Course Title: Material and Energy Balances

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Course Description: Material and Energy Balances for Engineering systems subjected to chemical and physical transformations. Calculations on industrial processes. (3-0-3). Prerequisite: CS 105, Math 152 and 1 year of chemistry.

Lecture hours: MW 11:25 AM – 12:40 PM

Objective: To develop skills of material and energy balances for physical and chemical processes, which includes chemical, as well as biological systems.


Evaluation: Based on 2 tests, midterm exam, final exam, homework, quizzes

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<thead>
<tr>
<th>EFFORT</th>
<th>POINTS</th>
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<tbody>
<tr>
<td>Exam 1 (Midterm)</td>
<td>20</td>
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<tr>
<td>Exam 2</td>
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<tr>
<td>Final</td>
<td>40</td>
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<tr>
<td>Homework (10 sets)</td>
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<td>Quiz (5 to 10)</td>
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Grade: A=90% of points 90 -100
        B=80% 80 -90
        C=70% 70 -80
The Exams grade (Exam 1 and Exam 2) will be the better of the two with the total possible weight of 40%. If class average falls below 60% on any exam/final, standard curving will be done.

**Homework Policy:**
* by 11:30 PM on due date - full credit
* due date, before 5 PM - 25% off
* One day after due date - 70% off
* More than one day late - no credit

**Exams:**
All exams including Final will be open book. Final exam will not be cumulative.

NO RETAKES OF THE EXAMS/FINAL ALLOWED.

MAKE-UP TEST/EXAM ALLOWED FOR PERSONAL EMERGENCIES ONLY. NO MAKE-UP QUIZ WILL BE GIVEN.

**Course Goals:**
1. To provide students a basic understanding of units, physical properties, kinetics, and thermodynamics and to apply them to solve engineering problems.
2. To provide students necessary skills required for drawing a process flowchart in terms of its components, establishing the relationship between known and unknown process variables based on descriptive information, and solving for the unknowns to obtain the desired solution.
3. To provide students the basic concepts to formulate and solve material balances, energy balances, and both simultaneously.
4. To develop systematic problem solving skills and improve confidence.
5. To learn how to deal with complex material and energy balances and work in a team environment to solve these complex problems.

**Students Learning Objectives:**
Upon completing the course, the student will be able to
1. Describe SI and American Engineering systems of units and carry out the conversions between units.
2. Describe basic laws of the behavior of gases, liquids, and solids.
3. Describe the difference between ideal and real gases, use compressibility factor and appropriate charts to predict P-V-T behavior of a gas.
4. Describe multiphase systems and use appropriate equations to calculate partial pressure, vapor pressure, humidity, etc.
5. Describe the difference between an open and a closed system and write material and energy balance for such systems.
6. Describe reactive and nonreactive processes and write material and energy balances for such systems.
7. Draw a process flow chart for a complex chemical system and solve for material and energy balances.

**Course Relationship to CHE program Educational Objectives:**
This introductory level course contribute to the CHE program objectives & outcomes as follows:

**Outcome II:** Students apply their knowledge of mathematics and science to understand systems of units, behavior of gases, liquids, and solids in single and multi-phase systems. Students learn to identify chemical engineering problems, represent them graphically using flow charts, formulate materials and energy balances and solve them. This outcome is supported by SLOs 1, through 6.

**Outcome VII:** This course is related to this outcome as teamwork is being introduced at the end of the course. Students perform materials and energy balances on a complex flow sheet as a team. Student self-assess their own contribution, team ethics and results. This outcome is supported by SLO 7.

**Outcome XI:** The entire ChE curriculum is designed to instill in the students a yearning for the pursuit of “Life Long Learning”, and the skills necessary for it. Each course achieves this goal by various means. The assessment plan for this outcome is currently under development, data are continually being collected to assess the whole range of methodologies that are used in this regard. All data collected will be used by the outcome XI assessment committee (in Year 3) to formulate future metrics.