<table>
<tr><td>COURSE #: CHE 230 (4 credits)</td><td>COURSE TITLE: Introduction to Material and Energy Balances</td></tr>
<tr><td>TERMS OFFERED: Fall</td><td>PREREQUISITES: Engineering 100: Introduction to Engineering, Engineering 101: Introduction to Computers and Programming, Chemistry 130: General Chemistry, Mathematics 116: Integral Calculus</td></tr>
<tr><td>TEXTBOOKS/REQUIRED MATERIAL: Elementary Principles of Chemical Processes, 4th ed., 2015. R. M. Felder, R. W. Rousseau, and L. G. Bullard, Wiley, New York.</td><td>COGNIZANT FACULTY: Goldsmith, Lenert, Min, Thurber</td></tr>
<tr><td>INSTRUCTOR: Goldsmith, Min</td><td>FACULTY APPROVAL: 2019-11-05</td></tr>
<tr><td>CoE BULLETIN DESCRIPTION:

An introduction to material and energy balances in chemical engineering applications, including environmental and biological systems. Engineering problem solving, the equilibrium concept, first law of thermodynamics. Introduction to chemical engineering as a profession.</td><td>COURSE TOPICS: (number of hours in parentheses)
1. Introduction to ChE and engineering calculations (5)
2. Steady state material balances (9)
3. Properties of ideal gases (2)
4. Phase equilibrium, vapor pressure, saturation (4)
5. The first law of thermodynamics and energy balance basics (6)
6. Material and energy balances on systems with mixing and temperature, pressure, and phase change (5)
7. Material and energy balances on reactive processes (4)
8. Introduction to computational tools for process flow (1)
9. Professional ethics/appreciation of safety (2)</td></tr>
<tr><td colspan="2">COURSE STRUCTURE/SCHEDULE: Lecture: 3 per week @ 1 hour, Discussion: 1 per week @ 1 hour</td></tr>
<tr><td>COURSE OBJECTIVES</td><td>Links shown in brackets are to course outcomes that satisfy these objectives.
1. Expose students to career opportunities in chemical engineering [a]
2. Make students aware of their preferred learning style and how to study most effectively [b]
3. Teach students the basics and applications of material balances [c-e, g]
4. Teach students the basics and applications of energy balances [f-g]
5. Provide students with the opportunity to practice oral and written communications skills [a, h]
6. Teach students to use computer tools in solving chemical engineering problems [g]
7. Give students experience working in teams [a, c-g]
8. Introduce students to professional ethics [h]
9. Make students aware of the application of material and energy balances concepts to environmental and biological problems [a]
10. Make students aware of the influence of economics on chemical engineering decision-making [a]</td></tr>
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COURSE OUTCOMES	Links shown in brackets are to ABET student outcomes 1-7. a. Search the chemical engineering literature and present a group report on a process, including its environmental, biological, economic and safety aspects, as relevant. [3,4,7] b. State their preferred learning style and applicable study techniques. [7] c. Write and solve material balances for simple chemical engineering processes, including those with multiple units, recycle, bypass, and reactive systems individually and in groups. [1,5] d. Solve problems involving single-phase systems using the ideal gas law. [1,5] e. Solve problems involving multiple phases, using Gibbs' phase rule, Raoult's and Henry's laws. [1,5] f. Perform energy balances for the solution of simple closed and open systems, including those requiring hypothetical process paths, heats of mixing, solution, reaction, and formation. [1,5] g. Develop computational tools, including familiarity with the use of chemical process simulators, to solve simple mass and energy balances and simulate simple process behavior. [1] h. Develop awareness of safety and ethical considerations in professional practice and society, including familiarity with AIChE code of ethics. [4]
ASSESSMENT TOOLS	1. Weekly problem sets test outcomes c-g under less time pressure and with student collaboration. 2. Submission of learning style inventory assesses outcome b. 3. Quizzes test the basics of outcomes c-g for individual students. 4. Exams test outcomes c-g for individual students. 5. A group oral presentation tests outcome a for groups of students and exposes all students to various aspects of chemical engineering 6. Homework assignments and assignment of a case study assess outcome h, as well as in-class ethics panel. 7. End of term course evaluation provides student self-assessment of outcomes a, c-h.