Course: GEOL / MSCI 557 **USC- Columbia: Fall 2011**

Title: COASTAL PROCESSES

Instructor:

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Office Hours: Mon & Wed 13:00 – 15:00

Location: EWS 604
Days: TUE - THU
Times: 12:30 - 1:45

I Course Description

This course is designed to introduce students to the study of the physical processes that occur in the coastal environment. Emphasis is placed on the forces that control sediment movement and morphology changes. These forces, acting on a coastal ocean environment are waves and currents with the latter being generated by waves, winds and/or tides. Waves provide the forcing for sediment entrainment while currents are the sediment transporters. Topics to be covered include: tides; wave theory; wave and current measurements, wave hindcasting and forecasting; sediment transport; beaches and bars; sediment budget.

The course is suitable for upper level undergraduate students and graduate students. Although a quantitative course in nature; it does not require more than basic numerical abilities. Different requirements and expectations apply to graduates and undergraduate students.

II Goals and Learning Outcomes

Goals

The goal of the course is to make aware the students of the most important physical processes that act in the coastal environment. After completion of the course the student will be able to (i) identify the most important relevant processes for a particular coastal environment (i.e., inner shelf, beach, tidal inlet, estuary); and (ii) apply quantitative formulations as relate to an environmental and/or engineering study relevant to that environment.

Learning Outcomes

(1) Identify dominant physical processes (waves, tides, winds) on a particular coastal environment.

(2) Being able to analyze tidal records and predict tides

(3) Being able to predict waves and account for wave propagation to the shore

(4) Be able to estimate physical forcing and circulation patterns developing in the nearshore in response to a particular physical forcing

(5) Being able to understand coastal erosion processes and the role physical forcing plays on driving those.

(6) Review current engineering methods for coastal defence.

III Reading Material

Text Book

- The material delivered through notes is mostly based on the book of: Robert G. Dean and Robert A Dalrymple, 2002. Coastal processes with Engineering Applications. Cambridge University Press, 475pp. No book required although it will be helpfull.

Suggested Reading Material

- Robert G. Dean and Robert A Dalrymple, 2002. Coastal processes with Engineering Applications. Cambridge University Press, 475pp.
- Komar, P.D. 1998. Beach Processes and Sedimentation. Prentice Hall. Second Edition. 544 pp.
- The Open University (1989), Waves, Tides and Shallow Water Processes, Open University Press & Pergamon Press
- A.D. Heathershaw, 1971. Sediment Transport in the Sea, on Beaches and in Rivers: Part I – Fundamental Principles. JNS 14(4) 154-220. (Copy available from Instructor).
- A.D. Heathershaw, 1971. Sediment Transport in the Sea, on Beaches and in Rivers: Part II – Sediment Movement. JNS 14(3) 221-234. (Copy available from Instructor).

List of Additional References

Fluid Mechanics, Open Channel Flow and Boundary Layer Flow

- Munson, Young, Okiishi, (1998) **Fundamentals of Fluid Mechanics**, Wiley, New York.
- Henderson, F.M. (1966) **Open Channel Flow**, Macmillan, New York.
- Schlichting, H. (1987) **Boundary-Layer Theory**, 7th edition, McGraw-Hill, New York.

Fluvial Sediment Transport

- Raudkivi, A.J. (1990) **Loose Boundary Hydraulics**, 3rd edition, Pergamon, New York.
- Yalin, M.S. (1992) **River Mechanics**, 7th edition, Pergamon, New York.

Water Wave Mechanics

- Sorensen, R.M., (1993) **Basic Wave Mechanics for Coastal and Ocean Engineers**, Wiley, New York.
- The Open University (1989), **Waves, Tides and Shallow Water Processes**, Open University Press & Pregamon Press
- Dean and Dalrymple, (1984) **Water Wave Mechanics for Engineers and Scientists**, Prentice-Hall, Englewood Cliffs, New Jersey.

Coastal Sediment Transport

- Komar, P.D. (1998) **Beach Processes and Sedimentation**, Prentice-Hall, Upper Saddle River, New Jersey.
- Horikawa, K. (1988) **Nearshore Dynamics and Coastal Processes**, University of Tokyo Press, Tokyo.
- U.S. Army Coastal Engineering Research Center (1984) **Shore Protection Manual**, U.S. Government Printing Office, Washington, D.C.

- Fredsoe, J. and Deigaard, R. (1992) **Mechanics of Coastal Sediment Transport**, World Scientific Publishing, River Edge, NJ.
- Sleath, J.F.A. (1984) **Sea Bed Mechanics**, Wiley, New York.
- Dean, R.G. and Dalrymple, R.A. (2007) **Coastal Processes with Engineering Applications**, Cambridge University Press.

