

# 國立臺北大學 109 學年度日間學士班暨進修學士班轉學生招生考試試題

學制系級：通訊工程學系日間學士班 3 年級

科 目：工程數學

第1頁 共1頁

可 不可使用計算機

1. (20%) Let  $z = x + iy$ , please find  $x$  and  $y$  for the following equations:

- (1)  $z = \overline{z_1} / \overline{z_2}$ , Let  $z_1 = -2 - 10i$ ,  $z_2 = 5 - i$
- (2)  $z = (\overline{z_1 / z_2})$ , Let  $z_1 = -2 - 10i$ ,  $z_2 = 5 - i$
- (3)  $\ln z = e + \pi i$
- (4)  $\ln z = 0.4 + 0.2i$

2. (20%) Let  $z = x + iy$ , please use Cauchy-Riemann Equations to verify if the following function is analytic or not?

- (1)  $f(z) = e^x(\cos y + i \sin y)$
- (2)  $f(z) = z^2$

3. (18%) For the following differential equation

$$y''(x) + 6y'(x) + 5y(x) = 0,$$

- (1) (12%) find two linearly independent solutions and compute their Wronskian;
- (2) (6%) find the solution if  $y'(0) = y''(0) = 4$ .

4. (10%) Solve the following differential equation

$$y''(x) - 4y'(x) + 4y(x) = \frac{e^{2x}}{x^4}.$$

5. (12%) For the differential equation  $y''(t) + y(t) = r(t)$  where

$$r(t) = \begin{cases} 1, & 0 < t < 1 \\ 0, & \text{otherwise,} \end{cases}$$

- (1) (6%) find the Laplace transform of  $r(t)$ ;
- (2) (6%) solve the differential equation if  $y(0) = y'(0) = 0$ .

6. (10%) The function  $f(x)$  be partially defined by

$$f(x) = \begin{cases} \frac{\pi}{2}, & 0 < x \leq \frac{\pi}{2}, \\ \pi - x, & \frac{\pi}{2} < x < \pi. \end{cases}$$

If  $f(x)$  is an odd periodic function with period  $2\pi$ , find its Fourier series representation.

7. (10%) Given the vector function  $f(x, y, z) = [x^2 + y^2, 3xy + z^2, 4z^3]$ , find  $\operatorname{div} f$  and  $\operatorname{curl} f$ .