TEACHING PORTFOLIO

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# TEACHING PORTFOLIO
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STATEMENT OF TEACHING PHILOSOPHIES AND OBJECTIVES

I believe that my success as a faculty member will be measured by my ability to effectively teach, advise, and mentor students and to promote these endeavors at the University of Kentucky. Based on this job description, I combine my passion for engaging students through effective classroom teaching and independent research to achieve teaching success. The goal of my teaching efforts is to develop each student's skills in broad-based problem solving and their depth of understanding in specialized areas, signifying the ability to address problems in detail. Recognizing the interdisciplinary nature of engineering, I introduce many opportunities to practice communication and team building skills, both in the classroom and in the research setting. The ability to approach problem solving as an individual and as a member of a team is emphasized. Hands-on examples are incorporated in my classroom teaching as well as my outreach activities. The objectives of my interactions with students are to engage them in learning the process, provide them with high personal and professional standards, and provide them with the means and motivation to achieve their goals.

As Director of Graduate Studies of the Chemical Engineering and Materials Engineering Graduate Programs, I have had the opportunity to develop broader goals for teaching and research training within these programs. The effectiveness of a graduate program can be measured by its ability to develop the fundamental knowledge base, the research and critical thinking skills, the communication skills, and the professionalism and leadership skills of its graduates. My experience as Director of Graduate Studies has provided me with a more global viewpoint of how the sum of the interactions and instructional opportunities of a student affect the development of the “whole” professional engineer. This experience has greatly impacted how I approach education, recognizing that every interaction is an opportunity to teach, advise, and mentor.

Classroom Instruction. I have had the opportunity to teach eight undergraduate and two graduate level courses since joining the University of Kentucky in 1995. These courses include a new undergraduate elective (Bioseparations) and a new graduate elective (Colloids and Interfaces).

My approach to classroom teaching reflects my belief that students strive to meet high expectations. I have the privilege of working with bright and talented individuals, each possessing a unique capacity for understanding and applying information. I believe that engineers taught in an environment of mutual respect and high expectations will excel if the proper personal and professional resources are developed. My coursework stresses setting up and analyzing problems through lecture examples, homework, and design problems. Particular emphasis is placed on open-ended problems, which highlight the significance of creativity in the engineering profession, and examples of non-traditional engineering applications. I have also implemented new laboratories and incorporated simulation packages into core Chemical Engineering courses (Separation Processes and Process Control), to enhance the students’ understanding of the course concepts. Highlights of innovative approaches that I have used to achieve my educational objectives in the classroom are summarized in Summary of Teaching Innovations.

At the undergraduate level, I also believe that it is important to relate classroom experiences to real-world examples and increase the awareness of the roles of chemical engineers in the workforce. For example, my freshmen-level class (Introduction to Chemical
Engineering) focused on creating a manufacturing company based on the successful implementation of a technology described in a research publication. In addition to a business plan, student teams developed job descriptions for engineers within their imaginary company and actively recruited their classmates to join their company. Coupling discussions of trends in corporate culture with course-based problems lead to group evaluations of goals, team diversity (in knowledge, experience, personality, ethnicity, and gender), team interactions, and group dynamics. These discussions also present an opportunity to draw on the experiences of undergraduates in the cooperative education program, non-traditional students, and my industrial collaborators. Similarly, in my role as AIChE Student Chapter faculty advisor from 2000-2003, I taught the Engineering Professions course (CME 006) each semester. Each semester’s program included a broad range of academic, industrial, and non-technical speakers who addressed various aspects of professional development. The Engineering Professions course was structured to achieve our department’s ABET-related outcomes of life-long learning and broad education.

I have taught one required graduate course, CME 620 Equilibrium Thermodynamics, which is closely related to my research area. My goal in teaching this course is to provide the students with a broad-based thermodynamics background and the ability to examine specific problems in greater detail. I engage the students in this course by providing a more cohesive link between theory and application than is generally achieved at the undergraduate level. This approach builds a firm foundation from which the students can identify, formulate, and analyze the broad range of thermodynamics problems that they will encounter in their research or in their careers. In addition, specific topics are highlighted in greater detail, first in the course and then in individual student projects. The individual student projects are an opportunity for the students to gain confidence in their ability to independently apply their thermodynamics knowledge.

The electives that I have developed reinforce the broad concepts of engineering by looking at specific applications or interpretations in greater detail. Bioseparations (CME 599), which is a senior-level elective, addresses the need to educate students on the unique processing strategies for bio-based products. This course, which is closely related to my research, highlights the similarities and differences between the separation of bio-based products and traditional unit operations encountered in chemical engineering applications. Thus, this course complements the previous required coursework by applying previous knowledge to new processes and emphasizing different chemical engineering unit operations. As described in the Summary of Teaching Innovations, this class uses journal articles as a primary supplement to lecture material, gives students the opportunity to deliver several mini-presentations on the course material, and incorporates an open-ended batch design project.

Teaching a graduate-level elective provides a unique opportunity to tailor the course to the broad research interests of the students. I have developed a Colloids and Interfaces course (CME 780) that has attracted students from across campus, including Chemistry, Pharmacy, Mining Engineering, Materials Engineering, and Chemical Engineering. This class builds a fundamental description of the forces used to characterize colloidal systems and provides the students with an opportunity to explore applications through class lectures, critiques of articles, guest speakers, and individual student-selected projects. The oral presentations by the students are an additional teaching tool used to introduce students to multi-disciplinary topics.

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achieve these goals. These goals may involve the comprehension of engineering principles, personal development, or professional development. Lectures, problem sessions, course-based group activities, and individual contact with the instructor are designed to engage the student in the learning process and advance students towards their goals. I strive to provide an inclusive learning environment that encourages student participation and interaction.

