# CEE 788/888
# Coastal Hydrodynamics and Sediment Processes
# Fall 2015

**Instructor**: Dr. Navid Tahvildari
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**Lectures:** W 7:10-9:50 pm Room: Goronto 221

**Office Hours**: W 1:00 - 3:00 pm, or by appointment

**Course Description:**
This course discusses the hydrodynamics and sediment processes in the coastal environment and reviews waves, currents, low-frequency motions, sediment processes and beach evolution. Specific topics to be covered include: introduction to coastal processes; review of linear wave theory, wave transformation, and wave dissipation mechanisms; introduction to nonlinear waves; wave-averaged motions, radiation stresses, wave setup; nearshore circulation, longshore currents, rip currents, and undertow; cross-shore sediment transport and equilibrium beach profile; wave and current boundary layers; fluid-sediment interaction, modes of sediment transport, and longshore transport models. An introduction to cohesive sediments will also be discussed.

**Learning Objectives:**
- Key concepts in coastal hydrodynamics
- Wave-induced motions that affect sediment transport
- Wave and current boundary layers
- Fluid-sediment interaction process
- Modes of sediment transport
- Cross-shore and longshore sediment transport

**Primary References:**
(A) *Coastal Processes with Engineering Applications*, Robert G. Dean and Robert A. Dalrymple, 2004, Cambridge University Press.
(B) *Mechanics of Coastal Sediment Transport*, Jørgen Fredsøe and Rolf Deigaard, 1992, World Scientific.
(C) Class Notes

**Additional References:**
(D) *Beach Processes and Sedimentation* (*2nd Edition*), Paul D. Komar, 1997
(E) *Introduction to Nearshore Hydrodynamics*, Ib A. Svendsen, 2006, World Scientific.
(F) *Water Wave Mechanics for Engineers and Scientists*, Robert G. Dean and Robert A. Dalrymple, 1991, World Scientific.
(G) *Coastal Engineering Manual*, 2008, U.S. Army Corps of Engineers, http://chl.erdc.usace.army.mil/cem.

**Lecture Notes:**
Notes and other course materials will be available on Blackboard: www.blackboard.odu.edu

**Prerequisites:** Fluid Mechanics, Advanced Engineering Mathematics

**Homework:**

- Homework will be due two weeks after assigned.
- Late homework will have a 10% penalty each day after the due date and will not be graded if it is more than three days late.
- Completed assignments must be submitted to Blackboard in PDF format. Spreadsheets or codes should not be submitted and will not be graded. Group work is accepted but blind copying is not allowed.

**Exams:**
One mid-term and a final exam will be given in class.

**CEE 888 Project:**
Ph.D. students should register in CEE 888 and are required to complete a term project. Refer to Project Guidelines for details.

**Course Grade:**
CEE 788 students: Homework 30%, Mid-term exam 30%, Final exam 40%
CEE 888 students: Homework 20%, Term project 20%, Mid-term exam 25%, Final exam 35%

**Tentative Course Outline:**

| Meeting | Date | Topics | Text |
|---|---|---|---|
| 1 | Aug. 26 | Introduction to coastal processes, Examples of coastal engineering projects | A(1) |
| 2 | Sep. 2 | Long- and short-term processes, Coast classification, Overview of beach profile and planform evolution | A(3) |
| 3 | Sep. 9 | Review of linear wave theory, Wave transformation, Wave breaking, Random waves | A(5), C |
| 4 | Sep. 16 | Wave-averaged motions, Radiation stresses, Wave setup | A(5), C |
| 5 | Sep. 23 | Longshore currents, Undertow | A(5), C |
| 6 | Sep. 30 | Nearshore circulation, Rip currents, Low frequency motions | A(5), C |
| 7 | Oct. 7 | Field measurement techniques, Data analysis methods | A(6) |
| | Oct. 14 | **Mid-term Exam, in Class** | |
| 8 | Oct. 21 | Wave Boundary layers, Combined wave and current boundary layers | A(2), B(2) |
| 9 | Oct. 28 | Sediment characteristics, Fluid-sediment interaction, | B(7) |
| 10 | Oct. 21 | Basic concepts of sediment transport, Bed load formulations | B(7) |
| 11 | Nov. 4 | Suspended load transport, Current generated bed forms | B(8, 9) |
| 12 | Nov. 11 | Wave generated bed forms, cross-shore sediment transport, Closure depth, Equilibrium beach profile | A(7, 8), B(10) |
| 13 | Nov. 18 | Longshore sediment transport, Planform evolution, Models for longshore sediment transport, Introduction to cohesive sediments | A(8), B(12) |
| 14 | Nov. 25 | Thanksgiving Holiday- **NO CLASS** | |
| 15 | Dec. 2 | Review, Final Project Presentations | |
| | Dec. 9 | **Final Exam 7:00-10:00 pm** | |