ChE 301 Syllabus

A. Course Details

ChE 301 Applied Statistics and Numerical Methods for Engineers

Meeting Place: Room 511, Dougherty Hall
Meeting Time: MWF at 10:10-11:00

Instructor: Dr. David Keffer, room 617 Dougherty Hall, dkeffer@utk.edu
Teaching Assistant: None

Required Text: "Probability and Statistics for Engineers and Scientists", 7th Edition, Walpole, Myers, Myers, & Ye, Prentice Hall, New Jersey, 2002.
Recommended Text: "Programming in Matlab", Marc E. Herniter, Brooks/Cole, 2001.

Course Website:
http://clausius.engr.utk.edu/che301/index.html

B. Course Objectives:

The general objectives of this course are to give the student the capability to understand and apply statistical techniques and numerical methods to solve engineering problems. Specifically, the department of Chemical Engineering has agreed that ChE 301 should have the following course objectives. At the conclusion of this course the student should be able to:

1. Explain the concept of both discrete and continuous probability distributions.

2. Calculate the mean and variance of a random variable using the associated probability density function.

3. Use the expected value operator as a linear operator to derive the mean and variance of functions of random variables.

4. Apply the appropriate distribution function in solving various probability problems.

5. State the significance of the Central Limit Theorem and its relationship to the Normal Distribution.

6. Derive and use an unbiased and efficient statistical estimator to characterize a population.

7. Derive the distribution of the sample mean and variance.

8. Calculate confidence intervals for population mean, variance, difference between means, and proportion, from sampling results under a variety of conditions.

9. Test a hypothesis for population mean, variance, difference between means, and ratio of variances using sampling results. Determine the power of a test..

10. Perform a linear regression and the associated ANOVA (analysis-of-variance) to measure the fit of the regression.

11. Perform a 1-factor ANOVA to assess the effect of that factor on outcome.

12. Perform a 2-factor ANOVA to assess the relative impact of and interaction among two factors.

13. Perform a 2-level and 2-factor factorial design experiment and interpret the ANOVA results.

14. Find roots of a system of non-linear algebraic equations using Newton's method and understand its limitations.

15. Use Simpson's rule to numerically integrate a function.

16. Fit a curve using splines.

17. Solve systems of ordinary differential equations with the Runge-Kutta method.

18. Use a computer program to solve systems of linear algebraic equations.

19. Apply these statistical techniques to engineering data and make engineering decisions based on the description of the data provided by the statistical analysis.

20. Apply these numerical methods to the solution of an engineering problem and make engineering decisions based on the results of the numerical model.

21. Cite examples on the role of statistical analysis in the chemical industry and in society.

22. Write an acceptable technically report.

23. Use a structured programming platform to implement the previous objectives.

C. Grading Policy

C.1. Grade Breakdown

- Exams (3 mid-terms and 1 final exam @ 16%): 64%
- Homeworks (14 assignments @ 2% each): 28%
- Computer Project and Report (1 project @ 8% each): 8%
- Total: 100%

C.2. Course Grades

Course grades will be assigned on the following basis:

90.0 - 100.0	A
85.0 - 89.99	B+
80.0 - 84.99	B
75.0 - 79.99	C+
70.0 - 74.99	C
60.0 - 69.99	D
00.0 - 59.99	F

This course grade basis may (at the instructor's discretion) be shifted uniformly down, should the overall performance of the class require it. This course grade basis will not be shifted up. (That is, if an exam proves to be too hard and the average is low, an 89% may make an A. However, if an exam proves to be too easy and the average is high, a 90% will always make an A.)

C.3. Homework

- Homework assignments are made each Wednesday and due the following Wednesday unless a change is announced in class.
- Homework assignments are due at the beginning of class.
- Late homework assignments are not accepted.
- Students can work together to solve homework assignments. However, each student must turn in his/her own work in his/her own handwriting. For homework assignments where computer-generated code or graphs are required, each student must generate their own codes and graphs.
- Instances of plagiarism will be dealt with as stipulated by University guidelines. Please do not force me to have to deal with plagiarism. Remember, you are here to learn.

C.4. Exams

- There are 4 exams, as indicated on the schedule.
- Each exam counts 16% of the course grade.
- Exams cannot be made up unless there is a serious explanation, extreme illness, death in the family, etc.

C.5. Computer Project

- There is one computer project using MATLAB worth 8% of the course grade.
- The computer project will be done in teams of 2 and will be assigned approximately one month before it is to be collected.

