

# COASTAL RESILIENCE CENTER

*A U.S. Department of Homeland Security Center of Excellence*

CRC 1<sup>st</sup> Annual Meeting: March 2-3, 2016  
Chapel Hill, NC

## Education for Improving Resiliency of Coastal Infrastructure

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# Caribbean Coastal Hazards

(Hurricane Winds-Storm Surges, Earthquakes-Tsunamis, Riverine Floods, Waves, Tides)

## Puerto Rico: Overpopulated PR Demographic Information



Based on the 2010 Census:

### Residential analysis

- 1.7 million people living in coastal areas
- 320, 027 people living in flood-prone areas (43,861 in the floodway)
- High number of residences constructed without a building code
- (44/78 municipalities nearby the coast)



## VISION

**To provide students and faculty, professionals and homeland security personnel, and affected citizens with capabilities to assess the effects of natural hazards on coastal infrastructure, the conditions of existing structures, and rehabilitation alternatives to mitigate future damage and potential risks.**

## MAIN GOALS

- **Develop and offer formal and informal education through courses, workshops, seminars, lectures and other educational means leading to advance knowledge on the state of practice on Resiliency of Coastal Infrastructure (built and natural).**
- **Strengthen the pipeline of students and professionals into RCI careers and practice.**
- **Help the community understand better various stages in coastal infrastructure hazard:**
  - **prevention, preparedness, response, recovery, and mitigation.**
- **Create a Certificate in Resiliency of Coastal Infrastructure (RCI).**

# Project Relevance to DHS S&T Mission

- Aligns with research theme **“Building Resilient Communities”**
- Contributes to **“Planning for a Disaster Resilient Future”**, **“Communicating Risk to Motivate Action”**, **“Flood Risk Communication”**, and **“Whole Community Approach”**.

## Impact of Project

- Provide **educated, updated, qualified, and competent** individuals, students, professionals, first responders, and officials from minority population who will be capable and motivated to engage, participate, and serve in the **“Whole Community Approach”**.

## Strengthen National Preparedness and Resilience

(Goal 5.2 Mission 5 – Mitigate Hazard and Vulnerability)

- Promote public and private sector awareness and understanding of community-specific risks
- Reduce vulnerability through standards, regulations, resilient design, effective mitigation and disaster risk measures; and
- Prevent incidents by establishing, and ensuring compliance with, standards and regulations.

## **METHODOLOGIES:**

# **Technology Transfer for Resilience of Coastal Infrastructure**

- **Formal courses**
- **Informal courses**
- **Workshops**
- **Seminars**
- **Lectures**
- **Literature resource library or repository – Web site**
- **Certificates**

## Resiliency of Coastal Infrastructure Education MILESTONES

June  
2016

- RCI Constituents Network
  - Program Inauguration
  - Educational Priorities
  - 1<sup>st</sup> Round: Seminars/Lectures

June  
2017

- Partnerships: Engage Partners
  - Seminar, Workshops, Conference
- Engage Faculty/Students/Professionals
  - Internships, Courses, Training
- First Round of Certificates

June  
2018

- Expand Educational Community
  - High School students/teachers
- Community of Minority Educational Leaders
  - Train the Trainers workshop
- Second Round of Certificates

## RESULTS: NETWORKING

- **Collaboration Agreement: UPRM and NDPTC**  
National Disaster Preparedness Training Center-NDPTC (University of Hawaii)  
Media Interview: Feb. 4, 2016 Local TV Station
- **Agreement with the UPRM Sea Grant Program**
- **Training: PER-306 HURRIPLAN Resilient Building Design for Coastal Communities**
- **Training: “Beyond Academia: Maximizing Research Impact” – UPRM R&D Center**



