Quiz 2 CE5312

Question 1: (40 marks)

Water flows at a uniform depth of 1.0 m and velocity of 1.0m/s in a rectangular channel. The depth at the downstream end of the channel begins to fall at a rate of 0.1m/hour for 2 hours and then stays steady at 0.8m.

(a) Determine when water depth drops to 0.9m at x=2 km. (15 marks)
(b) Determine the rate at which the region of non-uniform depth is lengthening after t=2 hours. (15 marks)

Since t=10 hour, the water level in the reservoir rises at 0.2m/hour for 1 hour, and then remains constant.

(c) Determine when and where a surge is first developed. (10 marks)

Question 2 (30 marks)

A sluice gate holds water in a very long rectangular channel. In the upstream direction from the gate (x<0), water depth is initially h=5m. The channel is dry in the downstream direction from the gate (x>0). The gate is suddenly lifted out of the water.

(a) Discuss the resulting flow (depth and discharge) at the gate's initial location (x=0). (10 marks)
(b) Through calculations to sketch the surface profile at t=100 second. Your calculation should determine the locations of the leading and trailing edge of the wave, and 3 points within the non-uniform region. (20 marks)

Question 3: (30 marks)

A long rectangular channel discharges into an estuary. The flow in the channel is steady and uniform at a depth of 2.4m and a velocity of 1.5m/s. Water level in the estuary initially is the same in the river. The estuary level **suddenly** drops by 0.4m at t=0 and then remains constant. Neglect bottom slope and resistance.

(a) Use method of characteristics to illustrate the development of negative surge in the channel. Graphically identify regions with uniform depth and non-uniform depth. Discuss the traveling of the leading and trailing edges of non-uniform region. (Hint: is there only one characteristics initiated at the origin of x-t plane?) (20 marks)
(b) When the water depth at x=1000m is reduced by 0.2m? (10 marks)