**Supervision of Research Projects.** Independent research is fundamental tool for developing engineering professionals capable of creating solutions for tomorrow’s problems. This requires knowledge of what can be done today, vision of what could be achieved through advances in the field, and effective communication and teamwork to make that vision happen. In my research program, rigorous research training emphasizes the interdisciplinary nature of research and seeks to build effective communication skills. My research benefits from interdisciplinary and industrial collaborations. Although the depth of the independent research project is varied to the level of the student, I have used research experiences as a basic teaching tool at the graduate, undergraduate, and high school level. Four Ph.D. and five Master’s degrees have been awarded to students working in my laboratory. One of my Ph.D. students was recently appointed to a tenure-track position in the Department of Chemical Engineering at the University of Rhode Island. My research group currently consists of three Ph.D. candidates, one Master’s student, and one post-doctoral researcher.

Undergraduate research experiences form a strong link between my cross-disciplinary research activities and my teaching objectives. I have advised approximately twenty undergraduate researchers in independent research. This has been accomplished through credit-based research projects (CME 395), programs sponsored by the National Science Foundation (REU programs), the University of Kentucky's Undergraduate Research and Creativity grants, and hourly-based salaries. To date, ten of these students have pursued advanced degrees in engineering.

Three high school students have also been participated in my research program through the Paul Laurence Dunbar High School, Math, Science & Technology Magnet Program, with a new student expected to join our research group in Spring 2007. This program involves a year-long commitment to provide a research environment and project suitable for high school student with technical interests. Students are mentored on conducting independent research, writing technical reports, and giving technical presentations.

**Mentoring, Advising and Outreach.** My mentoring and advising activities focus on the individual. Both personal and professional interactions are required to nurture the “whole” and creative engineer. In addition, I also feel that it is critical that underrepresented students recognize that the profession of engineering does not preclude a rich personal and family life. Student advising, both formal and informal, is an important opportunity to increase student retention and satisfaction. I officially advise approximately 10 undergraduate students yearly. I meet with my advisees prior to registration each semester to discuss their course selection for the upcoming semester, their progress in the current semester, and career planning. Opportunities for co-operative education, industrial summer internships, and research internships are also discussed. As Director of Graduate Studies, I also contribute to the professional development and advising of the 60+ graduate students in our program through regular but informal conversations regarding their progress in the graduate program and career development.
I participate in additional informal advising through classroom activities, research activities, and through participation in student organizations. I served as the faculty advisor for the Chemical Engineering Graduate Student Association (CHEGSA; 1995 – 2001) and the UK Student Chapter of American Institute of Chemical Engineers (AIChE, 2000 – 2003). During this time, CHEGSA successfully transformed its industrial Graduate Student Symposium into a regional meeting hosted by multiple universities. In addition, UK's AIChE student chapter has continued its award winning tradition, receiving its 16th consecutive Outstanding Student Chapter Award in 2003. I emphasize leadership development within the AIChE officers, recognizing that our current student leaders are highly likely to be future leaders within their industries.

Many of my outreach activities use hands-on demonstrations based on my research to educate students and the public on opportunities in Chemical Engineering, particularly in the fields of bioprocessing or materials synthesis. For example, I have participated in the UK College of Engineering's Open House, Kentucky's Women in Science program (which introduces Appalachian high school students to careers in science and engineering), UK’s Summer Engineering Camp and UK’s Freshman Summer Program through the Office of Minority Affairs. In addition, I represented the Chemical Engineering Program to freshmen EGR 101 classes from Fall 2002 to Spring 2004. My responsibilities included presenting an overview of the chemical engineering profession, providing a laboratory experience, and coordinating a department tour.

Providing a rewarding and enriching educational experience to students is a continuous challenge, and presents learning opportunities for me as an instructor. This is particularly true because of the large range of individual learning styles and the changing nature of the chemical engineering curriculum. To meet this challenge, I have worked to continuously improve my teaching skills and my knowledge of modern learning pedagogies. My classroom activities were particularly influenced by my involvement with the Creativity Group, sponsored by University of Kentucky's Teaching and Learning Center from 1997 - 2001. The Creativity Group included approximately 20 faculty from departments as diverse as Art, Interior Design, Architecture, German, Biology, and several Engineering fields. This was a unique forum that provides support for individual faculty in their endeavors to incorporate creativity in their curriculum and links creativity with a discussion of learning styles.
### COURSES TAUGHT (2001-present)