C.6. Extra-credit

- As you can see from the grading scale, an 89.99 is not an A, an 84.99 is not a B+, a 79.99 is not a B, etc.
- If you suspect you may be on the borderline and would like the instructor to round-up, you have the opportunity to submit an extra-credit project.
- The extra-credit project will be a two-page typed paper discussing the influence of science or technology in a novel, a play, a piece of music, a painting, a sculpture, etc.
- One extra-credit project per student.
- The topic of the extra-credit project must first be cleared with the instructor.
- If you would like help selecting a topic, see the instructor.

D. Getting Help

Although lectures and text are the primary means of instruction in this course, the instructor is here to help you successfully complete this course. When you do not understand something in class or have difficulty with an exam or homework, you are encouraged to seek out the instructor. Extra-effort will be made to meet with students who regularly attend lecture.

D.1. Email

The best way to contact the TA or the instructor is via email.

- Questions regarding course content, grading of homeworks, and grading of exams should be sent via email to the Instructor.
- To guarantee that the email is read promptly, make the subject of the email "ChE 301"

D.2. Office Hours

- The Instructor holds office hours on Friday afternoon 3:30-5:00.

E. ChE 301 Schedule for Fall Semester 2001

This course is broken down into two halves of equal length. The first half focuses on applied statistics. The second half focuses on numerical methods.

STATISTICS AND PROBABILITY

LECTURE	DATE	TOPIC	HOMEWORK
1	Wed. 08/18/04	Probability	[Assign HW1]
2	Fri. 08/20/04	Probability	
3	Mon. 08/23/04	Probability	[Assign HW2]
4	Wed. 08/25/04	Random Variables	[Collect HW1]
5	Fri. 08/27/04	Random Variables	
6	Mon. 08/30/04	Labor Day Holiday	[Assign HW3]
7	Wed. 09/01/04	Random Variables	[Collect HW2]
8	Fri. 09/03/04	Expectations	
9	Mon. 09/06/04	Expectations	[Assign HW4]
10	Wed. 09/08/04	Expectations	[Collect HW3]
11	Fri. 09/10/04	Discrete Distributions	
12	Mon. 09/13/04	**MIDTERM EXAM 1**	[Assign HW5]
13	Wed. 09/15/04	Review Midterm Exam 1	[Collect HW4]
14	Fri. 09/17/04	Discrete Distributions	
15	Mon. 09/20/04	Discrete Distributions	[Assign HW6]
16	Wed. 09/22/04	Continuous Distributions	[Collect HW5]
17	Fri. 09/24/04	Continuous Distributions	
18	Mon. 09/27/04	Continuous Distributions	[Assign HW7]
19	Wed. 09/21/04	Sampling	[Collect HW6]
20	Fri. 10/01/04	Sampling	
21	Mon. 10/04/04	Sampling	[Collect HW7]
22	Wed. 10/06/04	**MIDTERM EXAM 2**	
23	Fri. 10/08/04	Linear Algebra	

NUMERICAL METHODS

LECTURE	DATE	TOPIC	HOMEWORK
24	Mon. 10/11/04	Linear Algebra	[Assign HW8]
25	Wed. 10/13/04	Linear Algebra	
26	Fri. 10/15/04	Fall Break – No Classes	
27	Mon. 10/18/04	Regression	[Assign HW9]
28	Wed. 10/20/04	Regression	[Collect HW8]
29	Fri. 10/22/04	Regression	
30	Mon. 10/25/04	Numerical Integration	[Assign HW10]
31	Wed. 10/27/04	Numerical Integration	[Collect HW9]
32	Fri. 10/29/04	Numerical Integration	[Assign Computer Project]
33	Mon. 11/01/04	**MIDTERM EXAM 3**	[Assign HW11]
34	Wed. 11/03/04	Review Midterm Exam 3	[Collect HW10]
35	Fri. 11/05/04	Root-finding	
36	Mon. 11/08/04	Root-finding	[Assign HW12]
37	Wed. 11/10/04	Root-finding	[Collect HW11]
38	Fri. 11/12/04	Solution of a System of Equations	
39	Mon. 11/15/04	Solution of a System of Equations	[Assign HW13]
40	Wed. 11/17/04	Solution of a System of Equations	[Collect HW12]
41	Fri. 11/19/04	Solution of ordinary differential eqns	
42	Mon. 11/22/04	Solution of ordinary differential eqns	[Assign HW14]
43	Wed. 11/24/04	Solution of ordinary differential eqns	[Collect HW13]
44	Fri. 11/26/04	Thanksgiving Holiday	
45	Mon. 11/29/04	ANOVA	
46	Wed. 12/01/04	ANOVA	[Collect HW14]
47	Fri. 12/03/04	ANOVA	
48	Mon. 12/06/04	ANOVA	[Collect Project]
48	Wed. 12/08/04	*NO CLASS: STUDY DAY FOR FINAL EXAMS*	
49	Thurs. 12/09/04	**FINAL EXAM: 08:00-10:00 P.M.**	