

# USC Viterbi

School of Engineering  
*Sonny Astani Department  
of Civil and Environmental  
Engineering*

**CE 451: Water Resources and Coastal Engineering**  
**Units: 4**

**Day—Time: Mon and Wed 10:00 – 11:50 am**

**Location: Online**

**Instructor: J. J. Lee**

**Office: KAP 224A**

**Office Hours:**

**Contact Info: Email: [jjlee@usc.edu](mailto:jjlee@usc.edu);**

**Phone #: 213-740-7865**

**Mobile #: 626-221-8536**

**Teaching Assistant: Weijian Ding**

**Office: KAP 239**

**Office Hours:**

**Contact Info:**

**[Dingw@usc.edu](mailto:Dingw@usc.edu)**

**Phone # 213-269-7247**

## Course Description

Control and utilization of inland and coastal water, quantitative hydrology, groundwater, probability concepts, extreme events, coastal hydrodynamics, wave-structures interactions, multiple purpose water projects, economic study.

## Learning Objectives and Outcomes

By the end of the course, the student will be able to:

1. Use and interpret the basic fluid mechanics principles and its connection to the problems faced by engineers in water resources and coastal engineering.
2. Formulate and construct the theoretical models in hydrologic cycle.
3. Establish multi-parameters relationship of rainfall/runoff patterns. Develop outflow hydrographs from inflow hydrographs for resources or river routing.
4. Determine the groundwater characteristics through steady and unsteady pumping tests.
5. Use the probability concept to compute the design flood for extreme events.
6. Develop and assess the urban water management strategies.
7. Determine the needed reservoir storage capacities and the associated safe yield and secondary yield for a given storage capacity.
8. Analyze and design uniform and non-uniform open channels.
9. Measure flow rate (discharges) in flume and channels.
10. Analyze and design of flows in pressurized conduits.
11. Assess multipurpose water projects including economic comparisons.
12. Analyze various wave generation mechanisms and develop design wave patterns.
13. Assess the impact of wave propagation and transformation unto the coastal zone.
14. Compute wave forces on marine structure and assess the impact of wave-structure interaction.
15. Engage life long learning through research and preparation of the term paper and term hydrologic report.

**Prerequisite(s):** CE 309

## Course Notes

Lecture notes on coastal engineering prepared by the instructor will be provided to the class students.

These notes contained topics on wave theories, and the generation, propagation, transformation of waves and wave interactions in the coastal zones. Additional reference sources for the students will be cited in the notes when applicable for more study. Wave interactions with marine structure including groins, jetties, and breakwaters will be covered.

**Late Student Work:** Completed assignments (HW, Lab HW) are due at the beginning of class on the due date. If the student work cannot be turned in at the beginning of class on the due date, prior permission from the instructor to change the due date is necessary. Without permission, the student work will not be graded.

## Required Readings and Supplementary Materials

**Textbook:** "Water Resources Engineering" 2nd Edition (2011) by Larry Mays  
John Wiley & Sons, Inc (ISBN 978-0-470-46064-1)

**Reference Text:** "Water Resources Engineering" 4th edition (1992)  
by Linsley, Franzini, Freyberg, Tchobanoglous  
McGraw Hill Book Co.

## Description and Assessment of Assignments

### HW Assignments

A total of 12 sets of homework will be assigned during the semester.

Each assignment will have 2-3 problems, each problem will be given 20 pts. Total weights of the homework is 20% of the course grade

The homework problems are developed by the instructor to help individual students understand and apply the concepts covered in the classroom lectures. Each student works on the problems assigned and turn in one week after the assignment is given.

### Hydrologic Report

The students are required to select at least three stations of a geographical area (with the approval of the instructor) for collection of the daily rainfall data in these stations. The data will cover from the beginning of the water year (October 1 to May 1 of the following year). The hydrologic report will present the daily tracking of the rainfall record, seasonal pattern and spatial pattern as compared with the historical data and correlations observed or inferred among the chosen stations. When applicable the students must propose what can be done to estimate the missing data. The hydrologic report is due at the end of the semester. The weight of the hydrologic report is 5%.

### Term Paper

The students are required to submit a term paper describing a water resources project in the fields of control and utilization of water or a review of published technical paper on a chosen topics related to water resources and coastal engineering. Prior approval of the instructor regarding the chosen topics is required. The term paper should cite all references and include what can be improved on the project the strength and weakness of the technical papers reviewed. How you can improve on the work you studied. The length of the typed written report is limited to 12 pages (single lined) including graphs and reference list. The weight of the term paper is 10%.

### Grading Breakdown

Assignment	% of Grade
Class Participation	10
Homework Assignments	20
Midterm Exam	25
Hydrologic Report	5
Term Paper	10
Final Examination	30
<b>TOTAL</b>	<b>100</b>

### Grading Scale

Course final grades will be determined using the following scale

A	90-100
B	80-89
C	70-79
D	50-69
F	Below 50

### Assignment Submission Policy

Homework assignments are due one week after it is given. The deadline will be at 5:00 pm, on Wednesdays' class date.

