\textbf{Instructor & TA}

\begin{itemize}
  \item \textbf{Instructor}
    \begin{itemize}
      \item Dr. Jun Zhang (CE/TTI 808E)
      \item Professor of Civil/Ocean Engineering
      \item 845-2168, jzhang@civil.tamu.edu
    \end{itemize}
  \item \textbf{Grader (TBA)}
\end{itemize}
Pre-requisites

- CVEN 311
- OCEN 201
- Or approved by the instructor
Additional Learning Resources

- Course notes
  - Hand-outs & marker-board
  - Supplementary materials on the web
  - [http://ceprofs.tamu.edu/jzhang](http://ceprofs.tamu.edu/jzhang)
Attendance Policy

- Attendance is highly recommended
- You may lose credits from Pop-Quiz
- Attendance will be used as a determining factor when your grade is on the borderline
Grading Policy

- HW: 20%
- Mini-Project: 6%
- EX 1: 17%
- EX 2: 17%
- FINAL: 35%
- Pop-Quiz: 5%
Main Course Topics

- Mathematical modeling of surface gravity waves
- Linear water-wave theory
- Engineering applications of linear wave theory
- Wave energy and propagation
- Shoaling, reflection, refraction, diffraction, and breaking
- Long and shallow water waves
- Probability and statistics applied to random waves
- Fourier series, time series, and spectral analysis
- Wave Spectrum
- Wave Simulation
- Interactive tools: WOW
- Elementary nonlinear wave theory**
Oceans

Important Source of
Food
Energy
Transportation
Minerals
Weather
Recreation/space
Fields Related to Ocean Waves

• Ocean Engineering: Ships, water borne transport, offshore structures (fixed and floating platforms), Pipelines, Ocean Energy, Deep-sea Mining

• Navy: Navy fleet, amphibious operation, (WW II Allies landing), Mobil sea base

• Coastal Engineering: Harbor and ports, breakwaters, coastal structures, Tsunami, Storm surge, beach erosion, sediment transport.
Capping contaminated dredged material.
- Waste water disposal
- Diffusion and dispersion of toxic material in ocean and coastal water.
- Fish farming
- Oil spill and containment
OTRC Deep Water 3D Wave Basin
COASTAL ENGINEERING LABORATORY
Texas A&M University Research Park
College Station, Texas

Wave Tank (75'x120')

Observation Well

Sediment Pit

Towing Tank

Work Area (1,353 S.F.)

Forklift Ramp

Electrical Equipment Room

Section A-A

Section B-B

Section C-C

Section D-D

Building Floor Plan

J E S S E N
2D Wave Tanks & PIV
Figure 2-1. Approximate distribution of ocean surface wave energy illustrating the classification of surface waves by wave band, primary disturbing force, and primary restoring force.
Regular and Irregular Waves

• Ocean waves are almost always irregular and often multidirectional (short-crested).

• Regular waves have a single frequency, wavelength and amplitude (height).

• Most time we will spend on studying regular waves.

• Irregular waves can be viewed as the superposition of a number of regular waves.

• Solutions based upon linear wave theory can be applied to random (irregular) ocean waves using FFT and IFFT.
Actual (multi-directional) vs. Design (uni-directional) Seas
Wave Pattern Combining Four Regular Waves

FFT & IFFT – (Inverse) Fast Fourier Transform.
Irregular wave → Multi-component Regular Waves