

Tutorial 6

1. Calculate the critical depth for the following two channels:
 - a. A smooth rectangular channel ($n = 0.01$) with a bottom width of 0.4 m and a discharge of 150 l/s.
 - b. A natural channel with a slope of $S_0 = 0.003$ (m/m), Manning's roughness coefficient of $n = 0.035$, a flow of $75 \text{ m}^3/\text{s}$ and the following hydraulic relationships:

Stage (m)	Area (m^2)	Perimeter (m)	Surface Width (m)
0.5	3.4	9.0	8.1
1.0	10.1	12.2	11.0
1.5	18.2	18.6	16.5
2.0	31.3	26.2	22.0

2. The water discharge in a rectangular channel is $5 \text{ m}^3/\text{s}$, water depth is 0.4 m and channel width is 4m.
 - a. What is the flow regime? Subcritical or supercritical?
 - b. Consider that a hydraulic jump occurs. Calculate y_2 and the energy loss across the jump.

3. The discharge in a rectangular channel is $6.5 \text{ m}^3/\text{s}$, the channel width is $b_1 = 3 \text{ m}$ and the water depth is $y_1 = 0.4 \text{ m}$. Calculate the downstream depth (and upstream depth if it is changed) in the following cases:
 - a. $b_2 = 2.5 \text{ m}, \Delta z = 0$
 - b. $b_2 = 1.2 \text{ m}, \Delta z = 0$
 - c. $b_2 = 2.5 \text{ m}, \Delta z = -0.3 \text{ m}$ (downward step)
 - d. $b_2 = 2.5 \text{ m}, \Delta z = +0.7 \text{ m}$ (upward step)