

CMPS 80B  
**SYSTEMS AND SIMULATION**  
Fall Quarter, 2007

Plan: Have fun. Learn systems thinking.

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**Lectures:**

- TTh 12-1:45PM, Social Science I, room 161

**Formal Labs:** (You must register for one and attend it weekly)

- Monday 9:30-11:30am Baskin Engineering 109
- Wednesday 6-8pm Baskin Engineering 109
- Friday 2-4pm Baskin Engineering 109

Students will also be expected to spend an additional 4-5 hours in unscheduled labs each week.

Stella will be available at all the PC labs (Ming Ong, SS1, BE109, Cowell Apts, and Kresge). It may not be available at Oakes due to its much older hardware. It will also be available remotely through MS Windows "remote desktop" connection into "windows.ic.ucsc.edu".

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**Instructor:** Robert Levinson

**Office Hours:** Wed. 4-6PM, after class, or by appt. Engineering II-255

**Phone number:** 459-2087

**E-mail:** levinson@cse.ucsc.edu - Write me!

**News group:** ucsc.class.cmp80b - Please read regularly!

**Web:** <http://www.soe.ucsc.edu/classes/cmps080b> (check often)

Grader / Lab assistant:

Foaad Khosmood (will be in the scheduled labs)

**E-mail:** [foaad@ucsc.edu](mailto:foaad@ucsc.edu) (please use "80B" in subject line)

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**Prerequisites:**

High School algebra or instructor's permission. The course does use mathematics so you should have a genuine desire to use and improve your math skills. No programming experience is required.

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**Course Material:**

Required Texts:

1. Functions, Statistics, and Trigonometry by Sharon L. Senk, Steven S. Viktora, Zalman Usiskin, and Nils P. Ahbel et al. Publisher: Scott Foresman & Co; 2nd edition (January 1998) ISBN: 0673459268

Note: THIS BOOK IS ON MATHEMATICS and MODELING. We will cover chapters 1-7, and 10 (Call it "FST")

2. Modeling the Environment: An Introduction to System Dynamic Modeling of Environmental Systems, Andrew Ford, Island Press, 1999. ISBN 1-55963-601-7  
(Call it "MTE")

3. Lab exercises. Lab 1 handed out in class, the rest are from the MTE book.

4. Short Introduction to Stella: Modeling and Simulation using Stella:

Download free from: <http://archives.math.utk.edu/ICTCM/VOL13/C037/paper.pdf>

Chapter 2 and Appendix C of MTE also contain introductions to Stella.

Optional but Recommended (key excerpts provided):

5. Systems Thinking Basics: From Concepts to Causal Loops, Virginia Anderson and Laura Johnson, Pegasus Publishing 1997. ISBN 1-883823-12-9 (call it "STB")

Totally Optional:

6. Explorations in Scientific Thinking: A Systems Theoretic Approach, Robert Levinson, A R Goodwin, (2 chapter draft in progress)

Download the 2 chapters from here:

<http://www.soe.ucsc.edu/~levinson/Book/ScientificThinking.pdf>

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**Helpful Online Tools:**

- A LINEAR REGRESSION TOOL: <http://science.kennesaw.edu/~plaval/applets/LRegression.html>
- AN EXPONENTIAL REGRESSION TOOL can be found at: <http://www.xuru.org/rt/ExpR.asp>
- A FUNCTION PLOTTER can be found at: <http://www.sunsite.ubc.ca/LivingMathematics/Voo1N01/LBCExamples/PLotCalc.html>
- A STANDARD DEVIATION TOOL: <http://www.biokin.com/tools/aver.html>
- You may use other similar tools and calculators such as MAPLE, EXCEL etc.

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**Evaluation and Performance:**

WRITTEN HOMEWORKS	25%	4 homeworks
LAB REPORTS	35%	5labs
QUIZZES	20%	4x30-minute in-class exams.
FINAL EXAMINATION	20%	180 minutes in-class exam

**Guaranteed grade levels:** (these levels may be lowered and definitely will not be raised)

- 90.0% A-
- 82.5% B-
- 75.0% C-
- 65.0% D

**Class Policies:**

- Homework (not labs or exams) may be done with 1-3 other students in the class. If done in a group, the collaborators should be listed on the same paper when the assignment is turned in.
- It is fine and encouraged to discuss homework problems with other students – BUT CHEATING or ACADEMIC DISHONESTY on any course item (such as direct verbatim copying from a member outside your group or during an exam) will result in not passing the course and other undesirable consequences. What you turn in must reflect you or your group’s own understanding in you or your group’s own words.
- Homework is due as announced. Except for medical excuses , homework is late if it is not in the reader's hands by the time he/she grades the assignment. The grading schedule will not be changed to accommodate late submissions. Late homework receives 15% off for each school day (M-F) it is late.
- There will be no makeup examinations and no incompletes for the course.
- No work may be turned in after Dec. 10, 3PM. No exceptions.
- 100% work will be considered that level at which only 5% of students have done equal to or better than. Thus, it is possible to score more than 100% on any graded item.
- All labs, quizzes, homework will be weighted EQUAL - regardless of the length. However, your weakest quiz, lab and homework will be ignored!!!

