國立中正大學 106 學年度碩士班招生考試試題

系所別： 化學工程學系
光機電整合工程研究所

科目：工程數學

第 1 節

第 1 頁，共 1 頁

1. (15 points) Solve y' + y/x = sin x, associated with the condition: y(π) = 1.

2. Solve the following second-order ordinary differential equation: y" + 4y = x²sin 2x.
   (a) (10 points) Find the homogeneous solution.
   (b) (10 points) Find the particular solution.

3. (15 points) Evaluate the Laplace transform of the following function:

$$\int_0^t \frac{\sin wt}{t} dt$$

4. (15 points) Compute $\int\limits_0^\infty \exp(-x^2)dx$.

5. (a) (15 points) Solve $u_t = \alpha\, u_{xx}$, where α is the diffusion coefficient, with the initial and boundary conditions.

   For t = 0, u = 0.

   For t > 0, u = 1 at x = 0

   u = 0 at x = ∞

   (b) (5 points) If concentration at one location x = 0.1 cm reaches a certain value at t = 3 min, how long it takes to reach the same concentration at the other location x = 0.2 cm.

6. (15 points) Solve the heat transfer of a hot metal rod described by

   $u_t = u_{xx}$

   with IC: u(x,0) = sin(x) + 0.2 sin(100x) + $\frac{2}{\pi}$x +1, and BCs: u(0,t) = 1, u(π, t) = 3.