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course</th>
<th>Title</th>
<th>Type</th>
<th>Class Size</th>
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<tbody>
<tr>
<td>Fall 01</td>
<td>CME 006</td>
<td>The Engineering Profession</td>
<td>Required Undergrad</td>
<td>25</td>
</tr>
<tr>
<td>Fall 01</td>
<td>CME 200</td>
<td>Process Principles</td>
<td>Required Undergrad</td>
<td>15</td>
</tr>
<tr>
<td>Spring 02</td>
<td>CME 006</td>
<td>The Engineering Profession</td>
<td>Required Undergrad</td>
<td>45</td>
</tr>
<tr>
<td>Spring 02</td>
<td>CME 462</td>
<td>Process Control</td>
<td>Required Undergrad</td>
<td>24</td>
</tr>
<tr>
<td>Fall 02</td>
<td>CME 006</td>
<td>The Engineering Profession</td>
<td>Required Undergrad</td>
<td>25</td>
</tr>
<tr>
<td>Fall 02</td>
<td>CME 200</td>
<td>Process Principles</td>
<td>Required Undergrad, 2 sections</td>
<td>28</td>
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<tr>
<td>Spring 03</td>
<td>CME 006</td>
<td>The Engineering Profession</td>
<td>Required Undergrad</td>
<td>50</td>
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<tr>
<td>Spring 03</td>
<td>CME 462</td>
<td>Process Control</td>
<td>Required Undergrad</td>
<td>23</td>
</tr>
<tr>
<td>Fall 03</td>
<td>CME 415</td>
<td>Separation Processes</td>
<td>Required Undergrad</td>
<td>24</td>
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<tr>
<td>Fall 03</td>
<td>CME 433</td>
<td>Chemical Engineering Laboratory (25% Responsibility)</td>
<td>Required Undergrad</td>
<td>28</td>
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<tr>
<td>Spring 04</td>
<td>CME 462</td>
<td>Process Control</td>
<td>Required Undergrad</td>
<td>24</td>
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<tr>
<td>Fall 04</td>
<td>CME 415</td>
<td>Separation Processes</td>
<td>Required Undergrad</td>
<td>25</td>
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<tr>
<td>Fall 04</td>
<td>CME 433</td>
<td>Chemical Engineering Laboratory (25% Responsibility)</td>
<td>Required Undergrad</td>
<td>28</td>
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<tr>
<td>Spring 05</td>
<td>CME 462</td>
<td>Process Control</td>
<td>Required Undergrad</td>
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<td>Fall 05</td>
<td>CME 620</td>
<td>Equilibrium Thermodynamics</td>
<td>Required Grad</td>
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<tr>
<td>Spring 06</td>
<td>CME 462</td>
<td>Process Control</td>
<td>Required Undergrad</td>
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<tr>
<td>Fall 06</td>
<td>CME 620</td>
<td>Equilibrium Thermodynamics</td>
<td>Required Grad</td>
<td>13</td>
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Additional courses taught prior to 2001 (not listed above) include **Introduction to Chemical Engineering** (required undergraduate course), **Chemical Reactor Design** (required undergraduate course); **Bioseparations** (undergraduate elective developed by BLK) and **Colloids and Interfaces** (graduate elective developed by BLK). **Course Descriptions** of all courses taught by BLK (1995 – present) are provided. **Teaching Innovations** associated with the courses developed prior to 2001 are also described.
COURSE DESCRIPTIONS

CME 006    The Engineering Profession          Fall 2000 – Spring 2003
0 Credit Hours - 1 Contact Hour/week
Chemical engineering undergraduates are required to take three semesters of this course during
their junior and senior years. Guest lecturers address professional development topics such as
career opportunities and planning, interviewing strategies, opportunities for graduate education,
and life-long learning. Activities of the Student Chapter of the American Institute of Chemical
Engineers are also conducted.

--Course Syllabus Attached--

CME 101    Introduction to Chemical Engineering          Prior to 2001
1 Credit Hour - 1 Contact Hour/week
This freshmen-level course uses problem-based exercises and group activities to introduce
students to concepts of engineering and opportunities within the engineering profession. The
formation of imaginary technical companies by student groups is used to explore the activities of
engineers in industry, government, and academia. In addition, the students are exposed to the
concepts of life-long learning, technical communication skills, and a variety of engineering tools.
My sections of the course were developed to address recruitment and retention issues within the
chemical engineering program. The small class size promotes a higher degree of student and
teacher interaction.

CME 200    Process Principles          Fall 2001, 2002
3 Credit Hours - 4 Contact Hours/week
This is the first chemical engineering core course and is taught to sophomore undergraduate
students. This course applies basic principles of material and energy balances to chemical and
mechanical processes. The concepts of units, conversions, reaction and equilibria, recycle and
bypass, energy exchange, and basic thermodynamics provide the basis for developing problem
solving strategies. This course also develops approaches to problem solving, communication
skills, and computer skills.

--Course Syllabus Attached--

CME 395    Special Problems in Chemical Engineering
3 Credit Hours - 9 Contact Hours/week
In this undergraduate research for credit course, the student works on an independent research
project under the supervision of a professor. The student and advisor work together to formulate
a research hypothesis and devise experiments to test this hypothesis. Experimental design,
analysis, and interpretation are presented in a final research report. The student interacts
extensively with the faculty member and his/her research group over the course of this project.
Semesters which BLK taught this course are noted in the Undergraduate Student Research
Supervision section.

CME 415    Separation Processes          Fall 2003, 2004
3 Credit Hours - 3 Contact Hours/week
This is a junior-level required course which addresses the analysis and design of separation
processes. Separations based on both equilibrium stage concepts and mass transfer rate control
are examined for a range of chemical process operations, including distillation, gas absorption, extraction, adsorption, and membrane-based processes. Design problems are conceived to require computer-aided modeling and analysis.

--Course Syllabus Attached--

CME 433  Chemical Engineering Laboratory  Fall 2003, 2004
3 Credit Hours - 8 Lab Hours/week
This senior-level laboratory course emphasizes experimental work in chemical engineering unit operations based on fluid flow, heat transfer, mass transfer, and chemical reaction kinetics. Special emphasis is placed on equipment design, experimental procedures, mathematical and statistical data handling, report writing, and oral presentation.

--Course Syllabus Attached--

CME 462  Process Control  Spring 2003, 2004
3 Credit Hours - 3 Contact Hours/week
This senior-level course examines the basic theory of dynamic processes and the application of automatic control devices to these processes. Application of process control concepts to industrial chemical plants is emphasized. The formulation and solution of dynamic equations, the identification of control objectives, the use of appropriate measurements and manipulations, and the response of the system to standard (PID) and advanced control strategies is demonstrated. Interactions between the process units are analyzed using well-known analytical tools and design strategies.

--Course Syllabus Attached--

CME 550  Chemical Reactor Design  Prior to 2001
3 Credit Hours - 3 Contact Hours/week
This required senior-level course provides a systematic approach to the interpretation of rate data and the development of performance equations for single and multiple reactors. Emphasis is placed on the design and analysis of isothermal and nonisothermal reactors.

