**Fall 2013**

**WEST VIRGINIA UNIVERSITY**
**DEPARTMENT OF CHEMICAL ENGINEERING**
**Course Outline**
**MATERIAL AND ENERGY BALANCES 1, ChE 201**

COURSE GOAL: To introduce the principles of chemical engineering and related disciplines, and the methodology for doing calculations in these disciplines. We will focus here on material balances for batch processes and steady-state processes. The follow-up course, ChE 202, will concentrate on unsteady-state balances and energy balances.

LEARNING OUTCOMES: At the conclusion of this course, you will:

- be able to do engineering calculations in any system of units to end with an appropriate number of significant figures, be able to convert between systems of units, and be able to work with typical chemical engineering process variables, in partial fulfillment of *ChE Educational Outcomes 1 and 5* (see the "Undergraduate Program Mission, Outcomes and Objectives" statement, attached);
- understand how to set up elementary material balances for processes in chemical engineering and related disciplines, with or without one or more chemical reactions, with or without recycle and/or bypass and/or purge streams, in partial fulfillment of *ChE Educational Outcome 1*;
- be able to estimate and/or evaluate data using engineering correlations, charts or elementary thermodynamic principles, in partial fulfillment of *ChE Educational Outcome 5*;
- understand the fundamental relationships for ideal and non-ideal gases and be able to apply them to the solution of material balance problems, in partial fulfillment of *ChE Educational Outcome 1*;
- understand the concept of equilibrium in multi-phase systems (gas-liquid), and apply them to material balances, in partial fulfillment of *ChE Educational Outcome 1*;
- be able to account for multi-component systems (mixtures), and apply them to material balances, in partial fulfillment of *ChE Educational Outcome 1*;
- obtain experience in the solution of simple open-ended design problems, in partial fulfillment of *ChE Educational Outcomes 1,2, 6, and 7*.

This course will require individual and group study and practice, as provided by homework and project assignments, in partial fulfillment of *ChE Educational Outcome 4*.

INSTRUCTOR: Dr. Dady B. Dadyburjor, 421 ESB, 3-9337, dady.dadyburjor@mail.wvu.edu

TEACHING ASSISTANT / GRADERS: tba

OFFICE HOURS: Arranged during the first week of class, to take into account other commitments of students and instructors.
**You are encouraged to take full advantage of these office hours, or to request alternative arrangements as needed.**

TEXTBOOKS: R.M. Felder and R.W. Rousseau, Elementary Principles of Chemical Processes (with workbook), 3rd Edition, John Wiley & Sons, New York, 2005. Required.

WEB-BASED MATERIALS: BioENGR Educational Materials Bank, http://www.engr.sjsu.edu/~bioemb/index.php Required. (You need to register to access website.)

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|---|---|---|
| GRADING POLICY: | Homework | 20 percent |
| | Design project | 15 percent |
| | Exam 1 | 10 percent |
| | Exam 2 | 10 percent |
| | Exam 3 | 10 percent |
| | Exam 4 | 35 percent. |

There will be no final examination.

***Homework*** - Homework will be regularly assigned. In general, assignment will be via email, using your MIX account. You are required to have an active one, though you may auto-forward to a medium of your choice.

- Although you may work on homework problems in groups, all homework submitted must be individual work. Homework which appears to be copied may result in zero credit for all concerned, at the discretion of the T.A. and the instructor.
- Your homework solutions should be neat and easy to follow. Start each problem on a new page. Please work on only one side of the paper. Your answer to a problem should be boxed and rounded off to the correct number of significant figures; units should be appropriate. Intermediate solutions in a long problem should be underlined.
- Homework will be collected in class on the due date. Paper submissions are required. **Late assignments will not be accepted**.
- Solutions to the homework will be sent out by email shortly after the assignments are due. You are encouraged to review the solution **even when full credit has been received** for the assignment.
- For questions of credit, please approach the T.A. first; you are encouraged to approach either the T.A. or the instructor (or both) for questions of content.
- Requests for re-evaluation of homework must be made **within one week** after they are returned. The rationale for re-evaluation must be **in writing**.

***Design projec***t - Details will be made available shortly.

- Students will be divided into groups. It is expected that each member of the group will participate equally in the project and will receive a shared grade. Students not adopting this philosophy will be graded accordingly.

***Exams 1-3*** - These will be open-textbook, in-class examinations. They will be based primarily on material covered since the last exam.