### Course Schedule: A Weekly Breakdown

	Topics/Daily Activities	Readings and Homework	Deliverable/ Due Dates
Week 1	Review of Fluid Mechanics Principles, Problems in Water Resources and Coastal Engineering; Hydrologic Cycle, Precipitations, Runoffs.	Lecture Notes to be provided.  Chapter 7 (Sections 7.1 & 7.2) of May's Book	Homework 1 assigned
Week 2	Theoretical Models for Rainfall, Runoff, Evaporation and Transpiration, Variations and errors in Hydrological Data. Rating Curves, Slope-Stage-Discharge Relationship. Hydrograph Analysis. Rainfall-Runoff Models, Runoff Coefficients, Four Parameters Curves, Unit Hydrograph, Rational Formulas for Peak Discharge.	Chapter 7 and Chapter 8 of May's Book  Lecture Notes to be provided  Chapter 8 of May's Book	Homework 2 assigned  Homework 1 due
Week 3	Flood Routing, Routing through Reservoirs, River Routing, Concepts of Stochastic Hydrology, Ground Water Hydrology, Darcy's Law, Hydraulic Conductivity, Aquifer Characteristics, Well Hydraulics.	Chapter 9 of May's Book.  Chapter 6 of May's Book	Homework 3 assigned  Homework 2 due
Week 4	Steady and Unsteady Pumping Tests. Aquifer Analysis; Ground Water Development, Artificial Recharge, Conjunctive Use of Surface and Groundwater.	Chapter 6 (sections 6.4 to 6.9)  Lecture Notes to be provided	Homework 4 assigned  Homework 3 due
Week 5	Probability Concepts, Time Series Analysis, Extreme Events. Two-parameters	Chapter 10 of May's Book	Homework 5 assigned  Homework 4 due

	and Three-parameters Distribution Functions.		
Week 6	Urban Storm water Management, Detention Facilities.  Mid-Term Examination	Chapter 15 of May's Book	Homework 6 assigned  Homework 5 due
Week 7	Sediment Control Reservoir Engineering: Determining Required Capacity, Safe and Secondary Yields, Wind Waves, Significant Wave Heights, Dams, Spillways.	Lecture Notes to be provided	Homework 7 assigned  Homework 6 due
Week 8	Analysis and Design of Uniform and Non-uniform Open Channels. Normal, Critical Depth, Hydraulic Efficiency of Chanel, Channel Transition . Water Surface Profiles, Hydraulic Jumps.	Chapter 5 of May's Book  Lecture Notes to be Provided	Homework 8 assigned  Homework 7 due
Week 9	Field Measurements, Flume and Culvert , Inverted Siphons.  Analysis and Design of Pressured Conduits, Major Losses in Pipes.	Section 5.6 of May's Book  Chapter 4 of May's Book	Homework 9 assigned  Homework 8 due
Week 10	Minor Losses, Forces Acting on Pipes, Water Hammers and Surge Protections, Pumps and Turbines. Selection of Pumps.	Lecture Notes to be Provided	Homework 10 assigned  Homework 9 due
Week 11	Issues for Multi-purpose Water Projects, Engineering Economic Analysis in Water Resources Planning, Cost of Capital, Cost of Operation of Operation Cost of Risk, Methods of Economic Comparison.	Lecture Notes to be Provided	Homework 11 assigned  Homework 10 due
Week 12	Problems in Coastal Engineering and Coastal Zone Protections. Wave Generations by Winds, Landslides and Submarine	Lecture Notes to be Provided	Homework 11 due

	Earthquake (Tsunamis).		
Week 13	Linear and Nonlinear Wave Theories. Wave Superposition. Wave Forces.	Lecture Notes to be Provided	Homework 12 assigned
Week 14	Propagation and Transformation of Waves. Wave Refractions, Diffractions, Reflections and Harbor Resonances	Lecture Notes to be Provided	Homework 12 due
Week 15	Wave Interactions with Marine Structures, Groins, Jetties, and Breakwaters, Significant Wave Heights and Design Wave Heights, Stability of Breakwaters.	Lecture Notes to be Provided	Term Project – Hydrologic Report due  Term Paper due
FINAL			Date: For the date and time of the final for this class, consult the USC <i>Schedule of Classes</i> at <a href="http://classes.usc.edu/">classes.usc.edu/</a> .

## Statement on Academic Conduct and Support Systems

### Academic Conduct:

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” [policy.usc.edu/scampus-part-b](http://policy.usc.edu/scampus-part-b). Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, [policy.usc.edu/scientific-misconduct](http://policy.usc.edu/scientific-misconduct).

### Support Systems:

*Student Health Counseling Services - (213) 740-7711 – 24/7 on call*  
[engemannshc.usc.edu/counseling](http://engemannshc.usc.edu/counseling)

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

*National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call*  
[suicidepreventionlifeline.org](http://suicidepreventionlifeline.org)

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

*Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-4900 – 24/7 on call*  
[engemannshc.usc.edu/rsvp](http://engemannshc.usc.edu/rsvp)

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

**Office of Equity and Diversity (OED) | Title IX - (213) 740-5086**

[equity.usc.edu](http://equity.usc.edu), [titleix.usc.edu](http://titleix.usc.edu)

Information about how to get help or help a survivor of harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following protected characteristics: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations.

**Bias Assessment Response and Support - (213) 740-2421**

[studentaffairs.usc.edu/bias-assessment-response-support](http://studentaffairs.usc.edu/bias-assessment-response-support)

Avenue to report incidents of bias, hate crimes, and microaggressions for appropriate investigation and response.

**The Office of Disability Services and Programs - (213) 740-0776**

[dsp.usc.edu](http://dsp.usc.edu)

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

**USC Support and Advocacy - (213) 821-4710**

[studentaffairs.usc.edu/ssa](http://studentaffairs.usc.edu/ssa)

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

**Diversity at USC - (213) 740-2101**

[diversity.usc.edu](http://diversity.usc.edu)

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

**USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call**

[dps.usc.edu](http://dps.usc.edu), [emergency.usc.edu](http://emergency.usc.edu)

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

**USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call**

[dps.usc.edu](http://dps.usc.edu)

Non-emergency assistance or information.