

國立臺北科技大學九十八學年度碩士班招生考試

系所組別：2401 2402 光電工程系碩士班不分組

第一節 工程數學 試題

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**注意事項：**

1. 本試題共 8 題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

一、Use the Fourier transform to solve  $y''+6y'+5y = \delta(t-3)$  . (8%)

二、Solve by Laplace transform (10%)

$$\frac{\partial w}{\partial x} + x \frac{\partial w}{\partial t} = x, \quad w(x,0) = 1, \quad w(0,t) = 1$$

三、Evaluate

1.  $\int_0^{\pi} \frac{d\theta}{2 + \cos \theta}$  (10%)

2.  $\int_0^{2\pi} \frac{1 + 4 \cos \theta}{17 - 8 \cos \theta} d\theta$  (10%)

3.  $\int_0^{2\pi} e^{\cos(\theta)} \cos(\sin(\theta)) d\theta$  (10%)

四、Find all solutions of  $\sin(z) = i$  . (8%)

五、Show that for any real number  $\nu$ , (12%)

$$\left[ x^{-\nu} J_{\nu}(x) \right]' = -x^{-\nu} J_{\nu+1}(x)$$

and

$$\left[ x^{\nu} J_{\nu}(x) \right]' = x^{\nu} J_{\nu-1}(x)$$

六、Solve (12%)

$$\frac{\partial^2 z}{\partial t^2} = \frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial y^2} \quad \text{for } 0 < x < 2\pi$$

$$0 < y < 2\pi, \quad t > 0$$

$$z(x,0,t) = z(x,2\pi,t) = 0 \quad \text{for } 0 < x < 2\pi, \quad t > 0$$

$$z(0,y,t) = z(2\pi,y,t) = 0 \quad \text{for } 0 < y < 2\pi, \quad t > 0$$

$$z(x,y,0) = x^2 \sin(y) \quad \text{for } 0 < x < 2\pi, \quad 0 < y < 2\pi$$

$$\frac{\partial z}{\partial t}(x,y,0) = 0 \quad \text{for } 0 < x < 2\pi, \quad 0 < y < 2\pi$$

七、Find the flux of the vector field  $\mathbf{F} = xy^2\mathbf{i} + yz^2\mathbf{j} + zx^2\mathbf{k}$  across the surface

$$\sum \text{ bounding the cylinder } 2 \leq x^2 + y^2 \leq 4, \quad 0 \leq z \leq 7 .$$

(10%)

八、Solve the initial value problem by the Laplace transform.

$$y_1' = 2y_1 + y_2, \quad y_2' = 4y_1 + 2y_2 + 64tu(t-1), \quad y_1(0) = 2, \quad y_2(0) = 0$$

(10%)