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**PST 1706 (PhD Quant V): Advanced Probability and Statistical Models**

**Spring 2017**

**General Course Information**

*Meeting Times and Locations***:** Wednesdays 1:30-4:30pm

 Mor 397

*Instructor Information:* Sam Woolford

 Morison 376/x2086/swoolford@bentley.edu

*Office Hours:* Mondays 4:30-6:00pm

 Wednesdays 5:00-6:30pm

 Otherwise by appointment

*BlackBoard Site:* PST 1706

*Suggested Texts:*  *Stochastic Processes*, *2nd Ed.,* by Sheldon Ross 1996 (published by J. Wiley & Sons)

*Introduction to Stochastic Processes* by Hoel, Port and Stone, 1972 (published by Houghton Mifflin)

*Stochastic Processes* by Emanuel Parzen, 1962 (published by Holden-Day)

 *Bayesian Methods for Management and Business* by Eugene Hahn, 2014 (published by Wiley)

*Additional References:*  Available on the BlackBoard site and in the library

*Software:* **R** (available at [www.r-project.org](http://www.r-project.org)), OpenBugs (available at [www.openbugs.net](http://www.openbugs.net)), others as appropriate

*Course Materials:* Copies of all handouts and other course materials, data sets for homework problems and any announcements will be available on the MA 611 BlackBoard site.

**Course Description**

This is a course in classical stochastic models, Bayesian analysis and other advanced stochastic models that are used in various areas of business application. The initial component of the course will cover traditional stochastic models such as count processes, waiting time processes, Markov processes (discrete and continuous), branching processes, birth death processes and queueing processes. The second component of the course will cover both analytic and computer driven Bayesian models and utilize OpenBugs for applications. The final component of the course will cover topics that are of interest to the students. These topics could include hierarchical models, mixed models (latent class models), generalized linear models (glm), generalized estimating equation models (gee), longitudinal models, time series models or simulation models. This course provides a deeper exposure to the background, derivation and theory associated with these topics along with an understanding of how to apply the models in research situations.

**Learning Objectives**

**Knowledge:** For each of the topics discussed, students should:

* Develop a basic understanding of the topic
* Understand the methods and models commonly used in applications
	+ Understand model appropriateness and limitations
* Develop a knowledge of applied probability to enable further study into other stochastic models from appropriate sources.

**Skills:** Students will be able to:

* Become comfortable with stochastic process and advanced statistical modeling terms and notation
* Be able to use appropriate software to build stochastic models and apply advanced statistical and Bayesian analysis
* Provide an accurate written and verbal description of stochastic models and Bayesian analyses and their implications
* Prepare an explanation and presentation of course material.

**Perspectives:** Students will develop:

* Statistical thinking as an intellectual framework for problem solving.
* Recognition of the difficulties and limitations of stochastic models
* Recognition of benefits of stochastic models to decision making.

**Expected Outputs**

Course performance will be based on class presentations of the topics covered in the course including bibliographies for the topic established by each presenter to complement references made available to the class. Each student will be expected to present three of the topics covered in the course. Presentations should attempt to demonstrate an understanding of the relevance/importance of the key concepts associated with the topic and use at least one reference from the business literature to demonstrate applications of the topic (these could also be from the student’s research) and involve the other students in the discussion (particular around any issues not completely clear to the presenter). All students will be expected to keep up with the material and participate in meaningful discussions of other students presentations.

**English Language Support**

This course requires the student to be able to communicate clearly, correctly and effectively in English as would be expected in a business setting in the US:

**The ESOL Center** offers English language support for writing and all coursework to students who are English Speakers of Other Languages (ESOL).  Faculty tutors who specialize in working with multilingual students can offer feedback and strategies for writing at any stages from brainstorming through the drafting and organizing process.  Additionally, students can receive help related to research, documenting sources, Power Point slides, pronunciation, oral presentations, resumes, cover letters and interview practice.

The ESOL Center is located in Room 26 of the Bentley Library (ground level), down the hall from the Help Desk.  You can make an appointment by going to [bapps.bentley.edu](http://apps.bentley.edu/) and clicking on the ESOL Center, by calling 781-891-2021, or by dropping by the ESOL Center during the hours of operation to see if a tutor is available.  Day and evening appointments are available.

**PST 1706 TENTATIVE CALENDAR Spring 2017**

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| --- | --- | --- |
| **Class****Meeting** | **Topics** | **Reading for this day** |
| 1/18 | Project Overview and DiscussionReview of probability concepts and introduction to stochastic processes | Ross: Chapter 1 |
| 1/25 | Poisson processes | Ross: Chapter 2 |
| 2/1 | Renewal Processes | Ross: Chapter 3  |
| 2/8 | Markov chains (Discrete) | Ross: Chapter 4 |
| 2/15 | Markov chains (Continuous) | Ross; Chapter 5 |
| 2/22 | Bayesian computation | Hahn: Chapter 1-3 |
| 3/1 | MCMC and regression models | Hahn: Chapter 4 |
| 3/15 | Bayesian models with OpenBugs | Hahn; Chapter 5 |
| 3/22 | Bayesian Model Diagnostics | Hahn: Chapter 6-7 |
| 3/29 | TBD |  |
| 4/5 | TBD |  |
| 4/12 | TBD |  |
| 4/19 | TBD |  |
| 4/26 | TBD |  |
| 5/3 | TBD |  |

**NOTE:**

1. Topics may be moved slightly from week to week depending on how long coverage of each topic takes.
2. We may not have time to cover every topic in all chapters in class. That does not mean you are not responsible for reading and understanding all the material assigned. Any questions should be brought up in class.