國立臺北科技大學

九十二學年度機電科技研究所博士班入學考試

熱流學（冷凍空調組）試題

填准考證號碼

注意事項：

1. 本試題共【四】題，配分共 100 分。
2. 請按順序標明題號作答，不必抄題。
3. 全部答案均須答在答案卷之答案欄內，否則不予計分。

1. (25%) Water flows through the horizontal branching pipe shown in **Fig. 1** at a rate of $10 ft^3/s$. If viscous effects are negligible, determine the water speed at section (2), the pressure at section (3), and the flowrate at section (4). (water density $\rho = 1.94 slug/ft^3$)

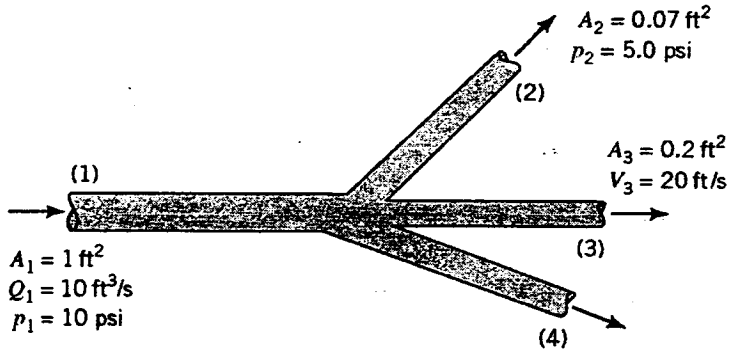

Fig. 1

2. (25%) Water flows steadily through the funnel shown in **Fig. 2**. Throughout most of the funnel the flow is approximately radial (along rays from O) with a velocity of $V= c/r^2$, where r is the radial coordinate and c is a constant. If the velocity is 0.4 m/s when r=0.1m, determine the acceleration at points ***A*** and ***B***.

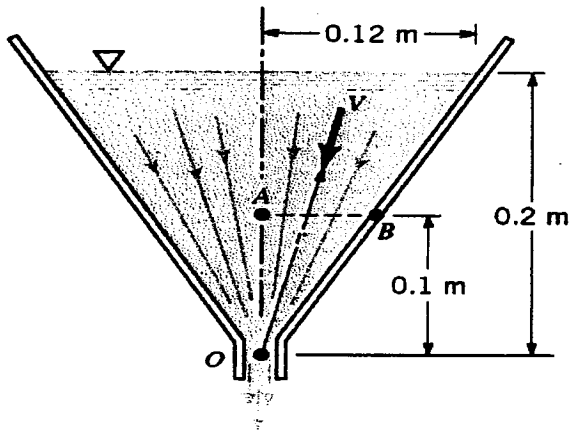

Fig. 2

3. (25%) For a flat plate heat exchanger (a) show that the relationship between the overall heat transfer coefficient for a clean heat exchanger, U_c, and that for a fouled heat exchanger, U_f, is

$$\frac{1}{U_f} = \sum F + \frac{1}{U_c}$$

where the ***F***s are the fouling factors. (b) Estimate what the overall heat transfer coefficient would be if the fouling factors was double.

4. (25%) A potato (A=0.0224 m^2, V=3.09x10^{-4} m^3) is initially at a uniform temperature of 18 ℃. It is placed in a forced convective microwave oven that supplies 300 W of energy to the potato. The temperature of the air in the oven is 200℃, and the convection heat transfer coefficient is 3 W/m^2℃. How long must the potato be heated to raise it to a temperature of 110℃ ? The thermophysical properties of the potato are k= 0.481 W/m ℃, ρ= 980 kg/m^3, and c= 3350 J/kg℃.