國立高雄科技大學 108 學年度碩士班 招生考試 試題紙

系 所 別：機械工程系碩士班　　組　別：乙組

考科代碼：1034　　考　科：工程數學

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注意事項：

1、各考科一律可使用本校提供之電子計算器，**考生不得使用自備計算器**，違者該科不予計分。

2、請於答案卷上規定之範圍作答，違者該題不予計分。

(一) 選擇題(單選)：(每題 5 分)

1. Which one is the solution of this differential equation?

$$(1+x)dy - y\,dx = 0$$

(a) $y = c(1+x)$

(b) $y = c\ln(1+x)$

(c) $y = c(1+x)^{-1}$

(d) $y = (1+x)+c$

2. Find the critical point(s) of the differential equation $\frac{dV}{dt} = V\sqrt{c+mP}$ where c and m are nonzero constants.

(a) $1, -\frac{c}{m}$

(b) $0, \frac{c}{m}$

(c) $0, -\frac{c}{m}$

(d) $-\frac{c}{m}$

3. Which one is not the exact equation?

(a) $(5x+4y)dx + (4x-8y^3)\,dy = 0$

(b) $(x^2-y^2)dx + (x^2-2xy)\,dy = 0$

(c) $(x - y^3 + y^2\sin x)\,dx = (3xy^2 + 2y\cos x)\,dy$

(d) $(3x^2y + e^y)\,dx + (x^3 + xe^y - 2y)\,dy = 0$

4. Which one is the linear equation?

(a) $(1-x)y'' - 4xy' + 5y = \cos x$

(b) $x\frac{d^3y}{dx^3} - \left(\frac{dy}{dx}\right)^4 + y = 0$

(c) $\frac{d^2u}{dr^2} + \frac{du}{dr} + u = \cos(r+u)$

(d) $\frac{d^2y}{dx^2} = \sqrt{1+\left(\frac{dy}{dx}\right)^2}$

5. Which one is linearly independent of the given set of functions on the interval $(-\infty, \infty)$?

(a) $f_1(x) = x$, $f_2(x) = x^2$, $f_3(x) = 4x - 3x^2$

(b) $f_1(x) = 0$, $f_2(x) = x$, $f_3(x) = e^x$

(c) $f_1(x) = 1 + x$, $f_2(x) = x$, $f_3(x) = x^2$

(d) $f_1(x) = x$, $f_2(x) = x - 1$, $f_3(x) = x + 3$

(二) 計算題：(每題 15 分)

1. Find the general solution of the nonhomogeneous differential equation.

$$y'' - 4y' + 4y = 2e^{2x} + 4x - 12$$

2. Evaluate $\mathcal{L}^{-1}\left\{\frac{s^2+6s+9}{(s-1)(s-2)(s+4)}\right\}$

3. When $\mathbf{a} = 2\mathbf{i} + 4\mathbf{j}$, $\mathbf{b} = -\mathbf{i} + 4\mathbf{j}$, find (a) $3\mathbf{a}$, (b) $\mathbf{a} + \mathbf{b}$, (c) $\mathbf{a} - \mathbf{b}$, (d) $\|a + b\|$, (e) $\|a - b\|$, (f) $\mathbf{a} \cdot \mathbf{b}$, and (g) $\mathbf{a} \times \mathbf{b}$.

4. If $\mathbf{A} = \begin{pmatrix} 1 & 2 \\ 2 & 4 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} -2 & 3 \\ 5 & 7 \end{pmatrix}$, find (a) $\mathbf{A} + \mathbf{B}^T$, (b) $2\mathbf{A}^T - \mathbf{B}^T$, (c) $\mathbf{A}^T(\mathbf{A} - \mathbf{B})$

5. Find the inverse of $\mathbf{A} = \begin{pmatrix} 2 & 2 & 0 \\ -2 & 1 & 1 \\ 3 & 0 & 1 \end{pmatrix}$