國立聯合大學 100 學年度碩士班考試招生

光電工程學系碩士班 入學考試試題

科 目：工程數學 第 1 頁共 1 頁

1. Find an integrating factor and solve the initial value problem (20%)

$$(e^x - \sin y)dx + \cos y dy = 0, \qquad y(0) = \frac{\pi}{2}.$$

2. Solve the initial value problem by the Laplace transform. (20%)

$$y^{(4)} - y = 0, \qquad y(0) = y'(0) = y''(0) = 0, \; y'''(0) = 2.$$

3. Use the frequency convolution theorem to find the Fourier transform for the function shown below (20%)

$$f(x) = \begin{cases} 2\cos(t) & , \; -10\pi < t < 10\pi \\ 0 & , \; otherwise \end{cases}$$

4. $\phi(x, y, z) = x^2 + y^2 + 2z^2$ (20%)

(a) What is the directional derivation at the point $(1,1,1)$ in the direction $\vec{u} = \hat{x} + \hat{y} + \hat{z}$?

(b) What is the normal vector of $\phi(x, y, z)$ at the point $(1,1,1)$?

5. Both of A and B are 5×5 matrices , where (20%)

$$A = \begin{bmatrix} -2 & 7 & 9/2 & 3 & 11 \\ 0 & 1 & 3/4 & -13 & 4 \\ 0 & 0 & 1 & 5 & -4 \\ 0 & 0 & 6 & 1/2 & 0 \\ 0 & 0 & -8 & 0 & 0 \end{bmatrix} \qquad B = \begin{bmatrix} 2 & 3 & 1 & 4 & 2 \\ 1 & 3 & 2 & 4 & 2 \\ 0 & 1 & 4 & 0 & 4 \\ 1 & 1 & 2 & 2 & 2 \\ 0 & 3 & 3 & 3 & 3 \end{bmatrix}$$

Find the determinants of following matrices.

(a) A (b) B (c) $-2A^{-1}B^2$ (d) $(((B^T A^{-1})^T)^{-1})^T$

(A^{-1} is the inverse matrix of A. B^T is the transpose matrix of B .)