# Florida International University
# Department of Civil and Environmental Engineering

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## Course Syllabus
## CES 3580, Hurricane Engineering and Global Sustainability (3 credits)
## Fall Semester 2016

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**Overview:**

Hurricanes are giant spiraling tropical storms that affect the coastal communities on the east coast of the United States and the Gulf of Mexico. These same tropical storms are known as typhoons or cyclones in other parts of the world. These storms bring destruction to coastal communities around the world in many different ways. Engineers have played a crucial role in enhancing resiliency of coastal communities against hurricanes. This course is intended to provide insight into engineering aspects for achieving sustainable coastal communities around the globe.

**Catalog Course Description:**

This course examines the impacts of hurricanes and explores the role of engineers in achieving sustainable coastal communities around the globe. This course serves as a global learning course.

**Prerequisites:**

PHY 2053 or PHY 2048

**Instructor:**

Dr. Arindam Gan Chowdhury
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**Location and Timing:**

Room: EC 2410
Tuesdays and Thursdays: 9:30 – 10:45 am

**Textbooks:**

Divine Wind: The History and Science of Hurricanes, Kerry Emanuel, Oxford University Press, USA, 2005

Hurricane Almanac: The Essential Guide to Storms Past, Present, and Future, Bryan Norcross, St. Martin's Griffin, 2007

**Active Learning Strategies:**

The course will involve inductive team based learning (TBL) to address hurricane related problems. Coastal communities around the globe are experiencing greater population growth and increasing losses caused by hurricanes. This course is aimed to develop a whole new philosophy of

understanding, planning, and preparedness to reduce hurricane related losses. The students will work on multidisciplinary projects aimed at understanding and mitigating the hazards associated with hurricanes in terms of severe winds, wind-driven rain, windborne debris, flooding, storm surge, and waves. Much of the inductive learning will occur as the students will work in teams and individually to develop essays, reports, and make oral presentations to demonstrate their awareness, multi-perspective analyses skills, and willingness to develop engineering solutions that reduce adverse impacts of hurricanes at local, global, and international levels.

**Exit Competencies:**
After successful course completion the students should be able to:

1. Understand the fundamentals of impacts of hurricanes and the interconnectedness of those impacts around the world.
2. Conduct multi-perspective analyses to evaluate the extent to which factors such as economics, technology, and society contribute to hurricane impacts.
3. Appreciate inductive learning strategies as opposed to traditional deductive learning.
4. Identify new techniques for building hurricane resilient and energy efficient communities around the world.
5. Assess their willingness in becoming hurricane-qualified engineers to save lives and reduce property damage.

**Global Learning Course Outcomes:**
This course is also intended to serve as an elective addressing FIU's global learning outcomes. The global learning outcomes that will be addressed are listed below:

1. *Global Awareness*: Students will demonstrate an understanding of (i) the interrelatedness of hurricane (hurricane/cyclone/typhoon) impacts around the world, (ii) hurricane related engineering/socio-economic problems that have no regional or national borders, and (iii) the extent to which these problems are affected by increasing human population along the coasts as well as by different technological and socioeconomic aspects and interdependencies of critical infrastructure.
2. *Global Perspective*: Students will be able to conduct multi-perspective analyses of the multi-stressor impacts of hurricanes on communities around the world. Also, the students will be able to evaluate the extent to which interrelatedness of engineering and socioeconomic factors and interdependencies of critical infrastructure contribute to those impacts.
3. *Global Engagement*: Students will demonstrate their willingness to develop engineering solutions or technologies that reduce adverse impacts of hurricanes (with some application to non-hurricane winds) and develop more sustainable communities. Such solutions or technologies should be applicable at national, regional, and global levels and appropriate within the framework of engineering and socioeconomic factors.

**Grading Criteria:**
The final grade will be based on the following criteria totaling 100 points:

Attendance: 5 points (for Regular Students, NOT for FEEDS Students)
Global awareness artifacts: 20 points (10 points for each project)
Global perspective artifacts: 20 points (10 points for each project)
Global engagement artifacts: 15 points for Regular Students / 20 points for FEEDS Students
Mid-Term Exam: 15 points (Regular AND FEEDS Students are required to take in-class exam). Date to be announced.
Final Exam: 25 points (Regular AND FEEDS Students are required to take in-class exam). Final Exam will be held on the scheduled date/time in the final exam week.

The final exam will be comprehensive, i.e., covering all the materials covered in the course.

**University Misconduct Statement:**

Florida International University is a community dedicated to generating and imparting knowledge through excellent teaching and research, the rigorous and respectful exchange of ideas, and community service. All students should respect the right of others to have an equitable opportunity to learn and honestly demonstrate the quality of their learning. Therefore, all students are expected to adhere to a standard of academic conduct, which demonstrates respect for themselves, their fellow students, and the educational mission of the University. All students are deemed by the University to understand that if they are found responsible for academic misconduct, they will be subject to the Academic Misconduct procedures and sanctions, as outlined in the Student Handbook.

Misconduct includes: Cheating – The unauthorized use of books, notes, aids, electronic sources; or assistance from another person with respect to examinations, course assignments, field service reports, class recitations; or the unauthorized possession of examination papers or course materials, whether originally authorized or not. Plagiarism – The use and appropriation of another's work without any indication of the source and the representation of such work as the student's own. Any student, who fails to give credit for ideas, expressions or materials taken from another source, including internet sources, is responsible for plagiarism.

In addition to this specific University Misconduct Statement, while students will perform team based activities, each student should individually strive to understand the course concepts to facilitate overall class understanding and performance in class.

