

## CE 552 – Coastal and Nearshore Processes

**Instructor:** Dr. David F. Hill  
**Office:** 231 D Sackett Building  
**Telephone:** 863-7305  
**email:** dfhill@enr.psu.edu  
**Office Hours:** TH 10:30p - 12:00p, F 12:30p - 2:00p

**Text:** *Coastal Engineering Manual*, USACE  
(<http://chl.erdc.usace.army.mil/chl.aspx?p=s&a=ARTICLES;104>)

**Reserve Books:** *Coastal Processes with Engineering Applications*, Dean & Dalrymple  
*Basic Coastal Engineering*, Sorensen  
*Water Wave Mechanics for Engineers*, Dean & Dalrymple  
*Applied Dynamics of Ocean Surface Waves*, Mei  
*Shore Protection Manual*, USACE

**Grading:** Homework - 40%  
Midterm - 30%  
Projects - 30%

1. **Introduction** Coastal and Nearshore Processes is a class motivated by several undeniable facts. First, an extraordinary percentage of the United States' population lives in the vicinity of a coastal area (Great Lakes included). Second, these coastal areas are subject to dramatic natural processes, including tides, waves, and storm surges. This overlay of human development on a constantly evolving and frequently unpredictable coastal margin raises the ever-present possibility of massive losses, both economic and in terms of human life. As a result, coastal areas present a challenge, in terms of policy making, from the local to the federal level.

During this semester, we will look at a number of physical aspects of coastal areas. First, significant attention will be paid to the description of the relevant hydrodynamic processes. The transport of mass, momentum, and energy provide the 'forcing' to coastal areas. Second, attention will be paid to the response of coastal areas to this forcing. Sediment transport occurs on length and time scales ranging from the very short (suspension due to an individual breaking wave) to the very long (morphological response of a coastline). Finally, more limited attention will be paid to the engineering of coastal areas, in terms of hard structures and 'soft' measures such as beach nourishment.

2. **Class Management** All communications and distributions of class materials will take place via ANGEL, the PSU course management system. If you have not already done so, you are encouraged to visit [www.angel.psu.edu](http://www.angel.psu.edu) and enroll. There, you will find homework assignments and solutions, announcements, and other materials relating to CE 552.

### 3. Tentative List of Topics

- Introduction
- Tides, tidal constituents, harmonic analysis and tidal predictions
- Storm surges, causes, governing equations, predictions
- Tidal modeling (ADCIRC)
- Wave mechanics, linear theory, velocity components, fluxes, nonlinear theories
- Wave shoaling, refraction, and diffraction
- Wave breaking
- Wave modeling (REF - DIF)
- Coastal response, sediment transport, equilibrium profiles
- Cross-shore response to sea-level changes
- Long-shore sediment transport and breaking-induced currents
- Coastal structures and beach nourishment

#### 4. Homework

Homework assignments will be given on a regular basis (every two weeks or so) and form a core component of the learning in this class. Some familiarity with a mathematical program such as MathCad, Matlab, or Mathematica will be useful, but is not absolutely necessary. While you are certainly encouraged to work together and to help each other learn, I do expect that you will each turn in work that is reflective of your own efforts. At the graduate level, you get out of a class what you put into it, so be honest with yourself.

#### 5. Midterm Examination

One in-class exam will be given along way in order to gauge your grasp of the material.

#### 6. Projects

We will have a series of 'projects' in this class; really they could be considered large-scale homework assignments. They will include:

- A tidal modeling project
- A wave modeling project
- A 'literature review' project

These projects will be due roughly at the end of the 5th, 10th, and 15th weeks. Details will be provided as each project nears.

#### 7. Academic Integrity

As excerpted from University Faculty Senate Policy 49-20:

Academic integrity is the pursuit of scholarly activity in an open, honest and responsible manner. Academic integrity is a basic guiding principle for all academic activity at The Pennsylvania State University, and all members of the University community are expected to act in accordance with this principle. Consistent with

this expectation, the University's Code of Conduct states that all students should act with personal integrity, respect other students' dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts.

Academic integrity includes a commitment not to engage in or tolerate acts of falsification, misrepresentation or deception. Such acts of dishonesty violate the fundamental ethical principles of the University community and compromise the worth of work completed by others.