

國立中央大學99學年度碩士班考試入學試題卷

所別：太空科學研究所碩士班 不分組(一般生) 科目：流體力學 共 / 頁 第 / 頁

本科考試禁用計算器

*請在試卷答案卷(卡)內作答

1. (a) Explain the physical meaning of the following equation. (10%)

$$\frac{\partial \rho}{\partial t} + \nabla \cdot (\rho \vec{u}) = 0$$

where ρ is the mass density and \vec{u} is flow velocity. (b) Explain the meaning of $\frac{d\rho}{dt}$. (5%) (c) What assumption needs be made to have $\frac{d\rho}{dt} = 0$ in the above equation? (5%)

2. For given $\vec{u}(t, x, y, z)$ with three components, u_x, u_y, u_z , obtain the equations for streamline. (10%)

3. Explain the meaning of $\nabla \times \vec{u}$ and give some examples for $\nabla \times \vec{u} = 0$ and $\nabla \times \vec{u} \neq 0$. (15%)

4. For an isentropic fluid obeying $\frac{d}{dt}(p\rho^{-\gamma}) = 0$. (a) What the meaning of the ratio of specific heats γ ? (5%) (b) Derive a relation for the change in pressure δp and density $\delta\rho$, namely, what is $\delta p = (?)\delta\rho$. (10%)

5. (a) What is the definition for Mach number? (5%). (b) For an object moving with velocity \vec{u} faster than the sound speed, a shock wave may form in front of the moving object. Explain the formation of shock front. (10%) (c) What is Mach cone? (5%)

6. (a) What is the Bernoulli's equation? Explain its meaning. (15%) (b) What is the stagnation point? (5%)

參考用