CME 599  Bioseparations  Prior to 2001
3 Credit Hours - 3 Contact Hours/week
This elective, aimed primarily at seniors, highlights the similarities and differences between the separation of bio-based products and traditional chemical engineering unit operations. The heuristics of bioseparation processes are presented and related to the primary recovery, product concentration, and product purification of bio-based products. Particular emphasis is placed on product extraction (liquid-liquid, aqueous two-phase, and supercritical fluid extraction), concentration (precipitation, crystallization, and ultrafiltration), and purification steps (chromatography).

CME 620  Equilibrium Thermodynamics  Fall 2005, 2006
3 Credit Hours - 3 Contact Hours/week
This course develops basic thermodynamic definitions and postulates and applies them to conservation of energy, reversibility and entropy, stability, and equilibrium. Equilibrium properties of pure substances and mixtures are examined for single-phase and multiphase systems. These properties are applied to separation processes and reaction equilibria.
CME 780  Colloids and Interfaces  Prior to 2001
3 Credit Hours  - 3 Contact Hours/week
This graduate level elective develops a description of the properties of colloidal systems and interfaces based on their microscopic and macroscopic interaction forces. This knowledge is applied to a variety of physical systems including micelles, microemulsions, bilayers, suspensions, and polymers. Applications of colloidal and interfacial properties to chemistry, biology, and engineering are explored in this interdisciplinary course.

--Course Syllabus Attached--
SUMMARY OF TEACHING INNOVATIONS

CME 006 The Engineering Profession
Fall 2000 – Spring 2003
• Formalized the course objectives and schedule of this professional seminar series, which also encompasses the regular meetings of UK’s student chapter of the American Institute of Chemical Engineers.
• Implemented a balanced series of seminars which promote life-long learning and broad education, in conjunction with CME’s Undergraduate Studies Committee and in fulfillment of ABET requirements.
• Provided Team Training sessions for the senior laboratory under the supervision of communications and team training expert Dr. Derek Lane (Dept. of Communications, University of Kentucky)
• Established links with the AIChE local section in Louisville for professional development and networking opportunities. Achieved a goal of having 90% of seniors attend a local section, regional, or national professional meeting.

CME 200 Process Principles
Fall 2001, Fall 2002
• Developed a recitation structure that focussed on group learning and problem solving.
• Incorporated team building exercises to emphasize the principles of listening, learning, teaching, and coaching in group problem solving.
• Developed brainstorming exercises that emphasized the creative component of engineering.
• Developed bioprocessing examples relating to material balances, with a goal of improving the retention of the large population of CME undergraduates interested in the biological opportunities in Chemical Engineering
• Incorporated ASPEN simulation into the course through team-based projects during recitation.

CME 415 Separation Processes
Fall 2003, Fall 2004
• Developed yearly design problem to address ABET-related outcomes in this course. These biotechnology-based design problems formed a link between my research and the coursework. This design problem resulted in a literature review, an oral presentation, and a written report.
• Provided team building exercises through the development of group plans to organize the design project and to address team skills and conflict resolution.
• Incorporated ASPEN as a tool for the analysis of separation problems, including an open-ended design problem. Analyzed distillation residue curves to a visualization of complex separation problems.
• Purchased and implemented a distillation column laboratory experiment within this course.
CME 462 Process Control  

- Incorporated MATLAB Simulink as a tool for analyzing and designing control systems. The use of this simulation tool is an excellent mechanism for the students to understand the results of implementing a control system even before they know how to mathematically describe the control strategy.
- Developed a hands-on experiment to implement process control strategies on an industrially relevant unit operation, a laboratory distillation column, in a group project format.
- Received money through the CPE Enhancement Fund Instructional Equipment to further update the distillation column for in-line composition analysis for improved distillation control.
- Purchased a commercial Process Control Teaching Package and implemented temperature and level process control experiments within the framework of the course.
- Developed a lecture format which provided for immediate student feedback on the understanding of the course concepts by adapting “Who Wants to Be a Millionaire?” style questions to my lectures. This immediate feedback, in the form of an ongoing game of “Who Wants to Be a Process Control Engineer?” (implemented in Spring 2005), increased student satisfaction with the course.
- Introduced dynamic equations describing biotechnology and cellular processes and drew analogies to metabolic engineering.
- The long term teaching of this course by BLK addresses the current teaching needs of the department.

CME 599 Bioseparations  
*Spring 2000 - Course Developed by BLK*

- Developed a senior-level elective highlighting the similarities and differences between the separation of bio-based products and traditional chemical engineering unit operations. Topics included chromatography, crystallization, filtration, centrifugation, cell disruption, liquid-liquid extraction, supercritical fluid extraction, aqueous two-phase extraction, ultrafiltration, and electrophoresis.
- Introduced journal articles and other assigned reading as the primary supplement to classroom lectures. This was necessary due to the lack of a suitable textbook.
- Incorporated mini-lectures (journal critiques or technology assessments) presented by student teams.
- Developed an open-ended design project based on current health-care needs: an economic analysis of the recovery of Zeamatin, an antifungal protein, from maize.
- Student evaluations reflect that too many unfamiliar elements and teaching components were introduced in a single course. The student comments demonstrate the perception that the course was too difficult and the teaching approaches were too novel.
CME 620 Equilibrium Thermodynamics  
*Fall 2005, Fall 2006*

- Developed individual project to allow students to focus on a specific nontraditional thermodynamics application in greater depth. The class presentations were used as a teaching tool to expose students to a variety of thermodynamic applications.
- Discussed technical presentation skills and implemented a peer review process to improve technical presentation skills.

