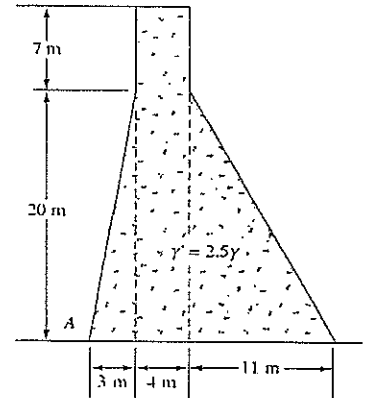※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. For linear stress variation over the base of the dam (the hydrostatic uplift was neglected).

(a) Please locate where the resultant crosses the base (10%).

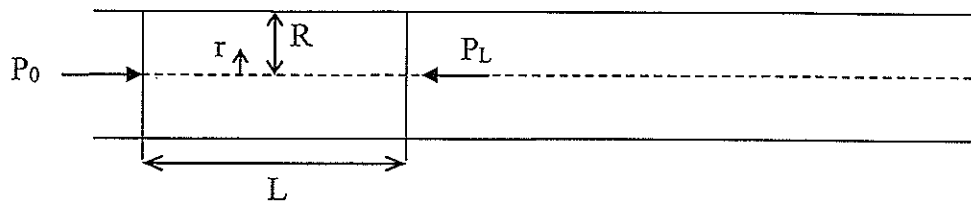(b) Find the resultant force (10%).

2. An incompressible laminar flow (viscosity μ) in a circular conduit is depicted in the following Figure. P_o and P_L are inlet pressure and outlet pressure, respectively. Please derive

(1) Shear stress (τ) as function of r (5%)
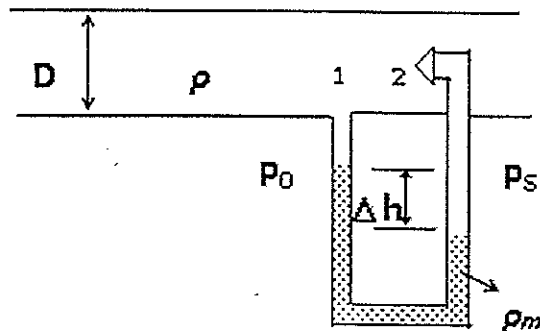
(2) Volume flowrate ($\dot{V}$) as function of R (5%)

(3) Draw the shear stress and velocity profile (5%)

(4) Energy correction factor (α)(10%)

3. Please describe how to measure the **volume flowrate ($\dot{V}$)** by a pitot-static tube? (20%) where $P_1 = P_o$, $P_2 = P_s$

4. A water drop (D = 30 mm, density= 1 g cm^{-3}) was settled down in the air (P= 1 atm, T= 300 K, MW$_{air}$= 29, μ=0.02 cP), calculate the **maximum sedimentation height** when settled time was 6 min? (15%)

5. Calculate the **inlet pressure** to a pump 0.3 m above the level of a sump. The pipe is 89 cm in diameter, 8.9 m long and made of cast iron (ε = 0.36 mm). The flow rate through the pump is 2.04 m^3/min. The kinematic viscosity of water is 1.22x10^{-5} m^2/s. The assumption of the flow is fully developed (20%) (Note that you may use the Moody chart shown below).

$$Re = \frac{\rho VD}{\mu}$$