

**Probability Theory: Math 60850**  
**Hayes-Healy 229: MWF 1:55-2:45**  
**Andrew Sommesse (Instructor)**

This first-year graduate course is a solid introduction to Probability. Though the only requirements are a full sequence of calculus, some linear algebra, and a willingness to learn what is needed; having had an undergraduate probability course and the equivalent of a mathematical methods course (including the rudiments of one complex variable, Fourier transforms, and Laplace transforms) will help a lot. Topics covered will include:

1. Basic setup of probability theory (including sample spaces, conditional probability, independence). Random variables (including the elements of measure and integration theory).
2. Discrete and continuous random variables.
3. Laws of Large Numbers.
4. Central Limit Theorems.
5. Random walks; stopping times; and recurrence theory.
6. Martingales and optional stopping theorems.
7. Markov chains (embedding, birth and death processes, Poisson processes)
8. Various stochastic processes, including Brownian motion, queues, and applications.
9. The rudiments of stochastic integration (including Ito's formula and the Black-Scholes differential equation).

Durrett [1] will be used as a text. A good elementary book is [3]. Feller [2] is a classic. Williams [4] is an excellent graduate text for some of the material we cover in the first half of the semester.

## References

- [1] R. Durrett, Probability: Theory and Examples, Duxbury Press, 3rd edition, 2004.
- [2] W. Feller, An Introduction to Probability Theory and Its Applications, Volume 1, Wiley.
- [3] S. Ross, A First Course on Probability, 6th ed., Prentice Hall (2002).
- [4] D. Williams, Probability and Martingales, Cambridge, 1991.