八十五學年度國立台灣工業技術學院研究所碩士班招生考試

所別：機械工程技術研究所　　組別：熱流組　　科目：流體力學

請依下列格式作答：

- Must be neat and organized.
- Answers underlined or boxed.
- Should include the appropriate sketch, properly labeled.
- Separate the problems by a line denoting the end of the problem.

1. Give operational definitions of :

(a) ideal fluid (4 %)

(b) external flow (4 %)

(c) uniform flow (4 %)

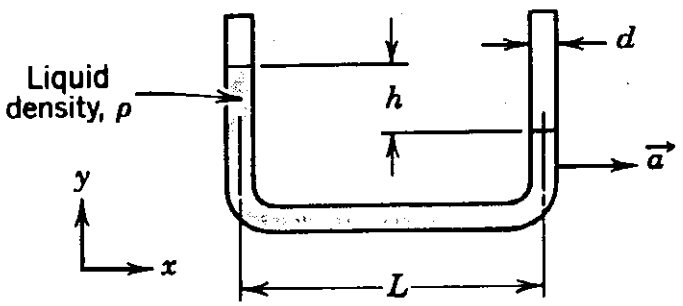
(d) hydraulic diameter (4 %)

(e) fully developed (4 %)

2. Thin-plate orifice, flow nozzle and venturi meter are the three primary Bernoulli obstruction-type meters. The choice of meter depends upon the loss and the cost. Use a table to compare the net head loss and cost of the above-mentioned flow meters. (5 %)

3. A needle-nose projectile traveling at a speed with M = 2 passes 300 m above an observer. Calculate the projectile's velocity and determine how far beyond the observer the projectile will first be heard if a standard temperature at the sea level is assumed in this calculation. (15 %)

4. A crude accelerometer can be made from a liquid-filled U-tube as shown in the following figure. Derive an expression for the acceleration $\bar{a}$, in terms of liquid level difference h , tube horizontal length L , and earth gravity g . (20 %)



八十五學年度國立台灣工業技術學院研究所碩士班招生考試

所別：機械工程技術研究所　　組別：熱流組　　科目：流體力學

5. A 5-mm-diameter spherical iron pellet (SG = 7.0) is dropped into a tank of water at 4°C . Try to estimate how fast the pellet falls. It is noted that the drag coefficients C_D of the flow over a sphere are 0.47 and 0.10 for laminar flow and turbulent flow respectively and the absolute viscosity of water at 4°C is 1.57×10^{-3} N·s/m². (20 %)

6. Consider the growth of a boundary layer on a flat plate as shown in the follwoing figure. The flow is assumed incompressible and steady. Show that

$$\frac{dD}{dx} = \rho\, b\, U^2 \frac{d\theta}{dx}$$

where

D(x) = drag force on the plate at location x

b = the plate width into the paper

U = free stream velocity

θ = momentum thickness　　(20 %)