Elementary Chemical Engineering, CHEN204, FALL 2009

Course description: Solution of elementary problems by application of mass balances, energy balances and equilibrium relationships.

Course Prerequisites: Admission to upper level chemical engineering.

Skill Prerequisites:
Knowledge of fundamental concepts of engineering.
- You are expected to have the ability to perform spreadsheet calculations. Know unit systems and conversions. Have basic graphing skills. Be familiar with an accounting framework.

Knowledge of fundamental concepts of science and math.
- Have basic skills in algebra, differential calculus, integral calculus, simple first order differential equations. Be able to balance chemical reactions. Know chemical nomenclature

Course Objectives:
By the end of the course, students should be able to do the following things:
1. Recognize the nomenclature of chemical engineering. Know systems of units and dimensions. Define and relate process variables. Learn basic unit operations of chemical processes and describe how each works qualitatively.
2. Use a systematic approach to solve chemical engineering problems. Identify variables, draw and label a process flow chart from a word description. Perform and use degrees of freedom analysis. Formulate mathematical expressions that represent word problems.
3. Use effectively an accounting framework to solve material and energy balance problems.
4. Work effectively in teams. Recognize the skills needed to function in a modern engineering environment. Develop teaming skills. Recognize engineering roles in society. Develop and practice written and oral communication skills.

Instructor: 🍀 Lâle Yurttaş (sh), Brown 206, Ph: 847-9316
Email: yurttas@chemail.tamu.edu

Class:
- 501 MW 9:10 –10:00 AM, CHEN 104
  MW 3:00 – 4:15 PM, CHEN 104
- 502 MW 11:30 –12:20 AM, CHEN 104
  MW 4:30 – 5:45 PM, CHEN 104

Office Hours:
1) Mon. 2:00 – 3:00 pm
   Tues. 2:00-3:00 pm
   Thur. 1:00 - 2:00 am

2) By appointment


Supplementary Material: http://alcheme.tamu.edu (ICC 1/Conservation of Mass)
**Course Policies and Procedures:**

**Changes in schedule**
The instructor reserves the right to change the order and content of lectures as necessary. Exam dates may be changed by the instructor, but in each case, at least 5 days notice will be given.

**Examination policy**
There will be three mid-term exams and a final exam. You are expected to take examinations when offered. If you miss a regular exam, you may take a comprehensive (challenging!) makeup exam at the end of the semester, provided you personally inform me by the end of the 2nd working day after missing the exam. Makeup exams will be given only for university excused absences. You will be given zero credit for additional examinations that are missed. There will not be makeup quizzes for missed ones.

Exam#1 (18%) TUES, 9/22, 7-9PM
Exam#2 (18%) TUES, 10/20, 7-9PM
Exam#3 (18%) TUES, 11/17, 7-9PM
Final (21%) SAT, 12/12, 10am-1pm
Quizzes (5%) Homework+Recitation*team evaluation (10%)
Group Project*team evaluation (10%)

\[ \Sigma 100\% \]

**Homework Policy**
Each student will be assigned a team. You must work in teams on homework, handing in one team solution per assignment.

Homework papers are to be turned in when due. Late homework will be accepted only in extremely unusual circumstances, and then only if prior approval has been obtained. You will be given zero for a missed homework. **Failure to work on the homework would be reflected in low grades on the examinations.**

**Recitation /Group project**
You will work in teams during recitations. Each team will turn in their work at the end of the recitation period. Note that, **failure to work on recitation problems would be reflected in low grades on the examinations.** Attendance to recitations is mandatory.

You will be assigned a service learning project for the semester. Project guidelines will be handed out in class. You are expected to submit a written report (50%) and give an oral presentation (50%). This will be a team activity.

**Course Outline:** *(Subject to change)*

<table>
<thead>
<tr>
<th>Chapter</th>
<th>1. What is Chemical Engineering?</th>
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<tbody>
<tr>
<td></td>
<td>2. Introduction to Engineering Calculations</td>
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<td></td>
<td>a- Units and Dimensions</td>
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<td>b- Significant Figures</td>
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<td>c- Graphs</td>
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<td>3. Processes and Process Variables</td>
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<tr>
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<td>a- Mass and Volume</td>
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<td>b- Flow Rate</td>
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<td>c- Chemical Composition</td>
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<tr>
<th>Chapter</th>
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<tbody>
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</table>
4. Fundamentals of Material Balances
   a- Process Classification 4.1
   b- Balances 4.2-4.3
   c- Multiple Unit Balances 4.4

EXAM#1

   d- Recycle and Bypass 4.5
   e- Reactive Systems 4.6 – 4.7
   f- Combustion 4.8

5. Single Phase Systems
   a- Liquid and Solid Densities 5.1
   b- Ideal Gases 5.2
   c- Real Gases 5.4

6. Multiphase Systems
   a- Single-Component Equilibrium 6.1
   b- Gibbs-Phase Rule 6.2
   c- Gas-Liquid Systems: One Condensable Component 6.3
   d- Multi-component Gas-Liquid Systems 6.4

EXAM#2

   e- Solutions of Solids in Liquids 6.5
   f- Immiscible and Partially Miscible Liquids 6.6

7. Energy and Energy Balances
   a- Forms of Energy: The First Law Of Thermodynamics 7.1
   b- Kinetic and Potential Energy 7.2
   c- Energy Balances on Closed Systems 7.3
   d- Energy Balances on Open Systems at Steady State 7.4
   e- Tables of thermodynamic Data 7.5
   f- Energy Balance Procedures 7.6

EXAM#3

8. Balances on Non-reactive Processes
   a- State Properties and Hypothetical Process Paths 8.1
   b- Changes in Pressure at Constant Temperature 8.2
   c- Changes in Temperature 8.3
   d- Phase Change Operations 8.4

9. Balances on Reactive Processes
   a- Heats of Reaction 9.1
   b- Hess' Law 9.2
   c- Heats of Formation 9.3
   d- Energy Balances on Reactive Processes 9.5
   e- Fuels and Combustion 9.6

10. Computer-Aided Balance Calculations *
11. Balances on transient Processes*

*Topics will be incorporated throughout the semester into homework and recitation problems and group projects.

FINAL (Cumulative)
## Relationship of course objectives to ChE program outcomes

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**Academic Integrity.** Aggie Honor Code: “An Aggie does not lie, cheat, or steal or tolerate those who do.” Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning, and to follow the philosophy and rules of the Honor System. Ignorance of the rules does not exclude any member of the TAMU community from the requirements or the processes of the Honor System. For additional information please visit: [www.tamu.edu/aggiehonor/](http://www.tamu.edu/aggiehonor/)

**Disabled Students.** The Americans with Disabilities Act (ADA) is a federal antidiscrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities in Cain Hall, Rm. 118 or call 845-1637.