

國立臺灣科技大學

九十一學年度碩士班招生考試試題

系所組別：電子工程系乙一組、電子工程系乙二組、電子工程系乙三組、電子工程系丙組
 科目：工程數學

(總分 100 分)

1. (15%) Solve $4y'' + 4(e^x - 1)y' + e^{2x}y = 0$

Note: Let $t = (1/2)x$

2. (10%) Solve $y'' + 4y = 3\delta(t-2); y(0)=3, y'(0)=0$

3. (15%) Show

$$\begin{vmatrix} 1 & 1 & 1 & 1 & 1 \\ \alpha & \beta & \gamma & \delta & \varepsilon \\ \alpha^2 & \beta^2 & \gamma^2 & \delta^2 & \varepsilon^2 \\ \alpha^3 & \beta^3 & \gamma^3 & \delta^3 & \varepsilon^3 \\ \alpha^4 & \beta^4 & \gamma^4 & \delta^4 & \varepsilon^4 \end{vmatrix} = (\beta - \alpha)(\gamma - \alpha)(\delta - \alpha)(\varepsilon - \alpha) \\ (\gamma - \beta)(\delta - \beta)(\varepsilon - \beta) \\ (\delta - \gamma)(\varepsilon - \gamma) \\ (\varepsilon - \delta)$$

4. (10%) Use Gram-Schmidt process to find three orthonormal vectors from

$$v_1 = \begin{bmatrix} 1 \\ 7 \\ 1 \\ 7 \end{bmatrix}, v_2 = \begin{bmatrix} 0 \\ 7 \\ 2 \\ 7 \end{bmatrix}, v_3 = \begin{bmatrix} 1 \\ 8 \\ 1 \\ 6 \end{bmatrix}$$

5. (10%) Invert the Z transform $X(z) = 1/(1-az^{-1})^2, |z| > a$.6. (15%) Given a joint density function $f(x,y)$. Let $f(x,y) = x(1+3y^2)/4$ for $0 < x < 2, 0 < y < 1$ and $f(x,y) = 0$ elsewhere. Find its marginal densities and the conditional density $f(x|y)$.

7. (10%) Find

(a) $\oint_C F \cdot dR, F = \langle x, y, -z \rangle, C$ the circle $x^2 + y^2 = 4, z = 0$.(b) $\int_{\Sigma} f(x,y,z) d\sigma$, where $f(x,y,z) = y, \Sigma$ the part of cylinder $z = x^2$ for $0 < x < 2, 0 < y < 3$.8. (15%) Compute $\oint_{\Gamma} f(z) dz$, where $f(z) = (2jz - \sin z)/(z^3 + z)$ and Γ is a closed path that enclosed $0, j$, and $-j$.Note: $\int \sqrt{x^2 + a^2} dx = (1/2) [x\sqrt{x^2 + a^2} + a^2 \ln(x + \sqrt{x^2 + a^2})]$ 