CME 780 Colloids and Interfaces  
*Fall 2000 – Course Developed by BLK*

- Developed a graduate elective focusing on the fundamental description of colloidal and interfacial forces and applying this description to physical systems including micelles, microemulsions, bilayers, suspensions, and macromolecular solutions. Applications of colloidal and interfacial properties to chemistry, biology, and engineering are explored through class lectures, critiques of articles, and individual student-selected projects.
- Implemented individual student projects that focus on the application and analysis of colloidal systems and interfaces. These projects will result in a written document and an oral presentation. The oral presentation is a teaching tool to introduce students to additional multi-disciplinary topics.
- Developed a multi-disciplinary approach to the coursework which takes advantage of the diverse disciplines of the 15 students participating in the class: Chemical Engineering, Materials Engineering, Mining Engineering, Chemistry, and Pharmaceutical Sciences.
SUMMARY OF TEACHING EVALUATIONS

- The mean teaching evaluations for the Department of Chemical and Materials Engineering over this period (1995-2000) are 3.0/4.0 for the value of the course and 3.0/4.0 for the quality of the teaching.

- The mean teaching evaluations for the College of Engineering over this period are 3.1/4.0 for the value of the course and 3.2/4.0 for the quality of the teaching.

<table>
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<tr>
<th>Course</th>
<th>Title</th>
<th>Semester/Section</th>
<th>Value of Course</th>
<th>Quality of Teaching</th>
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<tbody>
<tr>
<td>CME 200</td>
<td>Process Principles</td>
<td>Fall 2001</td>
<td>3.2</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fall 2002† (2 sections)</td>
<td>2.9</td>
<td>3.1</td>
</tr>
<tr>
<td>CME 415</td>
<td>Separation Processes</td>
<td>Fall 2003</td>
<td>3.4</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fall 2004</td>
<td>3.4</td>
<td>3.5</td>
</tr>
<tr>
<td>CME 462</td>
<td>Process Control</td>
<td>Spring 2002</td>
<td>3.4</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
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<td>Spring 2003</td>
<td>2.9</td>
<td>2.9</td>
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<td></td>
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<td>Spring 2004</td>
<td>2.6</td>
<td>2.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spring 2005</td>
<td>3.2</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
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<td>Spring 2006</td>
<td>3.4</td>
<td>3.6</td>
</tr>
<tr>
<td>CME 620</td>
<td>Equilibrium Thermodynamics</td>
<td>Fall 2005</td>
<td>3.1</td>
<td>3.6</td>
</tr>
</tbody>
</table>

† The teaching evaluation for one section of this course was mislabeled with the name of their early instructor in the course. This may represent a composite score for the instructors.
UNDERGRADUATE ADVISING AND RESEARCH SUPERVISION

Undergraduate Advisees
Since becoming Director of Graduate Studies, I advise 5-10 students yearly. Prior to becoming DGS in 2003, I advised 10-15 students yearly. Advising takes the form of meeting my advisees prior to registration each semester to discuss their course selection for the upcoming semester, their progress in the current semester, and career planning. Opportunities for co-operative education, industrial summer internships, and research internships are also discussed. I also have informal discussions with the students during the semester.

Undergraduate Student Research Supervision (2001-present)
Prior to receiving tenure in 2001, I advised the independent research projects of 20 students as independent research for credit (CME 395) or through funded grant activity, REU programs, or University of Kentucky mentoring programs (such as the Freshman Summer Program through the Office of Minority Affairs). Subsequent undergraduate researchers are listed below. Unless otherwise noted, the students are chemical engineering students at the University of Kentucky. Of the 36 student that I have mentored in my laboratory, ten students are applying for, are currently studying for, or have received an advanced degree in Engineering.

Sarah Bashadi (CME 395, Spring 2006), “Pore Expansion in Supercritical CO2-Processed Fluorinated Surfactant Templated Silica Powders.” Spring 2006 – present. Sarah presented her research at the 2006 Annual AIChE meeting, where she won a 3rd place prize in the Materials Division of the Undergraduate Poster Competition. She is applying to graduate schools in Chemical Engineering.

Kari Darling (REU program participant, Lake Superior State University), “Immobilization of Clostridium Thermocellum using Sol-Gel Silica.” Summer 2006. Kari is a junior in Chemistry. She plans to participate in an additional REU program in Summer 2007 and attend graduate school. Kari’s poster won a 3rd place award (of approximately 20 posters) at the REU Poster Session held on the UK campus at the conclusion of the REU program.


Justin Shofner (REU program participant, CME 395 Fall 2003), “Interfacial Activity of Phospholipids in the Presence of Compressed Carbon Dioxide,” Summer 2003 – Spring 2005. Justin presented his research at the 2003 Annual AIChE meeting, where he won a 2nd place prize
in the Undergraduate Poster Competition. His work contributed to a publication, for which he is a co-author (J. Phys. Chem. B, 2005, 109(51), 24495-24501.). Justin currently attends University of Texas at Austin, where he is a Chemical Engineering Ph.D. candidate.


Tracy Robertson, "Interfacial Activity of Biomolecules for Bioprocess Design," Fall 2002 – Spring 2003. Tracy’s work contributed to a publication, for which she is a co-author (J. Phys. Chem. B, 2005, 109(51), 24495-24501.).


Caroline Strasinger (REU program participant), “Supercritical Fluid Processing for the Immobilization of Whole Cells in a Polymeric Matrix,” Summer 2001 – Spring 2004. Caroline presented her research at the Annual AIChe meeting in Fall 2001 and at the Southern Regional student meeting of AIChe in Spring 2004. Caroline, who was co-advised with Kim Anderson (CME), was the 1st place winner of the University of Kentucky 2004 Oswald competition. She is currently pursuing a Ph.D. in UK’s Pharmaceutical Science program.

