

## PROBABILITY: MASTERS IN DATA SCIENCE AND STATISTICS

**Course times:** Lecture times are as follows:

- Online video
- Friday 1:00 - 3:00 PM,

**Office hours:** 2 hours a week at times to be determined at first class meeting.

**Contact Details:**

- Dr Matthew Nicol , Office PGH Room 210 , nicol@math.uh.edu, Extn: 6181
- Dr. Cathy Poliak, Office Fleming 11c, cathy@math.uh.edu

**Course Description:** Emphasis will be placed on an understanding of the basic concepts of modern probability as well as developing problem solving skills. Topics covered include: combinatorial analysis, independence and the Markov property, introduction to Markov chain theory, the major discrete and continuous distributions, joint distributions and conditional probability, modes of convergence. These notions will be examined through examples and applications.

**Topics covered:**

- Probability spaces, random variables, axioms of probability.
- Combinatorial analysis (sampling with, without replacement etc)
- Independence and the Markov property. Markov chains- stochastic processes, Markov property, first step analysis, transition probability matrices. Longterm behavior of Markov chains: communicating classes, transience/recurrence, criteria for transience/recurrence, random walks on the integers.
- Distribution of a random variable, distribution functions, probability density function. Independence.
- Strong law of large numbers and the central limit theorem.
- Major discrete distributions- Bernoulli, Binomial, Poisson, Geometric. Modeling with the major discrete distributions.
- Important continuous distributions- Normal, Exponential. Beta and Gamma.
- Jointly distributed random variables, joint distribution function, joint probability density function, marginal distribution.
- Conditional probability- Bayes theorem. Discrete conditional distributions, continuous conditional distributions, conditional expectations and conditional probabilities. Applications of conditional probability.

**Recommended Texts:**

- An Introduction to Stochastic Modeling, 3rd Edition, by H Taylor and S Karlin, Academic Press. Or the 4th edition with Pinsky as co-author.
- Introduction to Probability Models by Sheldon Axler 11th edition.
- Probability with Applications in Engineering, Science, and Technology, by Matthew A. Carlton and Jay L. Devore, 2014.

Lecture notes will be comprehensive and the books listed above are for reference. An Introduction to Stochastic Modeling is useful for Markov Chain theory.

There are many other texts that may be useful for reference and the library has a wide selection of books on probability.

**Assessment:** Approximately 5 take-home problem sheets.

**Not all the questions on the take-home problem sheets will be graded- a subsection of the questions will be randomly chosen and graded. The grade on the take-home problem sheet will be based on this graded subsection.**