

國立高雄應用科技大學
100 學年度碩士班招生考試
模具工程系

准考證號碼 (考生必須填寫)

工程數學

試題 共 2 頁，第 1 頁

- 注意：a. 本試題共 5 題，每題 20 分，共 100 分。
b. 作答時不必抄題。
c. 考生作答前請詳閱答案卷之考生注意事項。

1. Solve the following ODEs

(1) $2x \frac{dy}{dx} + y = 2x^2$ (8%)

(2). $\frac{d^2 y}{dt^2} - \frac{dy}{dt} - 2y = 2t + 4e^t$; $y(0)=0$; $\dot{y}(0) = 0$ (12%)

2. Use Laplace transform to solve the following ODE

$$\ddot{y} + y = r(t) ; y(0)=0; \dot{y}(0) = 0; r(t) = \begin{cases} 1; 0 \leq t \leq 1 \\ 0; t > 1 \end{cases} \quad (20\%)$$

3. Given a velocity potential, $\phi = xy$, please evaluate

(1) $\nabla \phi = ?$ (8%)

- (2) Using part (1) and a fluid velocity profile as $\vec{v} = \nabla \phi$;
please calculate $\nabla \times \vec{v} = ?$ What is the physical meaning of the
calculated value? (12%)

4. **Known water of density ρ , with a velocity profile**

$\vec{V} = 6z\vec{i} - 12\vec{j} + 3y\vec{k}$, **flowing through a given surface S :**

$2x+3y+6z=12$, $x>0, y>0, z>0$, **please evaluate**

(1) **the following surface integral, $\iint_S \rho \vec{V} \cdot \vec{n} dS = ?$ (15%)**

(2) **What is the physical meaning of the above evaluated value? (5%)**

5. **Given a heat diffusion equation of the form**

$$\frac{\partial T}{\partial t} = \frac{\partial^2 T}{\partial x^2}$$

subject with the boundary conditions: $T(0, t)=0; T(a, t)=0$

and the initial condition: $T(x, 0)=3x$, please solve the above solution, i.e. the transient temperature profile $T(x, t)=?$. (20%)