Kevin Jared Tatum (REU program participant), "Interactions of Biopolymers at Compressible Fluid Interfaces," Spring 2000 to Spring 2001. Jared won 3rd place in student poster competition at 2000 Annual AIChe meeting. His work contributed to a publication, for which he is a co-author (J. Phys. Chem. B, 2005, 109(51), 24495-24501.). Mr. Tatum is pursuing a Ph.D. at Princeton University, with an expected graduation date of March, 2007.
GRADUATE STUDENT RESEARCH SUPERVISION

Ph.D. Supervision

Previous Students:
Marazban Sarkari
Dissertation: Solvent Engineering of Compressed and Supercritical Fluid Solvents for Bioprocessing Applications. Completed 3/00.
Current Position: Manager, Analytical and Formulation Development. RX Kinetics Inc., Boulder, CO

Jason Berberich
Current Position: Product Development Team Leader, Agentase, LLC, Pittsburgh, PA

Yeh Wei Kho
Dissertation Title: Fundamental Investigation of Carbon Dioxide-Expanded Fluorinated Solvents as Process Solvents. Completed 5/03.
Deceased.
Previously employed as a New Product Introduction Engineer by GE Specialty Materials, Waterford, NY.

Geoff Bothun
Current Position: Assistant Professor, University of Rhode Island, Department of Chemical Engineering

Current Ph.D. Students:


Masters Student Supervision

Previous Students:
Karen L. White
Current Position: Process Engineer, Center for Nanoscale Science and Engineering (CNSE), North Dakota State University, Fargo, ND.

Joel Luckman
Current Position: Programs Leader/IP Portfolio Manager, Whirlpool Corporation
Joel completed an industrial internship with Whirlpool (from 6/00 to 9/00) while a Master’s student at UK, and was subsequently hired by Whirlpool.

Geoff Bothun
Thesis Title: *Application of Compressed Fluids to Polymeric Fractionation and Membrane-Based Extraction.* Completed 7/01.
Geoff continued in the Ph.D. program.

Jay Shah
Thesis Title: Immobilization of Whole Bacterial Cells in Amorphous Polymers using Supercritical Carbon Dioxide. Completed 4/03.
Co-advised with Kim Anderson.
Jay is currently a medical student at the University of Kentucky.

Matthew Penn
Thesis Title: *Whole Cell Immobilization in Polymer Foams using Supercritical Carbon Dioxide.* Completed 1/06
Co-advised with Kim Anderson (CME)

Current Students
Current Ph.D. Advisory Committees
Michael Clark, Pharmaceutical Sciences
Saurav Datta, Chemical Engineering
Shaoxin Feng, Pharmaceutical Sciences
Courtney Harrison, Chemical Engineering
Sumod Kalakkunnath, Chemical Engineering
Venkat Koganti, Chemical Engineering
YongChao Li, Chemical Engineering
Motombo Nombe, Mining Engineering
Mohammed Rahman, Chemical Engineering
Xing Rong, Chemical Engineering

Previous Ph.D. Advisory Committees (2001 – Present)
Claudia Amorim, Chemical Engineering
Louei El-Azzami, Chemical Engineering
Jenny Hilding, Chemical Engineering
Cheng-Hsuan Hsu, Pharmaceutical Sciences
Heqing Huang, Materials Engineering
Zhongping Huang, Mechanical Engineering
Satya Jujjuri, Chemical Engineering
Melanie Loiselle, Chemical Engineering
Kimberly May, Chemical Engineering
Santos Murty, Pharmaceutical Sciences
Moses Oyewumi, Pharmaceutical Sciences
Dhaval Shah, Chemical Engineering
Chad Snyder, Chemistry
Bing Tan, Chemical Engineering
Sefa Tarhan, Biosystems & Agricultural Eng.
Haohua Tu, Chemical Engineering
Scott Webb, Pharmaceutical Sciences
Guang Yuan, Chemical Engineering
ADDITIONAL STUDENT AND TEACHING RELATED ACTIVITIES AND AWARDS

Awards
- 1998-99 Outstanding Chemical Engineering Teacher Award, University of Kentucky
- 2001-02 Outstanding Chemical Engineering Teacher Award, University of Kentucky
- Lutes Teaching Award Finalist (College of Engineering), 2002
- Finalist, 2003 Provost’s Teaching Award for Outstanding Teaching, Tenured Faculty Category
- 2000-2001 "Outstanding AIChE Student Chapter Award" presented at the Annual AIChE Meeting, Reno, NV. President: Christy Woolums; Faculty Advisor: Barbara Knutson
- 2001-2002 "Outstanding AIChE Student Chapter Award" presented at the Annual AIChE Meeting, Indianapolis, IN. President: Jason Berger; Faculty Advisor: Barbara Knutson
- 2002-2003 "Outstanding AIChE Student Chapter Award" presented at the Annual AIChE Meeting, San Francisco, CA. President: Shana Shulte; Faculty Advisor: Barbara Knutson

Activities
Chemical Engineering Faculty Representative, EGR 101, Fall 2002 – Spring 2004. I was the Chemical Engineering faculty representative for the multi-section freshmen “Introduction to Engineering Course.” My responsibilities included presenting an overview of the Chemical Engineering, providing hands-on demonstrations, and coordinating department tours.

Compiled departmental approaches to introducing computing in the curriculum and contributed to “Enhancing the Undergraduate Computing Experience,” written by Prof. Tom Edgar (University of Texas). (Chemical Engineering Communication, 2006, 40(3), 231 237.

