SySc 512 – Quantitative Methods of Systems Science: Syllabus

Class meetings: Spring 2007, Mon & Wed 4:00-5:50, Harder House 104.

Professor: Patrick Roberts. Office (Mon/Wed): Harder House, room #03.
email: robertpa@ohsu.edu. Telephone: (503) 418-2620.
Office hours: Mon & Wed 1:00 PM -2:00 PM.

Grading: Homework 1/3, Midterm 1/3, Final 1/3

Exercises will be due every week. Homework problems will be graded pass/fail. Students are expected to complete all homework assignments. Homework is due with the next exercises are assigned. Late assignments will be accepted only with prior approval.

The grade in the course will be based on completion of the homework, and the results of both exams (midterm and final). Each exam will be graded based on its completeness, clarity, and demonstrated depth of understanding.

Text: There will be 3 texts, one for each section of the course.

- Dynamical Systems with Applications using MATLAB (2004) Stephen Lynch, Birkhäuser Boston.

- Probability Theory: A Concise Course (1977) Y.A. Rozanov, Dover.

- Optimization Theory with Applications (1987) Donald A. Pierre, Dover.

I will also provide the sources I use for the lectures, and suggest further reading.

Disability: If you have a disability, please notify the professor to arrange academic accommodations.

Schedule & Topics

I. Dynamics

Key Ideas: Non-linear differential equations, continuous and discrete; Linearization, eigenvalues and eigenvectors; Stability and Lyapunov functions.

Apr 2 Introduction to course & 2-Dimensional flow geometries. HW1

Apr 4 Discrete linear dynamics & Mappings.

Apr 9 Diagonalization & eigenvalues. HW2

Apr 11 Higher dimensional dynamics & linearization.

Apr 16 Stability & Gradient systems. HW3

II. Optimization

Key Ideas: First and second order conditions, Lagrange multipliers, Hessian matrix.

Apr 18 Optimization overview.

Apr 25 (skip Apr 23) Constraints. HW4

Apr 25-30? Quadratic extrema.

Apr 30 Review & catch-up.

May 2 Midterm.

May 7 Review midterm.

May 9 Dynamics of Optimization. HW5

May 14 Dynamic programming.

III. Uncertainty

Key Ideas: Distributions for discrete and continuous random variables. Bayes classification. Estimation and bias variance trade-off.

May 16 Probability → Bayes rule. HW6

May 21 Random Variables & Distributions.

May 23 Uncertain Dynamics.

May 28 Statistics: Hypothesis testing, likelihood. HW7

May 30 Estimation & information.

Jun 4 Review & catch-up. (Prep sheet for final)

Jun 6 Review & course evaluation.

TBA Final exam.

Software: The numerical exercises can be solved using your favorite software, but the recommended package will be **Matlab**. The academic version of Matlab for Windows is available at the PSU Bookstore for about $100. It is also available on many of the machines operated by CECS (Engineering). **Octave** is a free alternative to Matlab with similar syntax. Available at http://www.gnu.org/software/octave/.