

# 國立臺北科技大學九十八學年度碩士班招生考試

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## 第一節 工程數學 試題

第一頁 共一頁

### 注意事項：

1. 本試題共 5 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。

Problem 1. (25%)

- a) (10%) Please find the curve equation passing the original coordinate point and the curve maintain a constant  $45^\circ$  intersection angle with the curve set of  $y = \frac{c}{x-1}$  where  $c$  is constant.

- b) (15%) Please find the solution of following ordinary differential equation.

$$(x^2 + 1)y'' - 2xy' + 2y = 12(x^2 + 1)^2$$

$$\text{Boundary condition } y(x=0) = 0, y(x=1) = 9$$

Problem 2. (25%)

Please solve the following initial value problem by Laplace transform method

$$y'' + 2y' + 5y = f(t) \quad \text{where } f(t) = \begin{cases} k & 0 < t < \pi \\ -k & \pi \leq t < 2\pi \end{cases} \quad f(t+2\pi) = f(t)$$

$$\text{Initial condition } y(t=0) = 0, y'(t=0) = 1 \quad \text{where } k \text{ is constant}$$

- a) (10%) Please use form of  $\tanh\left(\frac{\pi s}{2}\right)$  to represent Laplace transform of  $f(t)$ .
- b) (15%) Please find the solution of  $y(t) = ?$

Problem 3. (25%)

Please use the matrix of  $A$  to find the following problems

$$A = \begin{bmatrix} 1 & 20 & 0 \\ -1 & 7 & 1 \\ 3 & 0 & -2 \end{bmatrix}$$

- a) (10%) The eigenvalues and eigenvectors of  $A$  matrix
- b) (15%) The matrix function  $e^{At} = ?$   $t$  is constant

Problem 4. (10%)

Please find the solution  $u(x, y)$  of first order partial differential equation

$$u_x + u_y = 2(x+y)u$$

$$\text{Boundary conditions } u(x=0, y=0) = 1, u(x=1, y=0) = e^2$$

Problem 5. (15%)

Please solve the following integral by complex variable function method

$$\int_0^{\infty} \frac{\sin(x^2)}{x^2} dx = ?$$