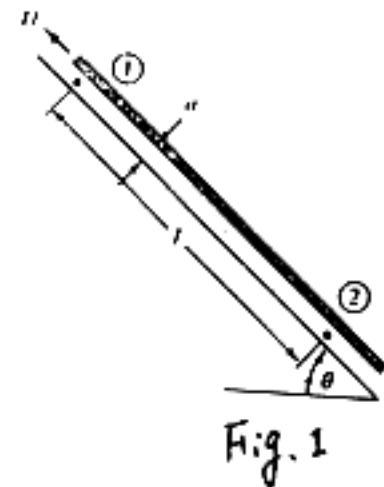1. For $\theta = 90\,^{\circ}C$ in Fig. 1, what speed U is required for no discharge? $S = 0.87$, $a = 2.7$ mm, $p_1 = p_2$, and $\mu = 0.2$ kg/m.s. (20%)

Fig. 1

2. In Fig. 2 find the discharges for water at 20°C ($\nu = 1.3 \times 10^6$ m²/s) with the following pipe data and reservoir elevations; $L_1 = 5{,}650$ m, $D_1 = 2.1$ m, $\epsilon_1/D_1 = 0.00021$; $L_2 = 910$ m, $D_2 = 0.99$ m, $\epsilon_2/D_2 = 0.0027$; $L_3 = 1{,}950$ m, $D_3 = 0.97$ m, $\epsilon_3/D_3 = 0.0029$; $Z_1 = 59$ m, $Z_2 = 37$ m, $Z_3 = 17$ m. (20%)
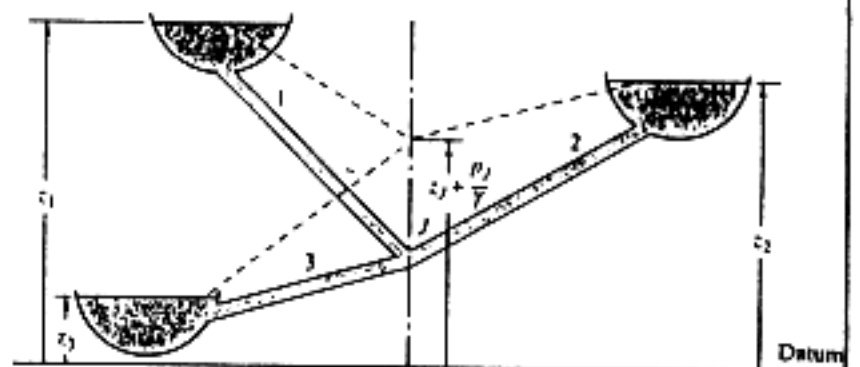
（請利用背頁之 Moody Diagram）

Fig. 2

3. The dam of Fig. 3 has a strut AB every 7m. Determine the compressive force in the strut, neglecting the weight of dam. (20%)
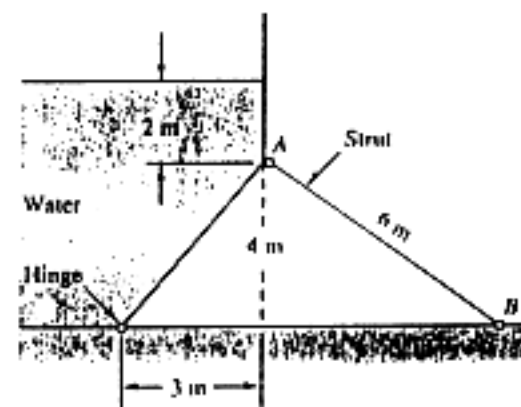
Fig. 3

