※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. What is a Pitot-static Tube and how is it used? (10%)

2. Briefly define: static pressure, dynamic pressure, hydrostatic pressure, stagnation pressure and total pressure. (10%)

3. A hypodermic syringe(Fig.1) is used to apply avaccine. If the plunger is moved forward at the steady rate of 20mm/s and if vaccine leaks past the plunger at 0.01 of the volume flowrate out the needle opening, calculate the average velocity of the needle exit flow. The inside diameters of the bsyringe and the needle are 20mm and 0.7mm. (15%)
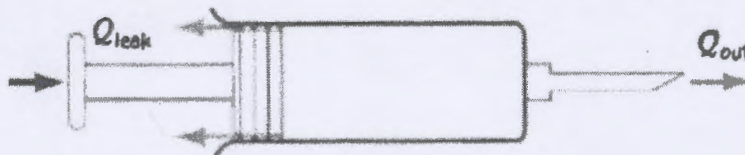

Fig. 1 A hypodermic syringe

4. A source and a uniform flow, one of strength m and the other with U, are located on the x axis as shown in Fig. 2. (a)Determine the location of the stagnation point in the flow produced by these simple flows. (b) Determine the equation of the streamline passing through the stagnation point. (15%)
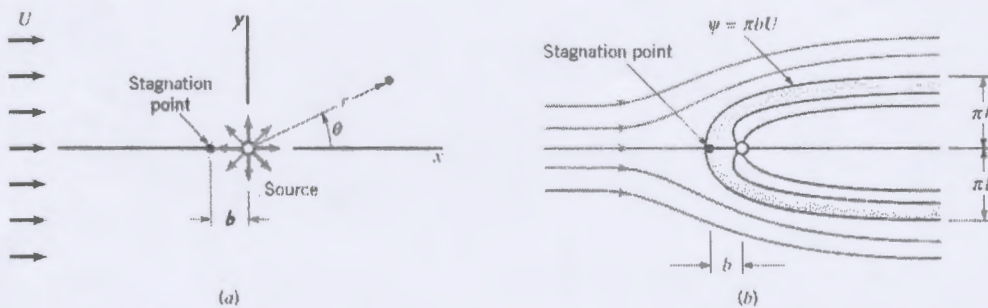

Fig. 2　A source and a uniform flow, one of strength m and the other with U

5. For laminar flow in a round pipe, derive an expression for the radial distance r at which the local point velocity is equal to the mean average velocity of the pipe. (15%)

6. The drag F_D of a wing is affected by the area A of the wing, the angle of attack α, the velocity of flight V, the viscosity μ and density ρ of air, and the sound speed C in air. Derive an expression for F_D by dimensional analysis. (15%)

7. A laminar boundary layer velocity profile is approximated by $u/U = [2-(y/\delta)](y/\delta)$ for $y \leq \delta$, and $u=U$ for $y > \delta$. (a)Shaw that this profile satisfies the appropriate boundary conditions. (b) Use the momentum integral equation to determine the boundary layer thickness, $\delta = \delta(x)$. (20%)