

## 國立臺灣科技大學 104 學年度碩士班招生試題

系所組別：材料科學與工程系碩士班乙組  
 科目：工程數學

(總分為 100 分)

1. A particle moves in a straight line in such a way that its distance  $x$  from the origin at time  $t$  obeys the differential equation  $x'' + x' + x = 0$ . Assuming it starts from the origin with speed 30 ft/sec, what will be its distance from the origin and its speed at  $\pi/\sqrt{3}$  seconds? (10%)

2. The steady-state temperature distribution  $u$  within a hollow sphere, of inner radius  $r_1$  and outer radius  $r_2$ , is governed by the differential equation

$$r \frac{d^2 u}{dr^2} + 2 \frac{du}{dr} = 0$$

Solve for  $u(r)$  if the inner surface  $r = r_1$  of the hollow sphere is kept at temperature  $u_1$  and the outer surface  $r = r_2$  is kept at temperature  $u_2$ . (10%)

3. Solve the differential equation: (20%)

$$x^2 y'' + (x^2 - x)y' - 3y = 0$$

4. Solve the initial value problem: (20%)

$$y''' + y'' + y' + y = f(t); \quad y(0) = 0, \quad y'(0) = 0, \quad y''(0) = 0, \text{ with}$$

$$f(t) = -1 + t - 2 \int_0^t f(t-\tau) \sin \tau d\tau$$

5. Find the angle between  $\mathbf{a} = 2\mathbf{i} + 3\mathbf{j} + \mathbf{k}$ ,  $\mathbf{b} = -\mathbf{i} + 5\mathbf{j} + \mathbf{k}$ . (10%)

6. Find the direction cosines and the direction angles of  $\mathbf{a} = 2\mathbf{i} + 5\mathbf{j} + 4\mathbf{k}$ . (10%)

7. Use Gauss-Jordan method to solve (10%)

$$\begin{matrix} x_1 + 3x_2 - 2x_3 = -7 \\ 4x_1 + x_2 + 3x_3 = 5 \\ 2x_1 - 5x_2 + 7x_3 = 19 \end{matrix}$$

$$4x_1 + x_2 + 3x_3 = 5$$

$$2x_1 - 5x_2 + 7x_3 = 19$$

8. Find the determinant of  $\mathbf{A} = \begin{pmatrix} 6 & 2 & 7 \\ -4 & -3 & 2 \\ 2 & 4 & 8 \end{pmatrix}$  (10%)

