Chemical Process Component Design 06401.01
Syllabus for Fall 2011

INSTRUCTORS: Mariano J. Savelski, Ph.D. 
Professor 
Jesse VanKirk 
Adjunct Professor 

Office: Rowan Hall 332 (Savelski) 
Phone Number: 5317 (Savelski) 
Emails: savelski@rowan.edu, vankirk@rowan.edu 

OFFICE HOURS: You are free to stop by Dr. Savelski’s office as needed. 
Email Prof. VanKirk for an appointment with him. 

COURSE SESSIONS: Mondays and Wednesdays 9:25 – 10:40 AM (ROW 340), Thursdays 8:00 – 10:40 AM (ROW 340) 

REQUIRED TEXTBOOK AND SUPPLIES 

Textbooks from all previous ChE courses will be useful as well. 

ABSOLUTE GRADING SCALE 
In this course, we would like to create an atmosphere of positive cooperation between students. In addition, most of the exercises in this course will require you to work in teams, and you will be expected to help one another learn the material. To encourage and support cooperative learning, you will be graded on an absolute grading scale as given below. The net result is that it is in your interest to help your classmates become successful engineers. You will learn through teaching others. 

<table>
<thead>
<tr>
<th>Letter Grade ranges</th>
<th>Percentages between</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>90 – 100</td>
</tr>
<tr>
<td>B</td>
<td>80 – 89</td>
</tr>
<tr>
<td>C</td>
<td>70 – 79</td>
</tr>
<tr>
<td>D</td>
<td>60 – 69</td>
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</tbody>
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Your final numerical grade in the course will be determined as follows: 

3 exams (12% L, 18% M, 25% H) 55% 
Final Exam 30% 
Professional Behavior* 10% 
Labs and Class Participation 5% 
Homework (extra credit) 5%
TEAM HOMEWORK
Each student will be assigned to a collaborative study group of 3-4 students. If every member of that
group scores above 83 on an exam, each group member will receive four bonus points on the exam.

Homework will be periodically assigned. Each team/study group should only submit one homework
assignment, and all listed team members will receive the same grade. Late work of any kind will not be
graded. Collaboration on homework is acceptable and encouraged, but all tests must be done
independently. All students will be asked to submit evaluations of how well their peers performed as
team members. These evaluations will be used at the end of the semester to adjust the final grading. The
grade received on all team assignments is a “raw score”. Raw scores will be adjusted according to each
individual’s contribution to the overall team effort. Each team member will be evaluated by every
member of the team, including him/herself. The adjusted score (not the raw score) will be used in
calculation of course grades. Thus, the student who consistently demonstrates a higher level of effort may
be rewarded. Likewise, the student who does not contribute substantially to team assignments may be
penalized.

Please be aware that the adjustment of grades for team assignments can substantially
impact the overall course grade, either positively or negatively.

Since most homework problems have no unique solution (problems are usually open ended),
no solutions will be posted.

HOMEWORK GRADING
Solutions will be scored according to the following scale:
- 4 points – Correct solution method, equations and tables properly cited, units clearly shown
throughout the entire problem, and correct numerical answer.
- 3 points – Correct solution method, equations and tables properly cited, units clearly shown
throughout the entire problem, and incorrect numerical answer.
- 2 points – Incorrect solution method OR equations and/or tables are NOT all properly cited OR
units are missing in two or more instances.
- 0 points - Problem not done.

At the end of the semester, homework points will be added and normalized based on the maximum
attainable points.

No assignment will be accepted without the appropriate cover sheet.

EXAMS
Three exams will be given. The exams will be weighted on an individual basis: 12% (for your lowest
score), 18%, and 25% (for your highest score).

All exams are comprehensive with an emphasis on material covered since the previous exam. In addition,
a comprehensive final exam will be given during Finals Week. All exams will be open-book and notes
unless otherwise announced. Absence at examination time is excusable only if deemed so by the Dean of
Students Office (it may be required to present documentation proving illness of the student or similar
emergency). An unexcused absence from an exam will result in a zero grade on that exam.

If an error has been made in grading your exam, you must resubmit your entire exam for re-grading
within 48 hrs of getting your graded exam back.

**ATTENDANCE POLICY**
Attendance to lectures is recommended but all labs are mandatory and will be graded. The instructor will also keep track of attendance and participation in class activities, and this information will be used at the end of the semester for borderline grade decisions. If you know that you will be absent from class for a valid reason, let your instructor know 24 hours before the class period. The only exception to this rule is a medical emergency.

**PROFESSIONAL BEHAVIOR**
All students are expected to behave professionally, unprofessional behavior includes but is NOT limited to, being late to class (see below), walk in and out of class while in session, cell phone use in class, working on assignments foreign to the class, electronic texting, sleeping in class, chatting in class, and horseplay.