**Topics to be Addressed:**

**Global Awareness**

1. Historical perspective of hurricanes (hurricanes, cyclones, and typhoons)
    - Special emphasis on the past two centuries
    - Impact zones around the globe (examples: *United States, Puerto Rico, Dominican Republic, Bermuda, Bangladesh, India, China, Burma*, and many others)
    - Increases in hurricane activities over the past decades
    - Impact of climate change/global warming on hurricane activities
    - Case studies of hurricanes' impacts around the globe
    - Interrelatedness of hurricane impacts around the globe
    - Understanding interrelatedness of engineering and socioeconomic global impacts

    *Suggested reference(s):*
    **NOAA** FAQ about hurricanes, typhoons, and tropical cyclones:
    http://www.aoml.noaa.gov/hrd/tcfaq/tcfaqHED.html

    Isaac's Storm: A Man, a Time, and the Deadliest Hurricane in History, Erik Larson, Vintage, 2000

2. Hurricane forecasting and advisory
    - Satellite observation
    - Aircraft reconnaissance

- Track and intensity models
- Storm surge forecast
- Technological advances in forecasting tropical storms around the globe

*Suggested reference(s):*
U.S. National Hurricane Center: http://www.nhc.noaa.gov/

Hurricane Watch: Forecasting the Deadliest Storms on Earth, Jack Williams and Bob Sheets, Vintage, 2001

*Performance evaluation based on articulation of global awareness via two artifacts (written and oral) using a 20-point rubric (10 points each for the essay and the oral presentation). Question and answer session will follow each presentation to evaluate the understanding of individual student.*

**Global Perspective**

3. Analyzing the characteristics of hurricane multi-stressors
    - Hurricane basics (tropical cyclone climatology)
    - Hurricane induced wind
    - Hurricane induced wind-driven rain
    - Hurricane induced flooding
    - Hurricane induced storm surge and wave
    - Analyzing multi-stressors impacts on communities around the globe (e.g., in United States, island-countries of the Caribbean, Asian Subcontinent, etc.)

*Suggested reference(s):*
Divine Wind: The History and Science of Hurricanes, Kerry Emanuel, Oxford University Press, USA, 2005

Hurricanes: Causes, Effects, and the Future, Stephen P. Leatherman and Jack Williams, Voyageur Press, 2008

4. Multi-perspective analyses of hurricane vulnerability
    - Analyzing hurricane impacts on built environment
    - Analyzing socio-economic aspects of hurricane related disasters
    - Analyzing interrelatedness of engineering and socioeconomic impacts
    - Interdependencies of critical infrastructure under hurricane impacts (system of systems approach)
    - Building codes and their transformation over last decades

*Suggested reference(s):*
Identifying, Understanding, and Analyzing Critical Infrastructure Interdependencies, by Steven M. Rinaldi, James P. Peerenboom, and Terrence K. Kelly, IEEE Control Systems Magazine, December 2001

Cutter, S.L., Johnson, L.A., Finch, C. and Berry, M., "The US Hurricane Coasts: Increasingly Vulnerable?" Environment, 47(7):8-20, 2007.

Infrastructure Resilience to Disasters, Stephanie E. Chang, 2009 Frontiers of Engineering Symposium Session on "Resilient and Sustainable Infrastructures"

*Performance evaluation based on ability to conduct multi-perspective analyses of the multi-stressor impacts of hurricanes on communities around the world via two artifacts (written and oral) using a 30-point rubric (15 points each for the report and the oral presentation). Question and answer session will follow each presentation to evaluate the analysis of individual student. The evaluation will be done by peer groups and the instructor.*

**Global Engagement**

5. Building hurricane resilient communities around the world
    - Engineering solutions to reduce adverse impacts of hurricanes
    - Retrofitting existing structures
    - Hurricane preparedness
    - Hurricane insurance
    - Evacuation management
    - Technological advances in hurricane disaster mitigation

    *Suggested reference(s):*
    Hurricane Almanac: The Essential Guide to Storms Past, Present, and Future, Bryan Norcross, St. Martin's Griffin, 2007

    Hurricane Force: In the Path of America's Deadliest Storms (New York Times) by Joseph B. Treaster, Kingfisher, 2007

    *Performance evaluation based on final group presentation to demonstrate willingness to engage in engineering solutions for developing hurricane resilient communities around the globe. Open ended reflective questions will be asked to evaluate the willingness and motivation of individual student for disaster mitigation. The presentation will be evaluated using a 20-point rubric. The evaluation will be done by peer groups and the instructor.*

**ABET-related Objectives & Outcomes:**
The course will accomplish the following ABET-related objectives and outcomes:

*Objective 1 - Technical Proficiency: Our graduates will have the ability to:*
3a. Apply knowledge of mathematics, science, and engineering to solve civil engineering problems;
3e. Identify, formulate, and solve civil engineering problems;
3k. Utilize the techniques, skills, and modern scientific and engineering tools necessary for civil engineering practice.

*Objective 2 - Communication: Our graduates will have an acceptable level of proficiency in:*
3d. Working with others as part of multi-disciplinary teams;
3g. Written, oral, and graphical communication.

*Objective 3 – Responsible Citizenship: Our graduates will have an acceptable level of appreciation for and understanding of:*
3h. The impact of engineering solutions in a global and societal context;
3j. Contemporary issues facing society as a whole.

*Objective 5 – Ethical Behavior: Our graduates will:*

3f. Have an understanding of professional and ethical responsibility.

The outcome identifiers correspond to those used in the ABET Criteria for Accrediting Engineering Programs (www.abet.org).