Photos Courtesy UPRM Sea Grant Program

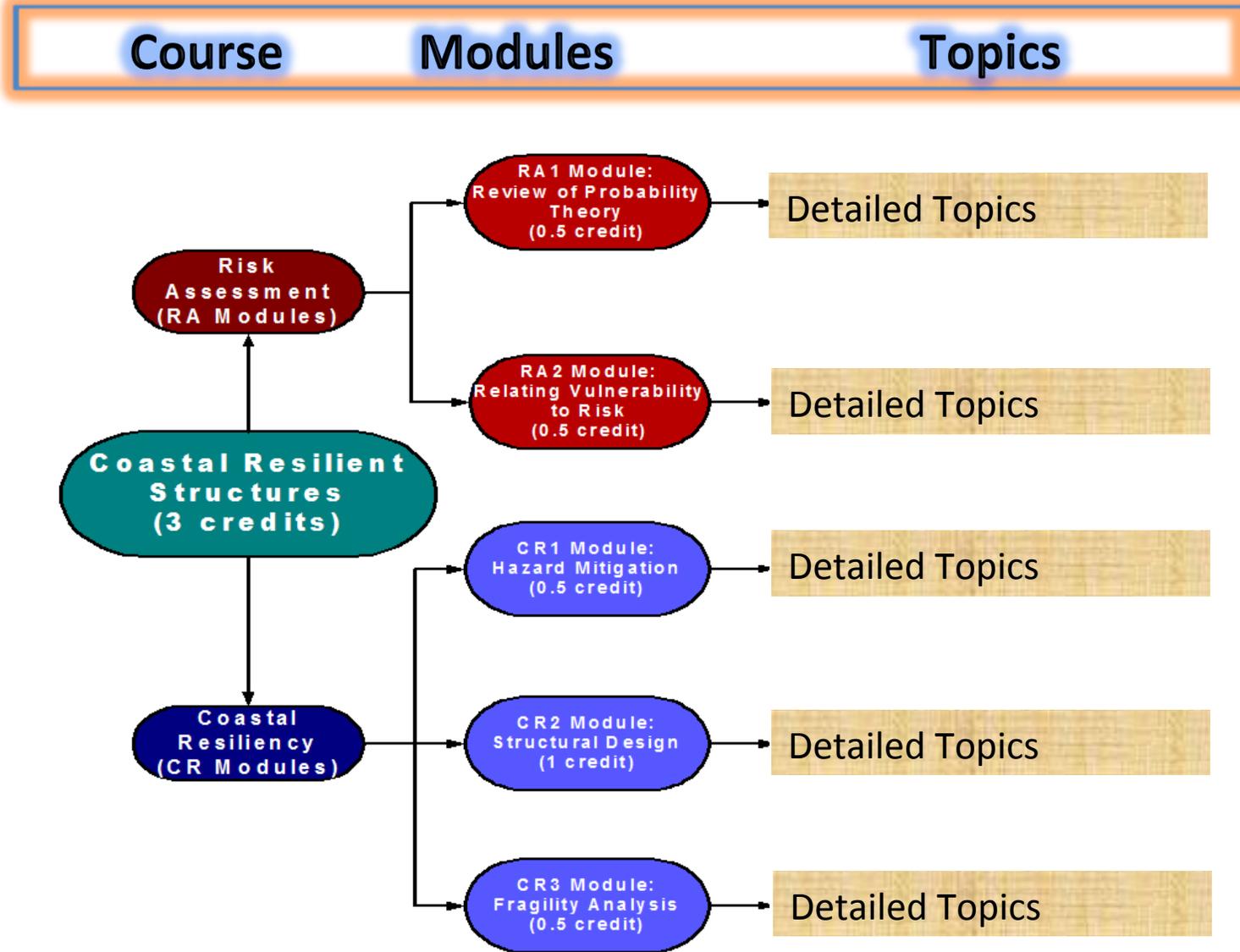
## RESULTS: UPRM – Conference Coordination

- **Climate Change Impact in the Caribbean**
  - **Goals:** Educational & Research Agenda in the Caribbean
  - **Format:** Lectures + Workshop
  - **Focus:** Coastal Environments
  - **Themes:** Economic Development/Infrastructure/Agriculture/Social-Governance/Others
  - **Date:** December 2016
  - **Site:** UPRM-Mayagüez and San Juan, PR
  - **Duration:** 2-3 days
- **Invitation: CRC Partners Collaboration**

## RESULTS

- **Education: Formal Course/Module Design (Faculty engagement)**
  - Coastal Resilient Structures (3 credits)– Saffar
  - Introduction to Marine Geomechanics (3 credits)– Morales
  - Natural Hazards in Coastal Zones (3 credits) – López & Pagán
  - Geotechnical Analysis of Coastal Structures (1 credit) - Ramos

