

## Syllabus for M560: Applied Stochastic Processes

- Class:** Location, Days, and Times Swain West 220, MWF, 9:05-9:55 am
- Section Number:** 27935
- Textbook:** Stochastic Processes by Sheldon Ross. Adventures in Stochastic Processes by Sidney Resnick is on reserve as back-up in the Swain Library.
- Course Website:** <http://mypage.iu.edu/~ehouswor/Spring2011/MathM560/index.html>
- Instructor:** Elizabeth Housworth
- Office:** 371 Rawles Hall
- Office Hours:** TBA
- Office Phone:** 855-1960
- e-mail:** ehouswor@indiana.edu
- Important Dates:** Last day for Automatic Withdrawal: Wednesday, March 9. Final Exam 8-10 am, Friday, May 6.
- Religious Holiday Policy:** If you will miss class, especially a class during which there will be an exam or other required work, for a religious holiday, you must inform me during the first two weeks of the semester.
- Cheating:** It is not possible to cheat on homeworks. These will all be open note, open text, open friend, etc... However, all exam work must be your own and no cheating will be tolerated. All suspected cases of cheating will be handled in accordance with University procedures found at <http://dsa.indiana.edu/ethics.html>. If you do cheat, you will receive an F in the course. Additional sanctions may be imposed by the Dean.
- Homework:** Homework will be assigned roughly weekly.

	Percentage
Attendance	15%
Homework	20%
First Exam	20%
Second Exam	20%
Final Exam	25%

## Very Tentative Schedule

Dates	Topics
January 10	What you should already know about probabilities, random variables, distributions, moments, and moment generating functions.
January 12	Increasing and decreasing sets, limit theorems for their probabilities, First Borel-Cantelli Lemma, applications.
January 14	Pairwise versus mutual independence, Second Borel-Cantelli Lemma assuming mutual or pairwise independence, applications.
January 17	Martin Luther King Jr. Holiday
January 19	Limit theorems and the Strong Law of Large Numbers
January 21	The Probabilistic Method
January 24	Conditional moments and applications
January 26	Memoryless distributions and hazards
January 28	Poisson counting processes
January 31	Interarrival and waiting times, renewals, relation to the uniform distribution.
February 2	Snow Day
February 4	Different types of events, introduction to queues
February 7	Non-homogeneous and compound Poisson processes
February 9	Renewal theory as a generalization of the Poisson process, modified and alternating renewal processes, convolutions, and examples
February 11	First renewal limit theorem and Wald's equation.
February 14	Elementary renewal theorem and applications.
February 16	Elementary renewal theorem and applications.
February 18	Exam 1
February 21	Three versions of the Key Renewal Theorem
February 23	Delayed and Alternating Renewal Processes
February 25	Markov Chains
February 28	Classification of states
March 2	Transience and recurrence
March 4	Applications and examples, absorption probabilities

## Very Tentative Schedule - Continued

Dates	Topics
March 7	Gambler's ruin
March 9	Other applications of Markov chains
March 11	Time reversibility
Spring Recess	
March 21	Semi-Markov Processes
March 23	Continuous Time Markov Chains
March 25	Kolmogorov Differential Equation
March 28	Transition Probabilities
March 30	Review, catch-up day
April 1	Exam 2
April 4	Limiting Probabilities
April 6	Time Reversibility
April 8	Martingales
April 11	Stopping times and an extension of Wald's theorem
April 13	Random walks and returning to the origin
April 16	Brownian Motion (BM): definition, preliminaries, relationship to random walks
April 18	BM properties: Markov, differential, scaling, symmetry, Gaussian process, time reversal, reflection
April 20	BM properties: Markov, differential, scaling, symmetry, Gaussian process, time reversal, reflection
April 23	BM: hitting times, maximum, arc sine laws
April 25	BM: variations and applications
April 27	BM: variations and applications
April 29	Review, Evaluations, etc...
<b>Final Exam 8-10 am on Friday, May 6</b>	