- A score of at least 50% work on EACH of the four basic course components, homework, labs, quizzes and final is required for being considered for passing the course.

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## 2 FUNDAMENTAL LAWS OF SYSTEMS:

1. DIVERSITY + SYMMETRY = TOTAL DIVERSITY OF PARTS (in a closed system)
2. SYMMETRY never decreases in a closed system.

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## LAB ASSIGNMENTS

- Lab 1: Handed out in class: introduction to Stella and modeling. (due Thursday Oct. 11)
- Lab 2: Chapter 6: Exercises 1-6. (due Thursday Oct. 25<sup>th</sup>)
- Lab 3: Chapter 10: Exercises 3-5, Chapter 11: 1-3. (due Thursday, Nov. 8)
- Lab 4: Chapter 17: Exercises 1-8. (due Tuesday Nov. 27)
- Lab 5: Chapter 18: 1-9. (due Monday Dec. 10, 3PM)

**For each lab report, please answer these three questions in paragraph form.**

1. What is the most useful or interesting thing you learned about STELLA from this lab? Explain.
2. What is the most useful or interesting thing you learned about mathematics or systems or science from this lab? Explain.
3. Please write an original word problem similar to one of the lab exercises, except with an original scenario in your own language and discuss the solution.

Basic Stella Manual: [http://www2.chemeng.lth.se/edu/STELLA/stellaintro/stella\\_manual/manual.html](http://www2.chemeng.lth.se/edu/STELLA/stellaintro/stella_manual/manual.html)

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## LECTURE AND ASSIGNMENT SCHEDULE (unless otherwise informed)

W1-W4 are Written assignments (pages are marked below) from FST and MTE.  
(some of the answers are in the back of the FST you should double check these answers and show how you arrive at them).

L1-L4 are the above reports based on labs using MTE, a lab handout, and the Stella Software.

### I. INTRODUCTION TO SYSTEMS THINKING and DYNAMIC MODELING

Read: Chapter 1 in MTE.  
Read: Sections 1-2 in STB.  
Read: Chapter 1 in FST

W1: pp.59-60 exercises 10-18 in FST and  
Appendix A, problems 1-5 in MTE (thus 14 exercises in all)

1. (Thurs. September 27)

2. (Tues. October 2) SCHEDULED LABS BEGIN on Monday October 1!!

3. (Thurs. October 4) W1 is due.

### II. GENERAL MODELING METHODS and CLASSICAL MODELS

Read: MTE Chapters 2-4  
Read: STB Sections 3-4  
Read: Chapters 2-3 in FST

W2: pg 94-95 14-16,  
pg 117 9-13,  
pg 126 12,  
pg 140 13 in FST and  
Chapter 2, 1-7 in MTE.  
(thus 17 exercises in all)

- 4. (Tues. Oct. 9)
- 5. (Thurs. Oct. 11) Quiz 1. Lab 1 is due.
- 6. (Tues. October 16)
- 7. (Thurs. October 18) W2 is due.

### III. FURTHER MODEL VARIATIONS

Read: MTE Chapters 5-7  
Read: STB Section 5  
Read: Chapters 4-5 in FST

W3: pg 290-291 exercises 9-13,  
pg 338-339 exercises 23-24,  
pg 343 exercises 15-16 in FST and  
Appendix B, 1-13 odd in MTE.  
(thus 16 exercises in all)

- 8. (Tues. October 23)
- 9. (Thurs. October 25) Quiz 2. Lab 2 is due.

### IV. APPLICATIONS and ADVANCED TOPICS

Read: STB Section 6

- 10. (Tues. October 30)
- 11. (Thurs. November 1) W3 is due.  
Read: FST Chapters 6-7  
Read: MTE Chapters 8-10,17,18
- W4: pg 438-439 exercises 13-19,  
pg 455 exercises 8-13.  
(thus 13 exercises in all)

- 12. (Tues. November 6)
- 13. (Thurs. November 8) Quiz 3. Lab 3 is due.

- 14. (Tues. November 13)
- 15. (Thurs. November 15)

- 16. (Tues. November 20)
- 17. (Thurs. November 22.) NO CLASS. Holiday.

- 18. (Tues. November 27) Lab 4 is due.
- 19. (Thurs. November 29) Quiz 4. W4 is due.

- 20. (Tues. December 4)
- 21. (Thurs. December 6)

22. (Mon. December 10) Lab5 is due. Final Exam Noon-3PM in Regular Class Room: Soc Sci I 161  
The final exam (in class and cumulative) will come from material in the lectures, readings, homework and programming problems, but the large majority come from lecture.