

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： 甲組

考科代碼： 1032

考 科： 工程數學

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

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

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

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) $\|\mathbf{a} + \mathbf{b}\|$, (e) $\|\mathbf{a} - \mathbf{b}\|$, (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 $\mathbf{A} = \begin{pmatrix} 2 & 2 & 0 \\ -2 & 1 & 1 \\ 3 & 0 & 1 \end{pmatrix}$