- No collaboration of any sort is permitted. Laptops are not permitted.
- The schedule of exams is given in the Progression Section, below.
- Make-up exams will be allowed only in case of **certifiable medical emergencies**, or approved University activities for which **advance permission** must be obtained from the instructor.
- Requests for re-evaluation of these exams must be made **within one week** after they are returned. The rationale for re-evaluation must be **in writing**.
- If the fire alarm goes off, the resolution of the situation is at the discretion of the instructor.

***Exam 4*** - This will be an open textbook, in-class, **comprehensive** test.

- No collaboration of any sort is permitted.
- If the fire alarm goes off, the resolution of the situation is at the discretion of the instructor.

Numerical grades, not letter grades, will be issued for individual homework assignments, the design project, and the exams. Letter grades will be issued only for the overall performance in the course, following the weighting above between homework, design and exams. However, an account of class performance will be provided after every test. The following serve as "ceilings" of minimum performance to receive the corresponding grades: "A"=90, "B"=80, "C"=70, "D"=60. They are "ceilings" in that these minimum numbers may be adjusted downwards.

OTHER CLASS POLICIES Attendance at class sessions is **very strongly recommended**. Those not in class for **any** reason are responsible for all material covered, homework assigned, etc., in that session.

Social-Justice Statement: "WVU is committed to social justice. I concur with that commitment and expect to maintain a positive learning environment based upon open communication, mutual respect, and nondiscrimination. WVU does not discriminate on the basis of race, sex, age, disability, veteran status, religion, sexual orientation, color or national origin. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration. If you are a person with a disability and anticipate needing any type of accomodation in order to participate in this class, please advise me **at least one week in advance** and make appropriate arrangements with the Office of Disability Services (304-293-6700)"

PROGRESSION: Tentative

| Week Starting | *Date* | Chapter | *Other Activity* |
|---|---|---|---|
| August 19 | | 1,2 | |
| August 26 | | 3 | |
| September 2 | | | |
| September 9 | | 4 | |
| | *September 9* | | *Exam 1* |
| September 16 | | | |
| September 23 | | | |
| September 30 | | 5 | |
| October 7 | | | |
| | *October 9* | | *Exam 2* |
| October 14 | | 6 | |
| October 21 | | | |
| October 28 | | | |
| November 4 | | 4 (Redux) | |
| November 11 | | | |
| November 18 | | | |
| | *November 20* | | *Exam 3* |
| November 25 | | | Thanksgiving Break |
| December 2 | | Design Workshops | |
| | *December 6* | | *Design Projects due* |
| December 9 | *December 9* | | *Exam 4* |

**West Virginia University**
**Department of Chemical Engineering**
**Undergraduate Program Mission, Objectives, and Outcomes**

## Mission

To prepare students to become practicing chemical engineers, consistent with the objectives of the College of Engineering and Mineral Resources and West Virginia University.

## Program Objectives

1. Graduates will be successful in their professional careers and/or post-graduate training as demonstrated by their abilities to solve traditional chemical engineering problems, to solve problems in extended applications of chemical engineering (especially biological) as well as non-related fields, and to develop new and valuable ideas.
2. Graduates will be able to work competitively in diverse professional environments as demonstrated by their abilities to work on teams, to work independently, to provide leadership, to mentor junior co-workers, and to communicate effectively.
3. Graduates will demonstrate professional character exhibited by their ethical behavior, their pursuit of professional registration, their pursuit of lifelong learning opportunities, their commitment to responsible safety practices, and their ability to articulate the environmental impact of their work.

## Educational Outcomes

1. Graduates will understand and be able to analyze entire chemical processes, including those with life science applications.
2. Graduates will be proficient in the oral and written communication of their work and ideas.
3. Graduates will be proficient in the use of computers, recent computer software, and computer-based information systems.
4. Graduates will have the ability to learn independently but will also be able to participate effectively in groups.
5. Graduates will be able to design effective laboratory experiments, to perform laboratory experiments, to gather data, to analyze data, and to test theories.
6. Graduates will be prepared for a lifetime of continuing education.
7. Graduates will understand the safety and environmental consequences of their work as chemical engineers and will be able to design safe processes.
8. Graduates will understand their professional and ethical responsibilities.
9. Graduates will have the broad education necessary to understand the impact of engineering solutions in a global and societal context.