

國立臺灣海洋大學 101 學年度研究所碩士班暨碩士在職專班入學考試試題

考試科目：流體力學

系所名稱：系統工程暨造船學系碩士班不分組

1. 答案以橫式由左至右書寫。2. 請依題號順序作答。

1. (20%) (a) Define the streamlines, the streaklines and the pathlines in fluid motion. In which condition the three lines act the same?
(b) If the velocity of a two-dimensional flow is expressed by $\vec{V} = 2V_0(x\vec{i} - y\vec{j})$, what is the equation of the streamlines of the flow?
2. (20%) For the incompressible plane flow, check the following velocity fields whether they satisfied the conservation of mass.
(a) $\vec{V} = x\vec{i} + y\vec{j}$ (b) $\vec{V} = 2x\vec{i} - 2y\vec{j}$ (c) $\vec{V} = (xy + y^2t)\vec{i} + (xy + x^2t)\vec{j}$ (d) $\vec{V} = 3x^2y^2\vec{i} - 2xy^3\vec{j}$
3. (20%) A certain two-dimensional shear flow near a wall has a velocity component along the wall given by $u(x, y) = U_0(\frac{2y}{cx} - \frac{y^2}{c^2x^2})$, where c is constant and U_0 is the free stream speed. Derive from continuity the other velocity component vertical to the wall $v(x, y)$ assuming that $v = 0$ at the wall.
4. (20%) Given the velocity field $\vec{V} = 10x^2y\vec{i} + 20(yz + x)\vec{j} + 13z\vec{k}$ (m/s), what is the total angular velocity of a fluid particle at (0, 4, 3) m?
5. (20%) A flat plate 40cm by 40cm slide on oil ($\mu = 0.7 \text{ N} \cdot \text{s} / \text{m}^2$) over a large plane surfaces. Calculate the force required to drag the plate at 3 m/s, if the separating oil film is 0.3mm thick?