ECHE 300 Chemical Process Principles

Credits and contact hours

Credits: 3. Contact hours: Two 50-minute lecture periods and one three-hour period devoted to problem solving per week.

Instructor’s or course coordinator’s name

ECHE 300/310/311 Working Group

Text book, title, author, and year

*Elementary Principles of Chemical Processes, Third Edition* by Richard M. Felder and Ronald W. Rousseau, John Wiley & Sons, 2005.

a. Other supplemental materials

None

Specific course information

a. Brief description of the content of the course (catalog description)

Material and energy balances in the chemical process industry. Properties of gases, liquids, and solids. Note: Two one-hour lectures and one three-hour laboratory period devoted to problem solving.

b. Prerequisites or co-requisites

Prerequisites: MATH 141 Calculus I

Prerequisite or co-requisite: CHEM 112 General Chemistry II

c. Indicate whether a required, elective, or selected elective (as per Table 5-1) course in the program

Required

Specific goals for the course

a. Specific outcomes of instruction, ex. The student will be able to explain the significance of current research about a particular topic.

1. Students will demonstrate the ability to use and calculate process quantities important to chemical engineering unit operations (e.g., mass and mole fractions, molar and mass flow rates, volume, concentration, temperature, pressure), and convert between them using densities and the ideal gas law.

2. Students will demonstrate the ability to formulate and solve material balances on various single (e.g., mixers, separators, reactors, etc.) and multi-unit operation systems, including those with recycle and/or bypass streams, as well as mixing and/or splitting points.

3. Students will demonstrate the ability to use vapor pressures and Raoult's Law to calculate process quantities (e.g., composition, pressure, dew point, bubble point) for ideal vapor-liquid equilibrium in multi-phase systems.

4. Students will demonstrate the ability to perform energy balances on typical ideal systems.

b. Explicitly indicate which of the student outcomes listed in Criterion 3 or any other outcomes are addressed by the course.

The importance of each course goal to meeting the program outcomes is indicated with the following scale: 3 = major importance; 2 = moderate importance; 1 = minimal importance. Blank if not related.

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| **Program Outcomes** | **Course Goals** |
| **CG1** | **CG2** | **CG3** | **CG4** | **Overall** |
| 1. Ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics | 3 | 3 | 3 | 3 | 3 |
| 2. Ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors |  | 1 |  | 1 | 1 |
| 3. Ability to communicate effectively with a range of audiences |  |  |  |  |  |
| 4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts |  |  |  |  |  |
| 5. Ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives |  |  |  |  |  |
| 6. Ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions |  |  |  |  |  |
| 7. Ability to acquire and apply new knowledge as needed, using appropriate learning strategies.  |  |  |  |  |  |

Brief list of topics to be covered

1. Introduction to chemical engineering calculations
2. Processes and process variables
3. Fundamentals of material balances
4. Material balances
5. Single phase systems
6. Multiphase systems
7. Multicomponent systems
8. Energy and energy balances
9. Energy balances on nonreactive processes
10. Phase change operations
11. Energy balances on reactive processes