4. The vertical reducing section shown in Fig. 4 contains oil, sp gr 0.86, flowing upward at the rate of 0.9 m³/s. The pressure at the larger section is 23 kPa. Neglecting losses but including gravity, determine the force on the contraction. (20%)
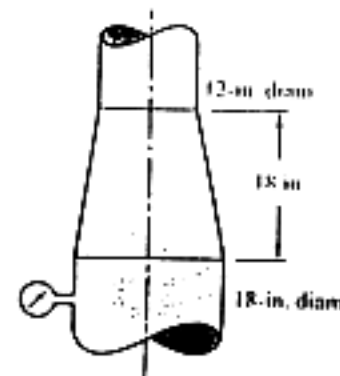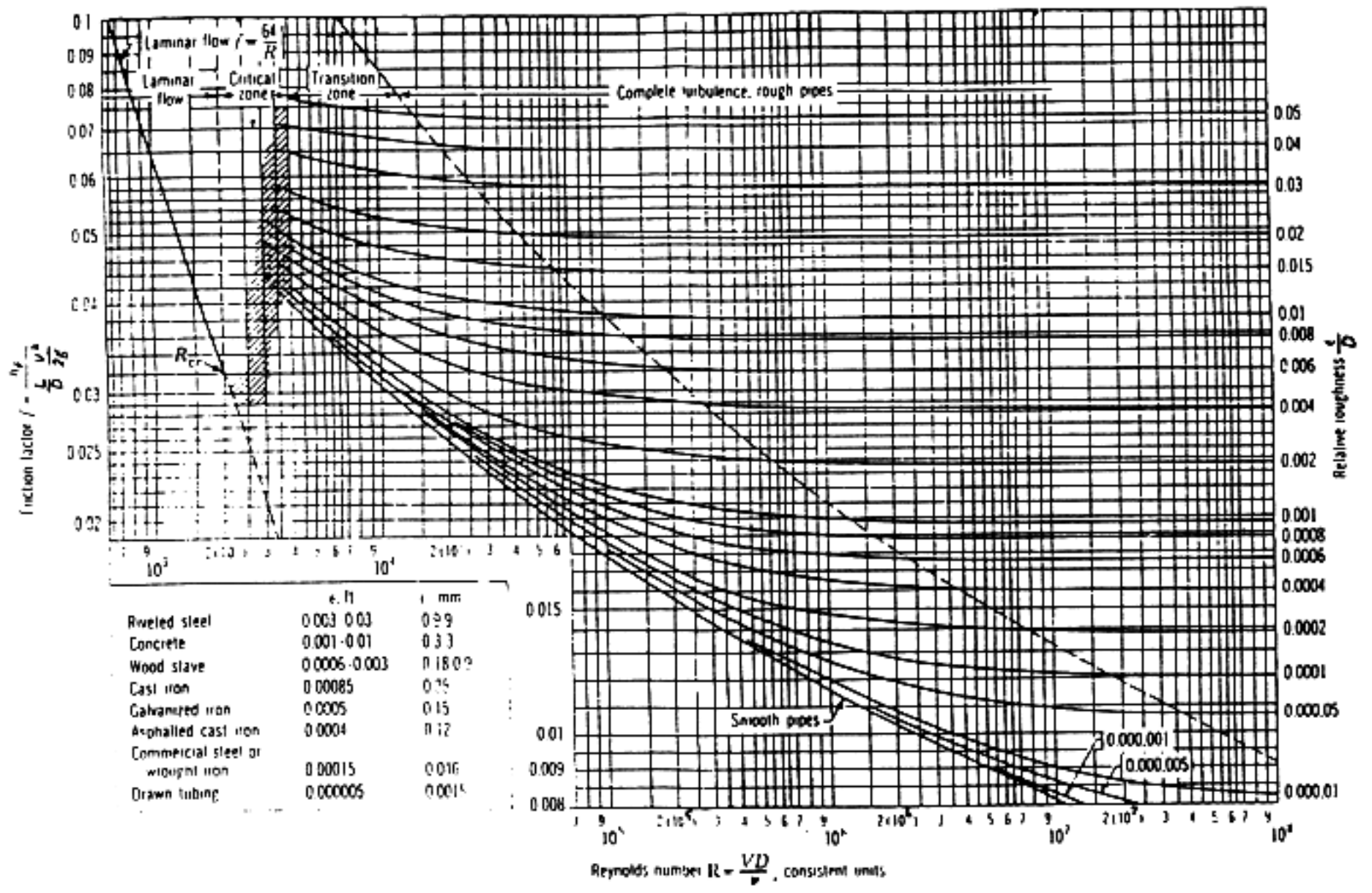
Fig. 4

5. At section 1 of a canal the cross section is trapezoidal, $b_1 = 15$ m, $m_1 = 3$, $y_1 = 11$ m, and at section 2, downstream 310 m, the bottom is 0.09 m higher than at section 1, $b_2 = 21$ m, and $m_2 = 2$, $Q = 410$ m³/s, $n = 0.040$. Determine the depth of water at section 2. (20%).

Moody diagram.