Students are expected to be ready for class at the beginning of the class period.
We have a zero tolerance policy to being late to class (including examination days)
No student will be admitted late as this constitutes a disturbance to class activities.

**ACADEMIC CONDUCT:** Any student engaged in an act of academic misconduct, which includes but is NOT limited to, cheating, plagiarism, use of written or oral offensive language, tampering with other student’s files or computer accounts will receive a grade of $F$ for the course and will be reported to the Provost’s Office for appropriate academic sanctions.

If another student is knowingly involved in the offense, he or she will receive the same penalty.

**STUDENTS WITH DISABILITIES**
If you have a documented disability that may have an impact on your work in this class, please contact the instructors. Students must provide documentation of their disability to the Academic Success Center in order to receive official University services and accommodations. The Academic Success Center can be reached at 856-256-4234. The Center is located on the 3rd floor of Savitz Hall.

**IMPORTANT DATES**

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Room</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>09-29</td>
<td>8:00 AM</td>
<td>ROW 340</td>
<td>Exam 1</td>
</tr>
<tr>
<td>10-27</td>
<td>8:00 AM</td>
<td>ROW 340</td>
<td>Exam 2</td>
</tr>
<tr>
<td>12-08</td>
<td>8:00 AM</td>
<td>ROW 340</td>
<td>Exam 3</td>
</tr>
<tr>
<td>Finals Week</td>
<td>TBA</td>
<td>TBA</td>
<td>Final Exam</td>
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**WITHDRAW SIGNATURE SCHEDULE**

Withdrawal
Sept 13 - Oct 21 ................. (W) ............... Student, Professor

Late Withdrawal
Oct 22 - Nov 22 ............ (WP/WF) .......... Prof, Dept Chair

Hardship Withdrawal
Nov 23 - Dec 20 .......... (WP/WF) .. Prof, Dept Chair, Dean
INSTRUCTIONAL OBJECTIVES

Part I: Introduction to Design and Design of Systems for Homogenous and Heterogeneous Mixtures

After completing this section, you should

- Be familiar with how design projects are planned, carried out, and documented in industry.
- Be familiar with the sources of information on manufacturing processes.
- Be able to obtain chemical and physical properties needed for the design calculations.
- Be able to select the appropriate thermodynamic method to solve a design problem.
- Understand the concept of separation factor and be able to select appropriate separation methods for vapor, liquid mixtures.
- Be able to solve vapor-liquid equilibrium problems for ideal and non-ideal systems.
- Be able to design gas-liquid separators and decanters.
- Be able to solve liquid-liquid equilibrium problems for isothermal two-phase systems.
- Be able to plot and interpret ternary extraction diagrams.
- Be able to find the mixing point and solve single stage and cross flow extraction problems.
- Be able to solve countercurrent extraction problems using McCabe-Thiele methodology.
- Be familiar with the features and applications of the more widely used industrial extractor designs.
- Be able to solve extraction problems using simulation tools.

Part II:

Design of Distillation Systems for Homogenous Mixtures without Azeotropes

After completing this section, you should

- Be able to explain the total, minimum reflux, and finite reflux conditions for Multicomponent mixtures.
- Be able to choose operating conditions for multicomponent distillation.
- Be able to design multicomponent distillation column using short cut methods and simulation tools.
- Be able to explain how different type of trays and packing work.
- Be able to calculate pressure drop, tray efficiencies and flooding conditions for either trays or packing.
- Be able to derive expressions for Number of Transfer Units (NTU) and Height of a Transfer Unit (HTU) in the gas and liquid phases, and use them to solve for the height of packing.
- Be able to calculate the height of packing using the concept of the height equivalent to a theoretical plate (HETP).
- Be able to size multicomponent distillation column using simulation tools.

Part III: Design of Heat Transfer Equipment

After completing this section, you should

- Be able to explain the terms in the Overall Heat Transfer Coefficient (U).
- Be able to derive the expression of the Mean Logarithmic Temperature Difference for co-current and counter current flow.
- Be familiar with the advantages and disadvantages of countercurrent flow.
- Be able to draw T-Q diagram for different configurations in Shell-and-Tube heat exchanger.
- Be able to calculate the heat transfer coefficients and pressure drop for a Shell-and-Tube heat exchanger.
- Be able to solve the energy balances for the fluids and the heat exchanger design equation to obtain the duty, missing temperatures, U value, and heat transfer area.
- Be familiar with the heuristics for the allocation of fluids in Shell-and-Tube heat exchanger.
- Be able to design or retrofit a Shell-and-Tube heat exchanger with no-phase changing fluids.
- Be able to design or retrofit a condenser and a reboiler and other heat transfer equipment (e.g.: air coolers and fired heaters).