, \text{ for } t > 0$$
   with the boundary conditions of
   $$\frac{\partial T}{\partial x} = 0 \quad \text{at } x = 0, \text{ for } t > 0$$
   $$T = a \quad \text{at } x = 1, \text{ for } t > 0$$
   and the initial condition of $T = a$ at $t = 0$, in $0 \le x \le 1$
   Find the solution of T(x, t).

6. (20%)
   Find the finite Fourier consine transform of the function:
   a) $f(x) = \begin{cases} 2 & \text{for } 0 \le x \le 0.5 \\ -1 & \text{for } 0.5 < x \le \pi \end{cases}$ (10%)
   b) $f(x) = e^{-x} \quad 0 \le x \le \pi$ (10%)