CEE6842 – Coastal Engineering Measurements

Georgia Institute of Technology, Savannah Campus

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Office Hours: flexible upon demand

Class Meeting: TuTh 3:05-4:25, PARB127 (Savannah), SEB110 (Atlanta)

Prerequisites: CEE3040 Fluid Mechanics or equivalent.

Text: notes to be provided by instructor

Homework: Various homework assignments will be made available via http://webct.gatech.edu. Late homework will not be accepted without a valid excuse. You are encouraged to work in groups, but independent homework solutions must be turned it.

Field Excursion: A 1-day field excursion on the R/V Savannah (Skidaway Institute of Oceanography research vessel) is planned for November. Details will be provided in class.

Grades: Your final grade will be based on
40% graded homework problems/reports
25% mid-semester exam, and
35% final exam. Graded papers will be made available via http://webct.gatech.edu.

All students must take each exam, including the comprehensive final exam. All assignments and exams will be graded such that: 90-100=A, 80-89=B, 70-79=C, 60-69=D, <60=F. Using the weights indicated above, each student should be able to calculate their grade at any time.

Honor Code: This course will be conducted under the guidelines of the Georgia Tech Academic Honor Code.

Course Outline: The course will give an introduction to state-of-the-art measurement techniques applied in field campaigns (Oceans, rivers, lakes, estuaries) and in fluid mechanics/hydraulic/coastal laboratories. Instrumentation principles and limitations, data acquisition, and data analysis are all considered. Systems/sensors to be discussed include A/D-cards, frame-grabbers, multiplexers, digital I/O lines; thermistors, diodes, photoresistors; acoustic, pressure and strain transducers, LVDT devices, lasers, optical components and digital cameras. The focus will be on time-resolved and space-resolved measurement techniques and data analysis. Selected time-resolved devices addressed include pressure arrays, Acoustic Doppler Velocimeters (ADV) and Laser Doppler Velocimeters (LDV); PUV and Heave-pitch-roll approach for measurement of water waves; optical and acoustic backscatter sensors (OBS, ABS) for sediments, LISST, and sonar.

Various aspects of quantitative flow visualization to be discussed include instantaneous measurements of velocity, pressure, density and temperature fields based on a variety of tracer methods such as PIV, PTV, LSV, LIF, Holography and Radar.

Both data collection and analysis will be addressed, including instrument calibration, deployment and sampling strategies, time series and spectral analysis, digital image processing (distortion, filtering, multi-dimensional correlations, pattern matching, feature extraction). A schedule is provided below.

Weeks (16 total)	**lectures**	**Topic**	**Instr.**
1-2	4	• Point measurement of scalar quantities: temperature, salinity, concentration, tide gauge/water level • Data acquisition: sensors, signals, A/D-conversion	PAW (sensors), HF (data acquisition)
3-4	3	• Signal/data analysis: zero-crossing, harmonic, spectral. Treatment of errors, holes.	PAW
5-6	4	• Multi-component point measurements: ADV, LDV • Optical components: light sources, lasers, crystals, lenses, filters, fibers • Seeding particles: flow fidelity, scattering of electromagnetic waves/light	HF
6-7	3	• Signal/data analysis: burst processing, turbulence, vibrations	HF
8	2	• Measurement errors / uncertainty	PAW
9-10	3	• Multi-component measurements at multiple points: array of pressure sensors • Multi-component measurements along beam / line: ADCP	PAW
11	2	• Sediment concentration measurements	PAW
12-13	3	• Multi-dimensional measurement techniques: Particle-Tracking-Velocimetry, Particle-Image-Velocimetry / Laser-Speckle-Velocimetry, Laser-Induced-Fluorescence • Space resolved sensors: imaging devices, intensifiers, pressure mats • Data-formats/standards and acquisition (frame-grabbers)	HF
13-14	4	• Pre-Processing: calibrations/distortions, noise/sensitivity corrections, filtering • Processing: correlation analysis, feature extraction, tracking, image mining and pattern matching • Post-processing: filtering, spatial derivatives of primary physical quantities	HF
14-15	2	• 2 lectures for tests through-out the semester	
15-16	3	• buffer for additional lectures, field trip, etc.	