

# 國立交通大學 101 學年度碩士班考試入學試題

科目：工程數學(3111)

考試日期：101 年 2 月 17 日 第 1 節

系所班別：土木工程學系

組別：土木系丁組一般生

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【可使用計算機】\*作答前請先核對試題、答案卷(試卷)與准考證之所組別與考科是否相符!!

1. Find the general solution of the following differential equation. (10%).  

$$y'' + y = 2 \cos x$$
  
2. Solve the following initial value problem. (10%)  

$$y'' + 2y = f(t) \quad \text{and} \quad y(0) = y'(0) = 0$$

where  $f(t) = \begin{cases} 1 & 0 < t < 1 \\ 0 & \text{Otherwise} \end{cases}$
  
3. Find the general solution for the systems of differential equations. (15%)  

$$\begin{aligned} y_1' &= 2y_1 + 2y_2 + 12 \\ y_2' &= 5y_1 - y_2 - 30 \end{aligned}$$
  
4. Find the power series solution in powers of  $x$ . (Show details of your work.) (15%)  

$$(2x^2 - 3x + 1)y'' + 2xy' - 2y = 0$$
  
5. Is the given function even or odd? Find its Fourier series. (15%)  

$$f(x) = \begin{cases} x & \text{if } -\pi/2 < x < \pi/2 \\ \pi - x & \text{if } \pi/2 < x < 3\pi/2 \end{cases}$$
  
6. 解出 (a)通過點：(1, 2, 1), (3,0,3), (1, 3, 2)的平面方程式 (5%)  
 (b)通過點：(2,6), (6,4), (7,1)的圓方程式 (5%)
  
7. 解出 (a)  $\text{div}(\text{curl}(f+g))$ ,  $f = x^2 \mathbf{i} + (y-z)^2 \mathbf{j} + xy \mathbf{k}$ ,  $g = (x+y)^2 \mathbf{i} + z^2 \mathbf{i} + 2yz \mathbf{k}$  (10%)  
 (b)頂點為 (-1, 0, 1), (4, 4, 5), (0, 1, 0), (2, 2, 0) 的四面體體積 (5%)
  
8. 假設  $f(x,y) = xy$  為某物體的密度函數。此物體涵蓋的區域 ( $R$ ) 為： $0 \leq y \leq x, 0 \leq x \leq 1$ ,  
 試解出其重心位置  $(x, y)$  (the coordinates of the center of gravity of the mass). (10%)