

## 國立臺灣科技大學 108 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. Solve the initial value problem (10%)

$$xy' = y + \frac{x^5 e^x}{4y^3}, \quad y(1) = 0$$

2. Solve the differential equation (10%)

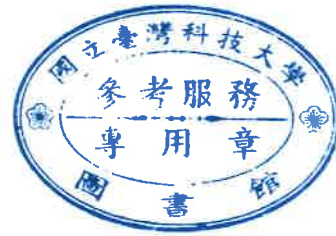
$$2(3x+1)^2 y'' + 21(3x+1)y' + 18y = 0$$

3. Solve the differential equation (15%)

$$y'' + 2y' + y = \frac{e^{-x}}{x}$$

4. Solve the initial value problem (15%)

$$y'' + 2y' + 2y = 2 + \delta(t - 2\pi), \quad y(0) = 1, \quad y'(0) = -1$$



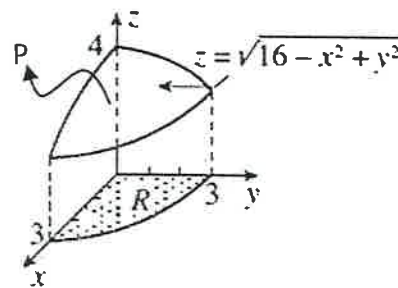
## 國立臺灣科技大學 108 學年度碩士班招生試題

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)

5. If  $\sigma(x,y,z)$  is charge density in an electrostatic field, then the total charge on a surface  $S$  is  $Q = \iint_S \sigma(x,y,z) dS$ . Find the total charge on that part of the hemisphere  $z = \sqrt{16 - x^2 - y^2}$  that is inside the cylinder  $x^2 + y^2 = 9$  if the charge density at a point P on the surface is directly proportional to distance from the  $xy$ -plane. (20%)



6. Find the general solution of the given system. (10%)

$$\mathbf{X}' = \begin{pmatrix} -6 & 2 \\ -3 & 1 \end{pmatrix} \mathbf{X}$$



7. A rod of length  $L$ , coincides with the interval  $[0,L]$  on the  $x$ -axis. Set up the boundary-value problem for the temperature  $u(x, t)$ . The left end is held at temperature  $u_0$ , and the right end is held at temperature  $u_1$ . The initial temperature is zero throughout. (10%)
8. Find the volume of the parallelepiped for which the given vectors are three edges.  
 $\mathbf{a} = 3\mathbf{i} + \mathbf{j} + \mathbf{k}$ ,  $\mathbf{b} = \mathbf{i} + 4\mathbf{j} + \mathbf{k}$ ,  $\mathbf{c} = \mathbf{i} + \mathbf{j} + 5\mathbf{k}$  (10%)