

# Open Channel Hydraulics

## ENGG\*6840

Fall 2011  
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### Course Description

The course covers topics related to open channel hydraulics normally covered at the level beyond the undergraduate level in water resources engineering and civil engineering. The focus is on advanced topics for open channel flow including basic concepts of the energy and momentum principles, flow resistance in uniform and non-uniform channels, flow in compound channels, natural channels, transitions, unsteady flows and flood routing. Application of the basic principles using the commonly used models is also stressed.

### Topics

1. Review of basic fluid mechanics and hydraulics
  - a. Energy
  - b. Momentum
2. Flow resistance equations
  - a. Basic equations
  - b. Velocity distributions
3. Basic backwater calculations
  - a. Uniform flow
  - b. Non-uniform flow
  - c. Control sections
  - d. Sub and supercritical conditions
4. Transitions
  - a. Bridges
  - b. Hydraulic jumps
  - c. Channel section changes
5. Unsteady flow
  - a. Basic Equations
  - b. Models
  - c. Stability Concerns
6. Sediment transport

### Course Evaluation

There are two principle components to the grade in the course: a series of approximately 5 assignments and a course project. The assignments will closely follow the lecture material and provide an opportunity for the student to go deeper into the

material presented in the lecture. The course project will be of the student's choice and is intended to allow the student to explore an area of open channel flow either beyond the normal scope of the course or explore an area covered in the course in much greater depth. The assignments are the basis for 60% of the final grade while the project and presentation total 40%.

Projects must be identified by the 3<sup>rd</sup> week of the course and be approved by the course instructor. An outline of the project must be submitted no later than the 5<sup>th</sup> week of the course. The projects will be presented at the later stages of the course.

Some example topics from past years include:

1. Turbulence measurements in open channel flows
2. Optimization of Hydraulic Conditions and Earthwork Requirements for a Canal
3. Effects of ice on flow in open channels
4. Bed forms and their evolution in estuary conditions
5. Bed load Transport in Mountainous Streams
6. Hydraulic Effects of Stream Enhancement Structures
7. Effects of River Hydraulics on Fish Behaviour
8. Modern measurement (laser Doppler, acoustic, etc.) techniques for sediment transport in rivers
9. Application of:
  - a. Dambreak
  - b. HEC-RAS
  - c. HEC-6
  - d. GEO-RAS
  - e. CANWET
10. Analysis of compound channel hydraulics
11. Modelling of open channel behavior
12. Backwater Profiles Under Low Flow Conditions

## **Course Schedule**

Course lectures will run from the week of September 12 to the last week of November. The days and time are to be determined. Projects will be due on December 1<sup>st</sup> with presentations the 1<sup>st</sup> Week of December.

## **References:**

1. Sturm, Terry, 2001, Open Channel Hydraulics, McGraw-Hill
2. Chow, V.T., 1959, Open Channel Hydraulics, McGraw Hill
3. Henderson, F.M., 1966, Open Channel Flow, MacMillan.
4. French, R.H., 1985, Open Channel Hydraulics.
5. Simons, D.B. and Senturk, F., 1977, Sediment Transport Technology