# ChE 240 Syllabus

## A. Course Details

ChE 240 Applied Statistics and Numerical Methods for Engineers

Lectures:
Meeting Place: Room 517, Dougherty Hall
Meeting Time: MWF at 8:00-8:50

Recitation:
Meeting Place: Room 429, Dougherty Hall
Meeting Time: T at 2:10-3:25

Instructor: Dr. David Keffer, room 617 Dougherty Hall, dkeffer@utk.edu
Teaching Assistant: TBA

Required Text:
"Transport Processes and Unit Operations", 3rd Edition, Christie J. Geankoplis, Prentice Hall, New Jersey, 1993.

Useful Reference Texts:
Perry's Chemical Engineer's Handbook, R.H. Perry and D.W. Green, 7th Ed., McGraw-Hill, New York, 1984.

Unit Operations of Chemical Engineering, W.L. McCabe, J.C. Smith, and P. Harriot, 5th Edition, McGraw-Hill, New York, 1993.

Transport Phenomena, R.B. Bird, W.E. Stewart, and E.N. Lightfoot, John Wiley and Sons, New York, 1960.

Flow of Fluids through Valves, Fittings, and Pipe, by the Engineering Division of CRANE, Technical Paper No. 410, CRANE Co., New York, 18th printing, 1979.

## B. Course Objectives:

The general objectives of this course are to give the student the capability to solve engineering problems relating to fluid flow and heat transfer. Specifically, the faculty of the department of Chemical Engineering has agreed that ChE 240 should have the following course objectives. At the conclusion of this course you should be able to:

1. efficiently solve engineering problems by analyzing equation units for consistency and homogeneity, converting to appropriate units, and utilizing the
2. appropriate number of significant figures.

3. solve hydrostatics problems involving the relationship between density, fluid depth and pressure.
4. calculate fluid shear stress in Newtonian fluid given the fluid viscosity and the shear rate.
5. calculate Reynolds Numbers in pipe and determine if a flowing fluid is laminar, in transition, or turbulent.
6. perform overall mass balances on piping systems and stirred tank reactors.
7. perform overall energy balances on piping systems and process units.
8. perform overall momentum balances on piping systems.
9. perform a momentum shell balance for piping systems and planar flows.
10. determine pressure drops and friction losses in piping systems.
11. use appropriate charts to calculate drag coefficients on various objects in external flow.
12. calculate pressure drops across packed beds.
13. calculate fluidization velocities in fluidized beds.
14. use orifice meters, venturi meters and pitot tubes to measure fluid flow rates.
15. size pumping and air-handling equipment.
16. determine the power required for agitated tank mixing units.
17. derive the expressions for the velocity profiles in pipes and planar flows.
18. calculate mixing lengths and boundary layer thickness for turbulent and laminar flows.
19. derive the appropriate equations governing steady-state heat conduction in planar and cylindrical geometries.
20. determine heat transfer rates for steady-state heat conduction in planar and cylindrical geometries.
21. calculate heat transfer coefficients and rates for steady-state heat convection from planar and cylindrical geometries, past banks of tubes or pipes, heat
22. exchangers and finned tubes.
23. calculate steady-state radiative heat transfer rates.
24. calculate heat transfer rates for spherical, cylindrical, and planar geometries for unsteady-state heat transfer

## C. Grading Policy

### C.1. Grade Breakdown

- Exams (3 mid-terms and 1 final exam @ 15%): 60%
- Homeworks (14 assignments @ 2% each): 28%
- Two Computer Project and Report (1 project @ 6% each): 12%
- 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 Monday 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 15% 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 are two computer project using MATLAB worth 12% of the course grade.
- The computer projects 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 and the TA are 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 or the TA. 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 should be sent via email to the Instructor or the TA
- Questions regarding grading of homeworks should be sent to the TA
- Questions regarding grading of exams should be sent to the Instructor
- To guarantee that the email is read promptly, make the subject of the email "ChE 240"

### D.2. Office Hours

- The T.A. office hours: TBA.
- The Instructor office hours: TBA.

