

109ME01

# 國立臺北科技大學 109 學年度碩士班招生考試

系所組別：1111、1112 機械工程系機電整合碩士班甲組

## 第一節 工程數學 試題

第 1 頁 共 1 頁

### 注意事項：

1. 本試題共 5 題，每題 20 分，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. Please solve the following differential equation: (20%)

(1)  $x^2y'' + xy' - y = \frac{1}{x+1}$  (10%)

(2)  $x(x-1)y'' + (3x-2)y' + y = 0$  (10%)

2. Using the Laplace transform to solve the initial value problem (20%)

$ty'' + (4t+2)y' - 4y = 0; y(0) = 2$

3. (1) Use Gauss elimination to solve the following system equation (10 %)

$$\begin{cases} x_1 + x_2 - 1x_3 = -3 \\ 2x_1 + 3x_2 + 5x_3 = 7 \\ x_1 - 2x_2 + 3x_3 = -11 \end{cases}$$

(2) Find the eigenvalue and corresponding eigenvector of  $A = \begin{pmatrix} 1 & 2 & 3 \\ 0 & 5 & 6 \\ 0 & 0 & -7 \end{pmatrix}$ .

(10 %)

4. (1) Use Green's theorem to evaluate the given line integral,  $\oint_C (x+y^2)dx + (2x^2 - y)dy$ ,

where  $C$  is the boundary of the region determined by the graphs of  $y = x^2$ ,  $y=4$ . (10 %)

(2) Use Stokes' theorem to evaluate the integral  $\oint_C \vec{F} \cdot d\vec{r}$ ; where  $\vec{F} = y^3\vec{i} - x^3\vec{j} + z^3\vec{k}$ ;

$C$  is the trace of the cylinder  $x^2 + y^2 = 1$  in the plane  $x + y + z = 1$ . (10 %)

5. Please solve the following PDE. (20 points)

PDE  $\frac{\partial u(x,t)}{\partial t^2} = \frac{\partial^2 u(x,t)}{\partial x^2}$

BC  $u(0,t) = u(\pi,t) = 0, t > 0, t > 0$

IC  $u(x,0) = \frac{1}{6}x(\pi^2 - x^2), \frac{\partial u}{\partial t}\Big|_{t=0} = 0, 0 < x < \pi$