

**Syllabus**  
**ChE 400 Applied Chemical Engineering Calculations**  
**Fall 2008**

*Ohio University*  
*Department of Chemical Engineering*

**Instructor:** Dr. Gerardine G. Botte

**Office:** 183 Stocker Center

**Office Hours:** 1:30-3:00 pm M-W and by appointments (please use phone or e-mail to schedule appointments). I will see you almost any time I am in.

**Phone:** 593-9670 (Stocker Office)

**E-mail:** [botte@ohio.edu](mailto:botte@ohio.edu)

**Class:** 10:10 am-11:00 am MF at Stocker 190

10:10 am-12:00 pm W at Stocker 190

We will meet in the chemical engineering PC lab (Stocker 049) at least 6 times during the quarter (see Tentative Schedule). This activity will be most likely on Wednesdays or Fridays. The instructor will remind the students about that activity in the class previous to the lab session and by e-mail.

**Class e-mail:** Make sure to check your e-mail routinely (at least once a day) as I will use it to communicate with you at times. E-mails will be considered an official way to communicate with the class. Please use only your oak account to send e-mails regarding the course. I will only e-mail you to your oak account.

**Required texts:** Class notes and hand outs. You can download the material from the web at the following site [http://webche.ent.ohiou.edu/course\\_index.html](http://webche.ent.ohiou.edu/course_index.html) (click on ChE-400)

**Recommended texts:**

1. Numerical Methods for Engineers with Programming Software Applications. Steven C. Chapra and Raymond P. Canale. WCB McGraw-Hill, Third edition, 1998, ISBN 0-07-010938-9.
2. Matlab tutorials available at <http://webche.ent.ohiou.edu/matlab/matlab.html>
3. Any differential equation text
4. Any material and energy balance book

**Grading:**

Homework	15%	A	93-100
Exam I	20%	A <sup>-</sup>	90-92
Exam II	20%	B <sup>+</sup>	85-89
Project	15%	B	82-84
Quizzes	5%	B <sup>-</sup>	79-81
Final Exam	25%	C <sup>+</sup>	76-78
		C	73-75
		C <sup>-</sup>	70-72
		D <sup>+</sup>	66-69
		D	63-65
		D <sup>-</sup>	60-62
		F	0-59

Even though class participation is not included in the grading breakdown you are encourage to participate actively in class. Class participation will count as [extra credit of up to 5%](#). Class participation means to contribute to the success of the class by: solving class exercises, participate in class discussions, etc. I do not curve or scale the class. There is no a predetermined number of A's and F's.

### **Course description and objectives:**

#### Catalog description:

Application of analytical mathematics and numerical methods to the formulation and solution of chemical engineering problems. (Ohio University, Undergraduate catalog 2006-2008).

#### Course details:

In order to solve problems in chemical engineering we need to apply problem solving techniques. In this course you will learn and apply a methodology that will allow you solving any given situation (system) in chemical engineering. Furthermore, you will use the results of your calculations to analyze the performance of the system and to recommend and justify decisions for its improvement. In few words, you will start thinking and acting as a CHEMICAL ENGINEER.

The intention of the course is that you will be able to formulate an equation or group of equations that expresses the essential features of a physical system or process in mathematical terms. Once you obtain your mathematical expression you will be able to recognize the type of mathematical problem and solve the equation (or equations). Finally, you will use the results of your solution to evaluate, interpret, and make decisions and recommendations about the system.

After successfully completing this course, you will be able to:

1. Develop your ability to convert a given problem (situation) into a mathematical expression.
2. Improve your ability to recognize the mathematical form of typical problems that arise in chemical engineering, and to think mathematically.
3. Learn or review a variety of solution techniques, both analytical and numerical with which to solve these problems.
4. Improve your ability to analyze chemical systems and processes.

During this course, you will improve your ability to:

1. Evaluate and analyze your solutions using engineering judgment (check input/output for reasonableness).
2. Develop a solution algorithm for a mathematical problem (structure of the program, comments and details for its understanding by any user).
3. Use appropriate programming methodology (initial guess, convergence criteria).
4. Communicate technical information effectively and confidently (clear expression of thought, use correct technical writing mechanisms, and create meaningful graphs and tables).
5. Use the computer as a tool to solve problems.

The objectives will be achieved by utilizing a case study approach. We will use information about a chemical system or process to formulate a mathematical representation of that system. We will then develop methods for solving theses equations. Analytical and numerical techniques will be used as appropriate to solve the equations that describe the systems of interest. Finally the results obtained will be analyzed and some case studies will be carried out to determine the effect of some of the parameters on the system. To fulfill the objectives of this course the class has been divided into *lecture and lab sessions*.

The *lecture sessions* will be used for presenting new concepts and problem solving techniques. Homework and exam's solutions will also be reviewed in class if necessary. The students are expected to read and understand all of the material in the sessions assigned in the textbooks, class notes, and hand outs.

The *lab sessions* will be used to develop the programs for the case studies presented in the lecture sessions. The students are expected to develop their own programs and models. All the exercises provided by the instructor should be practice during the lab sessions.