Student Organizations
Faculty Advisor, University of Kentucky Chemical Engineering Graduate Student Association (CHEGSA), (1995 – present). During this time, CHEGSA has successfully transformed their Graduate Symposium to a regional meeting hosted by multiple universities. Based on this experience, the graduate students co-authored a paper entitled “Conducting a Multi-University Graduate Symposium,” which was published in Chemical Engineering Education (Chem. Eng. Edu., 32, 4, 1998).

Faculty Advisor, UK Student Chapter of American Institute of Chemical Engineers (AIChE) (2000-2003). Duties as faculty advisor include advising students on ongoing activities (plant trips, fundraisers, socials, and community service), coordinating the Engineering Professions class (CME 006) and arranging for professional speakers, participating in the events of the local professional chapter, and helping to coordinate student travel to conferences. I also accompany students to the Southern Regional conference and the Annual AIChE Meeting.
Faculty Co-Advisor, Student AIChE Design Contest (1997-1998). Advised interdisciplinary team of students on the design of reciprocating jet bioreactor. This team received 1st place in the Southern Regional Conference and competed in the AIChE national competition.

I have participated in the student chapter of the Society of Women Engineers (SWE) through panel discussions, scholarship applicant judging, Spring Banquets, and social activities.

**Post-Doctoral Research Supervision**

Satya Jujjuri (Ph.D., Chemical Engineering, University of Kentucky, April 2006), “Pressure Perturbations of Biochemical Fermentations,” May, 1006 – present.

**High School Research Supervision**


APPENDIX A

REPRESENTATIVE COURSE SYLLABI

Syllabi from the following courses are attached:

Undergraduate Level Courses:
(i) CME 006 Engineering Profession (Spring 2003)
(ii) CME 200 Process Principles (Fall 2001)
(iii) CME 415 Separation Processes (Fall 2004)
(iv) CME 462 Process Control (Spring 2006)

Graduate Level Courses:
(v) CME 620 Equilibrium Thermodynamics (Fall 2005)
(vi) CME 780 Colloids and Interfaces (Fall 2000) (Sample Elective)
Instructor
Barbara Knutson
163A Anderson Hall
257-5715
bknutson@engr.uky.edu

Course Description
Activities of the Student Chapter of the American Institute of Chemical Engineers (for junior and senior year chemical engineering students). Guest lecturers address professional development topics such as career opportunities and planning, interviewing strategies, opportunities for graduate education, and life-long learning.

Outcomes
The student should be able to:
1. Experience activities in a professional organization
2. Describe the role of life long learning in their career development.
3. Demonstrate knowledge of career options within Chemical Engineering and the opportunities for advanced professional degrees.
4. Appreciate how knowledge generated in one discipline is related to another discipline.
5. Discuss globalization, environmental, economic, and political issues presented in the seminar series.

Class Policies
Students will receive a regular update of scheduled class events.

Attendance will be taken at every scheduled meeting of the class. More than three absences over the course of the semester will result in an “Incomplete” for the course unless these absences are excused for reasons given in the "Students Rights and Responsibilities Handbook."

How do I join the national chapter of AIChE?
Undergraduate chemical engineering students can join AIChE at the Student Gold level ($20) or Student Silver level ($10). Become a Student Member online or download a PDF registration form at http://www.aiche.org/students/stumember.htm.
Spring 2003

4:00 p.m.   Wednesday    257 Anderson Hall
(*Notes a non-standard class time or activity)

January 22   AIChe General Business Meeting
Pizza will be served!

January 29   Plant Trip to Maker's Mark Bourbon Distillery
Meet at 2:00 pm in AH lobby

February 5   Kimberley Coleman
UK Career Center
Associate Director and College of Engineering Liaison
“Marketing Yourself to Potential Employers”

February 12  Louisville AIChe Professional Section Meeting
Louisville, 7:00 pm
Guest Speaker:  Prof. Pradeep Deshpande
University of Louisville, Dept. of Chemical Eng.
“Six Sigma”

February 19  Cancellation Due to Ice Storm 2003

February 22*  Engineering Open House (E-Day) Activities
Saturday, a.m.

February 26  Prof. Paul Bummer
UK School of Pharmacy
“Microemulsions in Drug Delivery - Solubility and Mass Transport”

March 5      College of Engineering Spring Career Fair
No Meeting.

March 6-8    Southern Regional Meeting
Hosted by Florida Institute of Technology
Melbourne, FL

March 12
Prof. Vadeem Guliant
University of Cincinnati, Dept. of Chemical Engineering
“Pressure Swing Adsorption”

March 19
Spring Break. No meeting.

April 2
Mr. Daymond Talley, Assistant Director
NREPC/Administrative Services
“A Career in Environmental Protection at the NREPC”

April 9
Prof. Sandro de Rocha
Wayne State University, Dept. of Chemical Engineering
“Surfaces and Interfaces”
Meeting is followed by Nomination of AIChE Officers

April 16
Mr. Aaron Landrum (UK Mechanical Engineering Alum)
Project/Process Engineer
Parker Seals
“An Engineering Degree to a Management Career”
Meeting is followed by Election of AIChE Officers

April 23
AIChE Picnic
Dr. Grulke’s House
5:00 pm

April 30
Junior/Senior Survey
Dr. Donn Hancher, Interim Chair
UK Department of Chemical and Materials Engineering
University of Kentucky
Department of Chemical and Materials Engineering

CME 200 Process Principles
Fall 2001
MWF 2:00 – 2:50 p.m. AH 265
M 4:00 – 4:50 p.m. AH 257

Instructor:  Dr. Barbara Knutson
163A Anderson Hall
257-5715
bknutson@engr.uky.edu

Office Hours:  8:30 – 10:00 a.m. MWF or by appointment

T.A.    Wei Zhang
wzhang75@yahoo.com

Textbook:  R. M. Felder and R. W. Rousseau, Elementary Principles of Chemical Processes,

Grading:  Homework 20%
Group and Recitation Projects 10%
Quizzes 10%
Hour Exams (3) 35%
Final Exam 25%

Exam Dates:  Five 15-minute quizzes are scheduled for the following dates:  Sept. 1, Sept. 14,
Oct. 12, Nov. 2, and Nov. 30.