## E. ChE 240 Lecture Schedule for Spring Semester 1999

### FIRST HALF - FLUID FLOW

| LECTURE | DATE | TOPIC | HOMEWORK |
|---|---|---|---|
| 1 | Wed. 1/13/99 | Introduction, Chap. 1 | [Assign HW1] |
| 2 | Fri. 1/15/99 | Chap. 2. Section 2.2. | |
| 3 | Mon. 1/18/99 | NO CLASS: Martin Luther King, Jr. Holiday | |
| 4 | Wed. 1/20/99 | Chap. 2. Sections 2.3.-2.4. | [Collect HW1] [Assign HW2] |
| 5 | Fri. 1/22/99 | Chap. 2. Sections 2.4.-2.5. | |
| 6 | Mon. 1/25/99 | Chap. 2. Section 2.6. | [CollectHW2] |
| 7 | Wed. 1/27/99 | Chap. 2. Section 2.7. | [Assign HW3] |
| 8 | Fri. 1/29/99 | Chap. 2. Section 2.7. | |
| 9 | Mon. 2/1/99 | Chap. 2. Section 2.8. | [Collect HW3] |
| 10 | Wed. 2/3/99 | Chap. 2. Section 2.9. | [Assign HW4] |
| 11 | Fri. 2/5/99 | Chap. 2. Section 2.10. | |
| 12 | Mon. 2/8/99 | **MIDTERM EXAM 1** | [Collect HW4] |
| 13 | Wed. 2/10/99 | Chap. 2. Section 2.11 | [Assign Computer Project 1], [Assign HW5] |
| 14 | Fri. 2/12/99 | Chap. 3. Section 3.1. | |
| 15 | Mon. 2/15/99 | Chap. 3. Section 3.2. | [Collect HW5] |
| 16 | Wed. 2/17/99 | Chap. 3. Section 3.3. | [Assign HW6] |
| 17 | Fri. 2/19/99 | Chap. 3. Section 3.4. | |
| 18 | Mon. 2/22/99 | Chap. 3. Section 3.5. | [Collect HW6] |
| 19 | Wed. 2/24/99 | Chap. 3. Sections 3.6.-3.7. | [Assign HW7] |
| 20 | Fri. 2/26/99 | Chap. 3. Sections 3.8.-3.9. | |
| 21 | Mon. 3/1/99 | Chap. 3. Section 3.10. | |
| 22 | Wed. 3/3/99 | Chap. 3. Section 3.11. | [Collect HW7] |
| 23 | Fri. 3/5/99 | **MIDTERM EXAM 2** | [Collect Computer Project 1] |

## SECOND HALF - HEAT TRANSFER

| LECTURE | DATE | TOPIC | HOMEWORK |
|---|---|---|---|
| 24 | Mon. 3/8/99 | Chap. 4. Section 4.1. | |
| 25 | Wed. 3/10/99 | Chap. 4. Section 4.2. | [Assign HW8] |
| 26 | Fri. 3/12/99 | Chap. 4. Section 4.3. | |
| 27 | Mon. 3/15/99 | *NO CLASS: Spring Break* | |
| 28 | Wed. 3/17/99 | *NO CLASS: Spring Break* | |
| 29 | Fri. 3/19/99 | *NO CLASS: Spring Break* | |
| 30 | Mon. 3/22/99 | Chap. 4. Section 4.4. | [Collect HW8] |
| 31 | Wed. 3/24/99 | Chap. 4. Sections 4.5.-4.6. | [Assign HW9] |
| 32 | Fri. 3/26/99 | Chap. 4. Section 4.7. | |
| 33 | Mon. 3/29/99 | Chap. 4. Section 4.8. | [Collect HW9] |
| 34 | Wed. 3/31/99 | Chap. 4. Section 4.9. | [Assign HW10] |
| 35 | Fri. 4/2/99 | *NO CLASS: UT Holiday* | |
| 36 | Mon. 4/5/99 | Chap. 4. Section 4.10.-4.11. | [Collect HW10] |
| 37 | Wed. 4/7/99 | **MIDTERM EXAM 3** | [Assign HW11] |
| 38 | Fri. 4/9/99 | Chap. 4. Section 4.12. | [Assign Computer Project 2] |
| 39 | Mon. 4/12/99 | Chap. 4. Section 4.13. | [Collect HW11] |
| 40 | Wed. 4/14/99 | Chap. 4. Section 4.14. | [Assign HW12] |
| 41 | Fri. 4/16/99 | Chap. 5. Section 5.1. | |
| 42 | Mon. 4/19/99 | Chap. 5. Section 5.2. | [Collect HW12] |
| 43 | Wed. 4/21/99 | Chap. 5. Section 5.3. | [Assign HW13] |
| 44 | Fri. 4/23/99 | Chap. 5. Section 5.4. | |
| 45 | Mon. 4/26/99 | Chap. 5. Section 5.5. | [Collect HW13] |
| 46 | Wed. 4/28/99 | Chap. 5. Section 5.6. | [Assign HW14] |
| 47 | Fri. 4/30/99 | Chap. 5. Section 5.7. | |
| 48 | Mon. 5/3/99 | Course Review | [Collect Computer Project 2], [Collect HW14] |
| 48 | Wed. 5/5/99 | *NO CLASS: STUDY DAY FOR FINAL EXAMS* | |
| FINAL | Tues. 5/11/99 | **COMPREHENSIVE FINAL EXAM 8:00-10:00** | |