IV Performance Evaluation

1. Symposium on Coastal Processes

On October 6th 201, the Dept of Geological and Ocean Sciences is a co-organizer of the "**Miles Hayes Symposium on Applied Coastal Geomorphology"** A Number of short presentations will be presented by nationally and internationally renowned scientists from the area of Coastal Processes. All students should attend at least 3 presentations (as their schedule allows). The whole symposium and presentations will be discussed in Class and extra credits will be issued in relation to Symposium attendance and discussion participation. *(Note: it applies to both Graduate and Undergraduate students)*

2. Term Paper & Presentation

GRADUATE STUDENTS: One term paper is required.
UNDERGRADUATE STUDENTS: No term paper is required

The paper must be prepared in the format of Journal of Coastal Research, contain at least 10 pertinent references, and exceed 8 pages, excluding tables and graphs. Term paper topics are selected by the students but must be pre-approved by the instructor. The paper will be submitted to the Instructor and it will also be presented in the class using Power Point. Paper is due on November 29th at the beginning of the class. Paper copies are required.

3. Term Paper Peer Review (for graduate students only)

The graduate students will carry out peer review of the papers of their colleagues. The rigorous character of the review report and its quality will be evaluated.

4. Grading and Test Schedule

The homework load will be different for the undergraduate and graduate students that take this class. Homework exercises will consist of at least 2 problems. Graduate students will have to answer ALL questions while undergraduate students will have to answer 50% of the questions (the exact number will be indicated on each homework/test).

	Undergrad	Graduates
Final Exam (Take Home Exam, Due by December 9th, 2011 at the university scheduled final exam time. Paper copies only are accepted)	45 pts	30 pts
Homework exercises	35 pts	25 pts
End-of-term paper and presentation (Nov. 29th, at scheduled class time)	- pts	15 pts
Class Participation	20 pts	30 pts
Possible maximum score	**100 pts**	**100 pts**

Note: Not grade adjustment (i.e., curving) is carried out in this class. This class is highly applicable and potential employees and graduate schools need to be able to assess the real capacity of the students independently of their year of graduation. Curve shifting does not allow this.

The USC student code of academic responsibility will be enforced. Each student is required to read the section on the student discipline system, which details student affairs policy STAF 6.25. Intellectual and academic honesty of all class members is expected.

V Lecture Schedule

Date		Topic
August 18th, 2011		Distribution of course syllabus, Class Organization.
August 23rd, 2011		Introduction / Overview of Coastal Processes
August 25th, 2011		Sediment Characteristics & Analysis
August 29th, 2011		Class Discussion of Homework 1
September 1st, 2011		Seal level variability - Storm Surges
September 6th, 2011		Sea level Risk Analysis
September 8th , 2011		Tides & Tidal Analysis I
September 13th 2011		Tides & Tidal Analysis II
September 15th, 2011		Class Discussion of Homework 2
September 20th, 2011		Waves, Generation
September 22th, 2011		Wave Hydrodynamics
September 27th, 2011		Wave Propagation
September 29st, 2011		Waves on beaches; Radiation Stress
October 4th, 2011		Longshore & Cross-shore flows I
October 6th, 2011		Longshore & Cross-shore flows II
October 11th, 2011		Advanced Modeling of Nearshore Flows

October 13st, 2011		Sea bed bedforms
October 18rd, 2011		Class discussion of Hayes Symposium papers
October 20th, 2011		**Fall Break**
October 25th, 2011		Sediment Transport (steady currents)
October 27th, 2011		Sediment Transport (waves)
November 1th, 2011		Sediment Transport Waves and Currents
November 3th, 2011		The Concept of Equilibrium Profile & Shoreline retreat
November 8th, 2011		Tidal Inlets and Tidal Inlet Stability
November 10th, 2011		Tidal Inlets and Tidal Inlet Stability
November 15nd, 2011		Term Paper Discussion
November 17th, 2011		Estuaries I
November 22th, 2011		Estuaries II
November 24th, 2011		**Thanksgiving Break**
November 29st, 2011		Term Paper Due – Presentations I
December 1st, 2011		Presentations II
December 6th, 2011		Presentations III
December 8th, 2011		Class Review
December 9th, 2011		FINAL EXAM is Due

Note: The lecture schedule listed above is nominal. However based on class progress the material covered might be expanded or reduced as the objective of the class is to make student understand the material and not to fill the timetable.