NORTHEASTERN UNIVERSITY
DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING

CIVE 4777 – Climate Hazards and Resilient Cities or Coastlines – Summer 1 - 2015

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Course description: This course, which will be offered in India just prior to and possibly at the beginning of the monsoon season, combines the science, engineering, economic, social, and policy aspects of how cities can prepare themselves for climate change and natural hazards. Climate change and weather extremes are arguably the largest threats facing the nation, especially urban and coastal areas, as evidenced from the devastating impacts of hurricanes Katrina, Irene, and Sandy on the U.S. cities of New Orleans, Boston, and New York / New Jersey in 2005, 2011, and 2012. Coastal regions may be particularly impacted, with sea level rise and storm surge being major concerns. The challenge is global, as the 2005 Mumbai floods and the more recent 2013 floods in the Uttarakhand region demonstrated over India. The devastation is not restricted to cities however, as demonstrated by the recent droughts in the US southwest and in parts of India such as the northwest.

Students will learn about the science of what has been sometimes been called "global weirding": this refers to the possibility of unprecedented changes in weather and hydrological extremes or regional climate patterns caused by global warming and natural climate variability. The physical science basis of climate, and computer models of the earth system, will be introduced together with their uncertainties. Statistical tools for the analysis of climate model and remote sensor data will be presented. The concept of urban resilience will be introduced and developed, with a focus on the ability to prevent natural hazards from turning into catastrophic disasters in densely populated and vulnerable regions. The ability to prevent the disruption of critical functions, and recover these functions should they get disrupted, will be discussed. The multi-faceted aspect of resilience will be examined, and will include governance, emergency response, infrastructural, informational, social, and policy aspects. Decision support tools will be introduced. The students will get an opportunity to experience pre-monsoon India, and perhaps the onset of the Indian monsoons, and how this both refreshes and impacts life in cities such as Mumbai and Bangalore, as well as in Kerala where the monsoons hit the earliest. Flash floods in Mumbai, often caused by concurrence of high intensity rainfall on the paved urban surface and high tide, and corresponding adaptation strategies, will be discussed.

Students will be working in groups to produce integrated reports discussing the science, engineering, and policy challenges in transforming vulnerable urban and coastal regions to climate resilient cities. The reports will closely examine whether and how societies can learn from each other by comparing, for example, Boston with Mumbai, and the US in general with India. This course requires enthusiasm to explore and research another culture, and an interest in interdisciplinary learning that can contribute to providing solutions for urgent national and global priorities. The course will formally meet daily during the first half, when fundamental principles will be introduced in a classroom setting, and weekly assignments. An in-class, open-book, and open-notes examination will be conducted at the end of the first half of the course. The second half will be devoted to projects in small groups, some of which may involve students and faculty or other invited guests in India, and to the development of reports and presentations. While the course will formally meet twice during the week in this second phase, informal discussions with the instructor and supporting teaching assistants, as well as with interested guests, will be

encouraged and expected. A two-part report is required, where the first should be on a topic of general interest, and the second on first hand experiences of Northeastern students in India and their observations of how cities such as Boston and Mumbai or coastal states like Massachusetts and Kerala are similar or different and may learn from each other, understanding climate extremes and developing adaptation measures.

At the conclusion of this course students will be able to:

1. Develop a basic understand of the science of climate change and natural hazards.
2. Understand the concept of resilience as this applies in urban or coastal settings.
3. Learn introductory concepts and tools for pertinent analysis and decision making.

Assignments and Grading:

(1) Homework Assignments: There will be three homework assignments covering the three broad topics: climate science, urban resilience, and tools or methods. The completed assignments will need to be submitted individually, and may entail a combination of standard problem sets and questions that require out of the box and innovative ideas.
The three homework assignments will be weighed equally and will comprise 45% of your final Grade.

(2) Written Report and Oral Presentation: The written report will comprise two parts as described earlier, and end with a group presentation. The contribution of each student in the group project will be carefully monitored, and the final grades will be based on both the overall team performance and the contributions of individuals within the group.
The written report is worth 30% of your final Grade. I will be grading you on content, organization, participation, and overall presentation. The final presentation will be worth 10% of the final Grade. The final report is due no later than May 30, 2013.
Attendance, participation, and enthusiasm will account for 15% of the Grade.

REQUIRED REFERENCES:

1. UCCRN ARC3 2011: **"**Climate Change and Cities: First Assessment Report of the Urban Climate Change Research Network (ARC3)", 2011: Downloadable from http://uccrn.org/publications/
2. IPCC SREX 2012: **"**Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX)" a Special Report by the Intergovernmental Panel on Climate Change (IPCC), 2012: Downloadable from http://ipcc-wg2.gov/SREX/

BACKGROUND NEWS ARTICLES:

1. A quote from a March 2012 news report in USA Today on the IPCC SREX titled "Global warming linked to deadly, costly weather disasters": http://usatoday30.usatoday.com/weather/climate/globalwarming/story/2012-03-28/climate-change-global-warming-weather-disasters-floods-droughts-storms/53826590/1 *"The greatest danger from extreme weather is in highly populated, poor regions of the world, the report warns, but no corner of the globe — from Mumbai to Miami — is immune … The 594-page report blames the scale of recent and future disasters on a combination of man-made climate change, population shifts and poverty."*
2. A November 2012 report in the NY Times titled "Protecting the City, Before Next Time" on hurricane preparedness post Sandy: http://www.nytimes.com/2012/11/04/nyregion/protecting-new-york-city-before-next-time.html