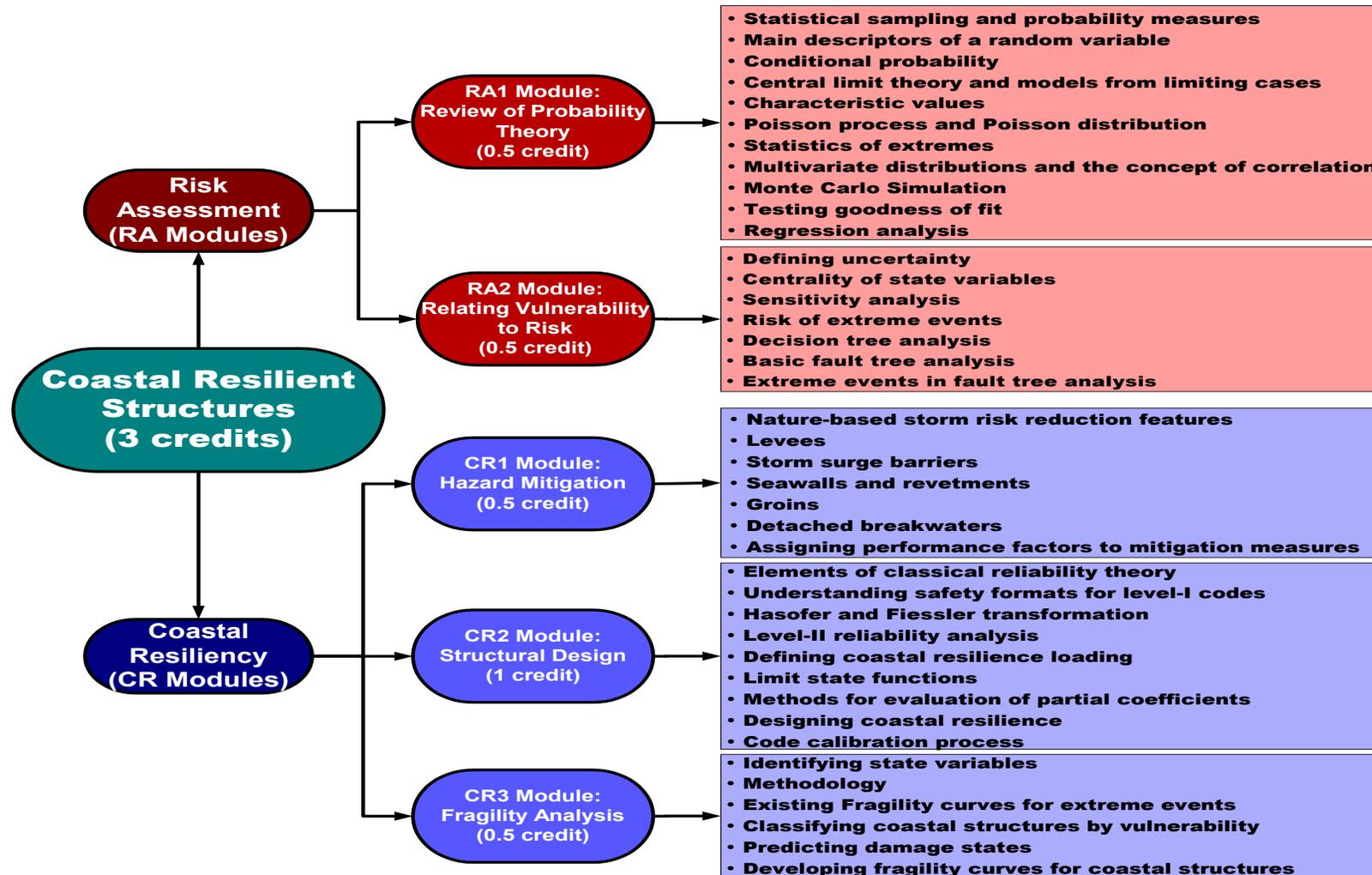
# Example New Course : Coastal Resilient Structures – 3 credits



## RA1 Module: Review of Probability Theory (0.5 credit)

- **Statistical sampling and probability measures**
- **Main descriptors of a random variable**
- **Conditional probability**
- **Central limit theory and models from limiting cases**
- **Characteristic values**
- **Poisson process and Poisson distribution**
- **Statistics of extremes**
- **Multivariate distributions and the concept of correlation**
- **Monte Carlo Simulation**
- **Testing goodness of fit**
- **Regression analysis**

# All detailed topics are designed for this course



## Course

## Modules

### Example 2 . New Course

### **Introduction to Marine Geomechanics (3 credits)**

- Marine Geomechanics
- Marine Soils (Properties and Strength)
- Marine Sediment Properties
- Wave Induced Pore Pressures
- Laboratory, Field, and Experimental Technics
- Offshore Resource Developments
- Challenges and design of nearshore and offshore Geotechnical Structures

End-  
Users

- **University** (Faculty, Students): [Teaching/Research](#)
- **Practitioners** (Engineering/Architecture/Planning/others): [Analysis/Design/Construction](#)
- **First Responders** (Government Officials): [Enforcement/Prevention, Response, etc.](#)
- **Precollege** (Faculty/Students): [Motivation/Pipeline](#)
- **Community** (Volunteers/Non-for Profit Org./Commercial Business/ Insurance Co.): [Preparedness, Engagement, Participation](#)
- **OTHERS**

## RESULTS: SUMREX INITIATIVES

- **BAA ERDC:** 1 MS Thesis “Coastal Hurricane Modeling”
- **OSU:** 2 positions: “*Hydrodynamic Modeling*”
- **LSU/UCF:** 1 position: “*Coastal Modeling*”
- **ERDC-EPRM Educational and Research Partnership (ERIP):**  
Coastal and Hydraulic Lab (CHL) – 5 positions – various researchers
  - *Synthetic Hurricane Tracks*
  - *Numerical Modeling of Riverine Floods*
  - *Near Shore Numerical Wave Modeling*
  - *Nonlinear wave modeling (FUNWAVE)*
  - *Hydrodynamic Numerical Modeling (Estuarine, riverine, coastal, salinity intrusion, sediments)*