Hydraulics 3 Coursework **AUTUMN 2025**

Submission deadline: Thursday 13th November 2025 (18.00pm GMT)
Coursework should be submitted via Canvas as a single PDF file. It may be typed or handwritten and scanned. **This must be entirely your own work.** No marks will be given if working is not shown or a scan is unreadable. Marks will be deducted for untidiness, excessive padding, inadequate working, units missing in final answers, non-single-PDF submission.

Question 1 (15 marks)

A trapezoidal channel has base width 1.5 m and sides sloping at 30° to the horizontal. When carrying a discharge of $6\ \mathrm{m}^3\ \mathrm{s}^{-1}$ find:

(a) the critical depth;
(b) the critical specific energy; (it is *not* 3/2 times your answer to part (a));
(c) the alternate depths with a specific energy 25% larger than that in part (b).

Question 2 (20 marks)

A long rectangular channel of width 4.5 m, bed slope $S = 0.0005$ and Manning's roughness coefficient $n = 0.015\ \mathrm{m}^{-1/3}\ \mathrm{s}$ carries a discharge of $9\ \mathrm{m}^3\ \mathrm{s}^{-1}$. A broad-crested weir is constructed at one point in the channel.

(a) Find the normal depth in the channel and show that it is subcritical.
(b) Find the minimum height of weir that will just force a hydraulic transition.
(c) Explain, *without calculation*, why no region of supercritical flow can exist immediately downstream of the weir if it has the height in part (b).

If the height of the weir is three times that in part (b), find:

(d) the depths just upstream and downstream of the weir;
(e) the sliding force on the weir.

Question 3 (15 marks)

Water flows at $6\ \mathrm{m}^3\ \mathrm{s}^{-1}$ in a long rectangular channel of width 4 m and slope 0.005. The lining of the channel has Chézy coefficient $C = 40\ \mathrm{m}^{1/2}\ \mathrm{s}^{-1}$. A smooth constriction is introduced to the channel at one point, narrowing the passage to 2.5 m.

(a) Show that a hydraulic transition will take place through the contraction.
(b) Will there be an upstream or downstream hydraulic jump as a result of the contraction? Explain your answer.
(c) Use two steps in the GVF equation to estimate the distance of the hydraulic jump from the constricted section.