淡江大學九十四學年度碩士班招生考試試題

系別：機械與機電工程學系　　科目：工　程　數　學

1. (15%)　Solve the initial value problem.
   $$x^2 y'' - xy' = 0; \quad y(2) = 9, y'(2) = 8$$

2. (15%)　Find the general solution of
   $$y'' + 4y = x + e^{-3x}$$

3. (15%)　Find the Fourier series of the function on the interval.
   $$f(x) = 1 \quad -1 \le x \le 1$$

4. (15%)　Use the Laplace transform to solve the system.
   $$2x' - 3y + 2y' = 0$$
   $$x' + y' = 1$$
   $$x(0) = y(0) = 0$$

5. (20%)　Solve the boundary value problem
   $$\frac{\partial u}{\partial t} = k \frac{\partial^2 u}{\partial x^2} \quad \text{for } 0 < x < L, \, t > 0$$
   $$\frac{\partial u}{\partial x}(0,t) = \frac{\partial u}{\partial x}(L,t) = 0 \quad \text{for } t > 0$$
   $$u(x,0) = f(x) \quad \text{for } 0 < x < L$$

6. (20%)　(a) Determine whether $\vec{F}$ is conservative.
   (b) If it is, find a potential function (ϕ)
   (c) Evaluate $\oint_C \vec{F} \cdot d\vec{r}$ for
   C any path from point p_A to point p_B.
   $$\vec{F} = 3x^2(y^2 - 4y)\vec{i} + (2x^3 y - 4x^3)\vec{j}$$
   $$p_A = (-1,1)$$
   $$p_B = (2,3)$$