**Homework:** Homework will be assigned regularly during the quarter (see Tentative Schedule) and you are responsible for their solutions. Most of the time, they will be presented as a regular task assigned to a chemical engineer. Students are expected to attempt every problem and ask any necessary questions before their due dates. Homework will be due at the beginning of the class of the target day (usually you will have a week to do your homework). No late homework will be graded. The homework will usually involve a computer solution. You will use Matlab or Excel for this. Your program must be legible. It is your responsibility to determine how to access the machines, run programs, get printouts, etc (access hours and other information about the PC lab in Stocker 049 are given at <http://webche.ent.ohiou.edu/matlab/pcfaq.html>). Homework should be presented clearly. Homework that does not provide clear communication will not receive full credit. Homework will count 15% of your grade. You are required to follow the homework standards given below:

#### *Homework Standards*

Below are given the minimum standards for assignments and homework:

1. All written homework and computer print outs are to be done on 8.5x11" white paper. Write on the front side of each page only. Do not crowd your work.
2. The first page of your homework must contain your name, course number, due date, and homework number.
3. Pencil is preferred. Pen is acceptable if there are no substantial splotches. Write neatly.
4. All pages, in the correct order, must be numbered sequentially in the upper right-hand corner: 1/7, ..., 7/7, for example. Staple pages together in the upper left-hand corner.
5. Show your work. Your final answers must be marked in a block.

#### *Homework Guidelines*

When your homework (or project) requires the application of the problem solving methodology, you are expected to follow these guidelines:

1. *Diagram:* Always draw a diagram of the process.  
Label all given properties and variables on the diagram with their units  
Label all unknown variables with a question mark
2. *Assumptions:* State all assumptions clearly.
3. *Equations:* Write down all of the governing equations (in symbolic form) that will be needed to solve the problem.

Use the same variables as defined by the diagram.

Use narrative text where needed to explain how the equation will be used.

Do not begin by plugging in numbers.

4. *Simplify:* Algebraically manipulate the equations to simplify them as much as possible.

5. *Solve:* Insert numerical values and compute values of unknown variables.

Insert units along with values. Make sure the units are consistent and cancel so that the answer has the correct units.

Clearly mark the final answer with correct units.

Discuss the physical meaning of your answers.

6. *Graphs:* All graphs must be clearly labeled and explained using narrative text.

All graphs must have titles and axis labels with units.

Graphs should be done using a computer program (Excel)

Use different line types or symbols to distinguish multiple sets of data on the same graph. Use a legend.

Explain your graphs using narrative texts.

7. *Spreadsheets, computer programs, and Matlab problems:* All of them should contain narrative text that explains the functions, variables, etc used.

**Quizzes:** In class quizzes will focus on problem identification and solution strategies. Usually, they will be a follow up of the homework but not all the time. All the quizzes will be closed notes. Only one piece of paper with equations is allowed. Quizzes will be made at the end of the class of the target day. They will not last more than 15 minutes. The intention of the quizzes is to make you study the material of the course constantly. Quizzes will count 5% of your grade. You can expect about 5 quizzes during the quarter. I will eliminate one quiz (the one with the lowest score) from your grade.

**Exams:** These exams will be closed notes, except for one piece of paper with the necessary equations. Any material needed will be provided during the test, or you will be told to bring it with you. The material you are responsible for under each format will be explained ahead of time. We will have in class review sessions before these exams (see tentative schedule). There will be two exams and a final exam. Each exam has been assigned the same grade weight as they will cover similar fractions of the course material. The approximate days for the examinations are given in the tentative class schedule. Each of these exams will count for 20% of your grade. The final exam will weight 25% of your grade. **Final Exam will be held on Tuesday November 18 at 8:00 am (Stocker 049, Computer Lab).**

**Project:** There will be a group project that will consist in the mathematical modeling and analysis of a chemical process assigned by the instructor. A program code may be needed for the solution of the problem. The work groups and the projects will be assigned during the quarter. The solution of the problem must be presented as a Technical Memo (<http://www.ent.ohiou.edu/~valy/techwrite.html>). The exact content of the memo will not be defined by me. You need to decide what to present and the form it should be in. The project will count for 15% of your grade.

**Software:** Your homework, projects, quizzes, and exams (if necessary) will be solved using Matlab (or Excel).

**Muddiest Point:** Because I firmly believe that teaching is a *two-way process between the instructor and the students*, I will survey your input frequently during the course in order to identify the muddiest point about a topic. The surveys are anonymous. The grader for the course will collect the surveys. The next class after the administration of the survey, I will emphasize/review the muddiest topic.

**Attendance:** Students are expected to attend every class and lab session. If you miss a quiz or exam, contact me to schedule a makeup. There must be a honorable excuse for a makeup quiz or exam. If you know you *will* miss a quiz or exam, speak to me in advance to make arrangements. Refer to "Class Attendance" in the *Student Handbook* for the Ohio University policy on unanticipated absences.

**Academic Conduct:** *Engineering is a profession, and ethical behavior is expected of professionals. You are expected to act in a professional manner in this course. Academic dishonesty is defined in the Student Handbook and will be dealt with according to the guidelines therein. Exchanging information on assignments or exams where such an exchange has been forbidden and plagiarism are violations of the standards set forth in this course and the Student Handbook in general. Appropriate penalties will be imposed, which could include failing the course and a referral to the Office of Judicial Affairs (refer to the Student Handbook for descriptions of unethical behavior and the potential penalties). Other potential violations include any action that deceives your professor or your classmates, and any action taken without due consideration of its possible harmful effect on others. I would not accept disrespect to me or to any of the students in the class. If you act in this way you will be asked to leave the classroom and you will lose any credits for the activity that takes place that day (including quizzes and exams).*