國立臺灣科技大學

九十一學年度博士班招生考試試題

系所組別：機械工程系甲一組、甲二組、乙組、丙組、丁組

科　目：　工程數學

ENGINEERING MATHEMATICS

(Entrance examination for Ph. D. program in ME)

Five problem test, 20 points for each problem.

1. Find the general solution of the following differential equation

$$y' = \frac{3x - y - 9}{x + y + 1}$$

2. Find the flux of $\mathbf{F} = x\mathbf{i} + y\mathbf{j} - z\mathbf{k}$ across the part of the plane $x + 2y + z = 8$ lying in the first octant.

3. Find the orthogonal matrix Q that transforms the following quadratic form into the standard form:

$-3x_1^2 + 4x_1x_2 + 7x_2^2$

Also find the standard form.

4. Solve the following boundary value problem.

$$\frac{\partial^2 y}{\partial t^2} = 3\frac{\partial^2 y}{\partial x^2} + 2x \qquad (0 < x < 2, t > 0)$$

$$y(0,t) = y(2,t) = 0 \qquad (t > 0)$$

$$y(x,0) = \frac{\partial y}{\partial t}(x,0) = 0 \qquad (0 < x < 2)$$

5. Apply the residue theorem to evaluate

$$\int_{-\infty}^{\infty} \frac{\cos(sx)}{k^2 + x^2} dx \quad \text{and} \quad \int_{-\infty}^{\infty} \frac{\sin(sx)}{k^2 + x^2} dx \qquad (k > 0)$$