

# Catastrophe Modeling (CAT)

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## Courses

### **CAT 401 Catastrophe Modeling and Resilience 3 Credits**

Introduction to catastrophe modeling and resilience terminology, methods, and tools. General framework of catastrophe modeling and resilience assessment, with simple applications to various fields. Description of hazard, fragility, vulnerability and portfolio analysis. Effect of climate change. Research methods, scientific communication. Use of catastrophe risk and resilience modeling software and databases. Societal impact and ethical concerns raised by catastrophe insurance and resilience enhancement. Guest lectures from experts and term project. Students cannot receive credits for both CEE 331 and CAT 401.

### **CAT 402 Applications of Catastrophe Modeling and Resilience 3 Credits**

Advanced analyses of various applications of catastrophe models, such as natural disasters or health-related threats to inform management and policies. Course activities include 1) reading recent publications on catastrophe model development, application and limitations, 2) practical exercises, in-class and as homework, about deterministic and stochastic model construction, and 3) result visualization of disaster impacts via geographic information systems. Theory and context-dependent practical problems on catastrophe model parameterization are covered. Students cannot receive credits for both CEE 332 and CAT 402.

**Prerequisites:** CEE 331 or CAT 401

**Can be taken Concurrently:** CEE 331, CAT 401

### **CAT 403 Mathematics of Actuarial Science 3 Credits**

Introduces tools from financial mathematics necessary for insurance applications. It presents the basic mathematics of interest rates and investments, such as present value, annuity calculations, and bond valuation. An introduction to modeling claims with Markov chains and Poisson processes will be presented. In a second part, the course will also introduce some of the standard models used in risk modeling, such as no-arbitrage pricing for derivatives and the Black-Scholes model. Fixed-income markets models are also discussed briefly.

**Prerequisites:** MATH 309 or MATH 310 or STAT 410

### **CAT 411 Catastrophe Modeling and Resilience Capstone 3 Credits**

Students work individually or in teams, integrating knowledge and skills acquired in their prior course work, to develop catastrophe models or perform resilience assessment for realistic scenarios and applications. Projects will be inspired by and possibly conducted in collaboration with partners from private sector, public sector, or academia. The students will produce written reports and/or oral presentations, as appropriate for the project.

**Prerequisites:** CEE 331 or CAT 401

### **CAT 412 Supervised Research in Catastrophe Modeling and Resilience 1-3 Credits**

A study of selected topics in catastrophe modeling and resilience, applied to any field of interest to the student. The research may include methodological advancements, new findings, or extensions of the scope of application of known techniques. A report and/or presentation is required. Consent of the department required.

**Repeat Status:** Course may be repeated.

### **CAT 490 Thesis 1-6 Credits**

Master thesis.

**Repeat Status:** Course may be repeated.