1012 機械系博士班資格考試題目

考試科目	方式	
流體力學	**Closed Book, 可使用計算機**	**Part I**

1. Explain the Physical meaning of "Moody Chart". (10%)

2. **GIVEN** Air at a temperature of 38 °C and standard pressure flows from a clothes dryer. According to the appliance manufacturer, the 10-cm-diameter galvanized iron vent on the clothes dryer is not to contain more than 6 m of pipe and four 90° elbows.

$\gamma = 11.05\ N/m^3$, $\nu = 1.66 \cdot 10^{-5}\ m^2/s$,

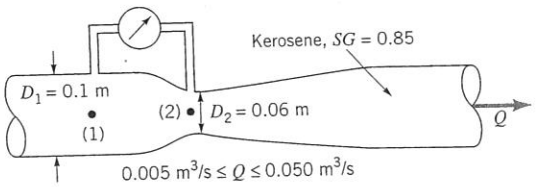
FIND Under these conditions determine the air flowrate if the pressure at the start of the vent pipe, directly downstream of the dryer fan, is 0.5 cm of water. $\varepsilon = 1.5 \cdot 10^{-4}\ m$

$$\frac{1}{\sqrt{f}} = -2.0 \log\left(\frac{\varepsilon/D}{3.7} + \frac{2.51}{Re\sqrt{f}}\right)$$ (15%)

3. **GIVEN** Kerosene ($SG = 0.85$) flows through the Venturi meter shown in Fig. E3.11*a* with flowrates between 0.005 and 0.050 m^3/s.

FIND Determine the range in pressure difference, $p_1 - p_2$, needed to measure these flowrates.

$\rho_{H_2O} = 1000\ Kg/m^3$



■ FIGURE E3.11*a*

(25%)

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(1)What is the " vortex"? Please write down the expression of velocity potential and stream function for the vortex motion. Also explain the difference between free vortex and forced vortex. (15%)

(2)For a certain two-dimensional flow field the velocity is given by the equation

$$\vec{V} = 4xy\,\vec{i} + 2(x^2 - y^2)\,\vec{j}$$

Is this flow irrotational? (15%)

(3) Please derive the Bernoulli equation for irrotational flow. (20%)