

高苑科技大學 95 學年度機械與自動化工程研究所碩士班入學考試試題卷

注意事項：1.請作答於另附之空白答案紙上，否則不予計分，並註明題號

考試科目：工程數學

1. 求函數 $f(t) = e^{2t}(\cos 3t + \sin 3t)$ 之 Laplace 轉換 (15%)

2. 以 Laplace Transform 解以下方程式 (15%)

$$y'' - 4y' + 3y = 10e^{-2x}, y(0) = 2, y'(0) = 2$$

3. 請以矩陣方法求解聯立方程組 (15%)

$$\begin{cases} 3x_1 - x_2 + 2x_3 = 6 \\ x_1 + 2x_2 - x_3 = -2 \\ 2x_1 + x_2 - 4x_3 = -3 \end{cases}$$

4. 求 $I = \int_c (x^2 + y^2) ds$ (1) c 沿著 $y = -x$ 由(2,-2)至(1,-1) (2) c 沿著 $x^2 + y^2 = 4$ 順時針由(0,2)至(2,0)。 (15%)

5. 一流體之流動速度場為 $\vec{V} = 2xi' - 4yj' + 2zk'$ ，證明此流場不可旋轉與壓縮並求勢位函數 ϕ 。(15%)

6. 設 I_1, I_2, I_3 為下列矩陣 H 的特徵值，試求(1) $I_1 + I_2 + I_3$ (2) $\sum_{i=1}^3 I_i^2$ (15%)

$$H = \begin{pmatrix} 2 & -1 & -3 \\ -1 & 1 & 2 \\ -3 & 2 & 3 \end{pmatrix}$$

7. 試求以 a, b, c 為鄰邊之四面體的體積。(10%)

$$a = i + 2k, b = 4i + 6j + 2k, c = 3i + 3j - 6k$$

1. $f(x, y, z) = x^2 + xy + z^2$, 且 $x(t) = t$, $y(t) = t^2$, $z(t) = t^3$ 求 $\frac{df}{dt}$ (15%)

2. Find the solution of T: $\frac{dT}{dt} = k(T - T_m)$; $T(0) = T_0$, k, T_m and T_0 are constants (15%)

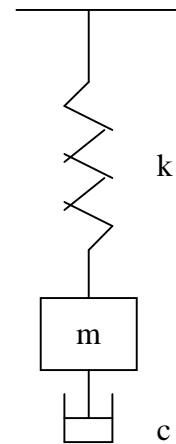
3. Solve: $x^2 y'' - 2xy' + 2y = x^4 e^x$ (15%)

4. 解 $\frac{d^2x}{dt^2} + 3\frac{dx}{dt} + 4x = t$, $x(0) = 0$, $x'(0) = 0$, $x(0) = 1$ (15%)

5. $y'' + 4y = -2$, $y\left(\frac{\pi}{8}\right) = \frac{1}{2}$, $y'\left(\frac{\pi}{8}\right) = 2$ (15%)

6. 求解 $y''' - y'' + 2y = 0$ (10%)

7. A mechanical system with mass m , spring constant k and damping constant c , as shown below, is governed



by linear D.E. $m\ddot{y} + c\dot{y} + ky = 0$, plot the motion on the $y-t$ plane for (15%)

(a) $c=0$ (undamped)

(b) $c^2 > 4mk$ (overdamping), and

(c) $c^2 < 4mk$ (underdamping)