淡江大學九十四學年度碩士班招生考試試題 911

系別：航空太空工程學系　　科目：流　體　力　學

准帶項目請打「V」
V	簡單型計算機

本試題共 1 頁

一、繪出一均勻流流經一平板(a uniform flow over a flat plate)之速度分佈示意圖，並說明什麼是 velocity boundary layer？ 爲何會形成 velocity boundary layer？ (10%)

二、繪出一均勻流流經一圓柱體(a uniform flow over a cylinder)之流線示意圖，並說明什麼是 flow separation？並解釋高爾夫球凹孔之原因。(10%)

三、說明雷諾數(Reynolds number)在流體力學之重要性。說明因次分析(dimensional analysis)之重要性。(10%)

四、繪出一均勻流流經一管道(uniform flow through a pipe)，在 entrance region 及 fully developed region 之速度分佈示意圖。爲何有此差異？在 inviscid flow 假設下，其速度分佈又如何？ (10%)

五、A velocity field is specified as $\vec{V} = ax^2\vec{i} + bxy\vec{j}$, where a=2/(m.s), b=-4/(m.s), and the coordinates are measured in meters. Is the flow filed one-, two-, or three-dimensional? Why? Calculate the velocity components at the point (2, 1/2, 0). Develop an equation for the streamline passing through this point. (20%)

六、A small rocket, with initial mass of 400 kg, is to be launched vertical (y-direction). Upon ignition the rocket consumes fuel at the rate of 5 kg/s and ejects gas at atmospheric pressure with a speed of 3500 m/s relative to the rocket. Determine the initial acceleration of the rocket if air resistance is neglected. (25%) Hint: applying the y-momentum equation for the problem:

$$F_{By} - \int_{CV} a_{rfy}\rho dV = \int_{Cs} v_{xyz}\rho\vec{V}_{xyz}\cdot d\vec{A}$$

七、A gas-filled pneumatic strut in an automobile suspension system behaves like a piston-cylinder apparatus. At one instant when the piston is L=0.15 m away from the closed end of the cylinder, the gas density is uniform at ρ=18 kg/m^3 and the piston begins to move away from the closed end at V=12 m/s. The gas motion is one-dimensional and proportional to distance form the closed end; it varies linearly from zero at the end to u=V at the piston. Evaluate the rate of change of gas density at this instant. (15%)

Hint: applying the continuity equation for the problem: $\frac{\partial \rho u}{\partial x} + \frac{\partial \rho}{\partial t} = 0$