

1. Course number and title  
ORE/CEE 621 Coastal Flood Mitigation
2. Credits and contact hours  
3 credits, one 2.5-hour session per week
3. Instructor  
Oceana Francis
4. Textbooks  
Textbooks: None  
Reference books:
  - a. Coastal Engineering Manual – Part II, US Army Corps of Engineers, 2006 (PDF version on <http://chl.erdc.usace.army.mil>).
  - b. *Handbook of Coastal and Ocean Engineering*, Vol. I, II, and III, Edited by John Herbich, Gulf Publishing Company, 1990.
  - c. Zanuttigh, B., R.J. Nicholls, Jean-Paul Vanderlinden (Editor), Richard C. Thompson (Editor), Hans Falk Burcharth (Editor) (2015). *Coastal Risk Management in a Changing Climate* 1st Edition, ISBN-13: 978-0123973108.
  - d. Francis, O., H. Brandes, G. Zhang, D. Ma, L. Yang, O. Doygun, H. Togia, C. Rossi, G. Costanzo (2019). *State of Hawai‘i Statewide Coastal Highway Program Report*. Prepared for the State of Hawai‘i Department of Transportation, Project Number HWY-06-16, August 21, 2019, [https://hidot.hawaii.gov/highways/files/2019/09/State-of-Hawaii-Statewide-Coastal-Highway-Program-Report\\_Final\\_2019.pdf](https://hidot.hawaii.gov/highways/files/2019/09/State-of-Hawaii-Statewide-Coastal-Highway-Program-Report_Final_2019.pdf).
  - e. Francis, Oceana; Yang, Linqiang; Togia, Harrison ; Tumino Di Costanzo, Giannicola (2019), *Ocean Hazards Database (OHD) for the State of Hawai‘i Statewide Coastal Highway Program Report*, Mendeley Data, doi: 10.17632/7p3hyypmjm.
  - f. Other references provided by the Instructor.
5. Specific course information
  - a. Course context: Design and solutions to coastal flood mitigation problems. Topics include climate adaptation; engineering solutions and best practices to mitigate coastal risk under different ocean hazard scenarios; and ecological approaches to mitigate coastal risk. Pre-req: consent; knowledge of AutoCAD and ORE 661 desirable.
  - b. Prerequisites by Topics:
    - i. Applied mechanics
    - ii. Engineering economics
    - iii. Fluid mechanics
    - iv. Hydraulics
    - v. Probability and Statistics
    - vi. Soil Mechanics
    - vii. Wave mechanics
  - c. Designation: ORE elective course
6. Specific goals for the course
  - a. Learning Outcomes:

The goal of the class is to build the students' ability to work on creative, realistic, tangible solutions to sometimes difficult flood mitigation problems through teamwork. This includes developing the student's ability in several key areas:

- To engineer using active methods of mitigation.
  - To prepare for new challenges due to expected effects induced by climate change.
  - To use natural habitats as a form of defense and how to restore and/or create them.
- b. Student Outcomes:
- i. Course provides in-depth technical knowledge in a subdiscipline of specialization (i.e. flood mitigation of coastal environments).
  - ii. Course provides the understanding of the interconnectivity of social, built infrastructure and natural systems.
  - iii. Course provides evidence based thinking on the implications of sustainability problems and proposed solutions.
  - iv. Students evaluate and synthesize literature to develop engineering solutions.
  - v. Students present their technical work orally in a formal setting.
  - vi. Students produce a technical final report.
  - vii. Students perform engineering research and a conduct project that address open-ended problems.

7. Topics covered

- a. Introduction  
Coastal flooding impacts on communities, ecosystem, and built infrastructure
- b. Coastal Engineering Methods  
Rubble mound breakwaters, floating breakwaters, revetments, seawalls, sediment Resources
- c. Nature-Based Solutions for Coastal Resilience  
Sandy beaches and sand dunes, reef systems, seagrass meadows, incorporating ecological design to hardened protection methods
- d. Incorporating Climate Stressors into Coastal Engineering Design  
Sea level rise, tides, waves, shoreline change, storm surge, tsunamis, implications on society, ecosystem and built infrastructure
- e. Design of Revetment and Breakwaters due to Climate Stressors  
Assessing infrastructure and asset impacts, force calculations, design considerations, armor units, crest height and width, layer thickness, number of armor units, primary and secondary cover layers, underlayers, bedding layer, toe protection, core
- f. Incorporating Nature-Based Solutions