Hour exams are scheduled for Sept. 28, Oct. 19, and Nov. 19.

A cumulative final exam is scheduled for Friday, December 14 at 8:00 am.
CME 200 Process Principles

Fall 2001

Catalog Data: CME 200 Process Principles (3)
A course in material and energy balances, units, conversions, tie elements, recycle, bypass, equations of state, heat effects, phase transitions, and the first and second law of thermodynamics applications in separation processes involving equilibrium reactions and energy exchange.

Pre-req: CHE 115, CS 221, "C" grade or better in MA 113, "C" average or better in CHE 105 and 107; pre-req or concur: MA 114, PHY 231.

Outcomes: The student should be able:
1. To identify the dimensions associated with engineering units and convert to desired units;
2. To conduct an order of magnitude analysis;
3. To construct a simple flow sheet from a word description of the problem;
4. To formulate material balances and calculate unspecified variables for steady-state multiple-unit processes in the following modes of operation: single pass, recycle, bypass, and purge;
5. To incorporate chemical reactions in material balances;
6. To apply the concepts of conversion, yield, selectivity, theoretical, and excess components to develop equations for material balances;
7. To calculate pressure-volume-temperature properties for pure components;
8. To solve single and multiphase material balance problems;
9. To formulate energy balances for open and closed systems;
10. To apply energy balances to reactive processes;
11. To solve combined material and energy balances by hand calculations;
12. To solve combined material and energy balances using a spreadsheet and a simulation package (ASPEN PLUS).

Course Relevance: The conservation of mass and energy are concepts that are fundamental to all further engineering courses. This course develops a methodology for converting mass and energy balance problems into mathematical equations and systematically solving these equations. Students are also taught to recognize system constraints due to thermodynamic and reaction equilibrium which result in additional equations relevant to mass and energy balances. The course is intended to provide the student with the skills to solve significant chemical and materials engineering problems.
CME 200 Class Policies

Grading Procedure
If your composite class score is in the following ranges, you will receive at least the corresponding grade.

<table>
<thead>
<tr>
<th>Score</th>
<th>Letter Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater than 90</td>
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<td>60-70</td>
<td>D</td>
</tr>
<tr>
<td>Below 60</td>
<td>E</td>
</tr>
</tbody>
</table>

Homework
Homework will be due at the beginning of the class. Late homework is not accepted for credit. Homework is considered late if it is submitted more than ten minutes after the beginning of the class period. The lowest homework grade for each student will be dropped when determining the final grade.

Group discussion of homework problems is not discouraged. However, submitted homework problems should reflect the thought process of the individual. In an attempt to minimize the "copying" of homework as opposed to meaningful group discussions that enhance learning, you are required to document which classmates were involved in your group discussion. Failure to do so will result in partial credit on your homework assignment.

Some problems will be specifically designed for groups. These groups will be assigned when the problem is handed out. Do not fold homework solutions. Staple the pages together.

Course-Related Reading Assignments
Reading assignments should be completed prior to class.

Quizzes
Five short quizzes (approximately 15 minutes in length) will be given at the end of each class period on the dates provided in the syllabus. These quizzes will cover topics from the lectures, homework assignments, and reading assignments.

Make-Up Exams
Make-up exams will be given only for reasons of absence given in the "Students Rights and Responsibilities Handbook." The instructor must be notified prior to the scheduled time of the exam.
University of Kentucky
Department of Chemical and Materials Engineering

CME 415 Separation Processes
Fall 2004
TR 12:30 – 1:45 p.m. FPAT (AH) 255

Instructor:  Dr. Barbara Knutson
175 Anderson Hall
257-5715
bknutson@engr.uky.edu

Office Hours:  8:30 – 9:30 am TR or by appointment

T.A.:  Vivian Ojogun  e-mail: vojogun@hotmail.com
Office hour (in AH 160) T 10:00 – 11:00 am or by appointment


Grading:  Homework  20%
Group Projects  10%
Quizzes  10%
Hour Exams (2)  35%
Final Exam  25%

Exam Dates:  Five 10-minute quizzes are scheduled for the following dates: September 9,
September 23, October 7, October 28, December 2.

Exams are scheduled for October 14 and November 18.

A cumulative final exam is scheduled for Tuesday, December 14 at 1 pm.
CME 415 Separation Processes  
*Fall 2004*

Catalog Data: CME 415 Process Control (3 credit hours)

*Separations based on both equilibrium stage concepts and mass transfer rate control are addressed for a range of chemical process operations, including distillation, gas absorption, extraction, adsorption, and membrane-based processes. Design problems are conceived to require computer-aided modeling and analysis.*

Outcomes: At the completion of this course, the student should be able:

1. Identify, analyze, and solve equilibrium and rate-based separation problems including flash, binary, and multicomponent distillation, extraction/leaching, membrane and adsorption processes.
2. Apply knowledge of separation processes to the design of equilibrium-based separations, including distillation and absorption.
3. Identify and compare multiple separation strategies on the basis of mixture properties.
4. Use knowledge of calculus, physics, material and energy balances, and thermodynamics to solve separation problems.
5. Use modern computational tools, such as ASPEN and Excel, to analyze and design separation processes.
6. Locate and utilize resources (reference books, journal articles, and internet sources) to analyze and design separation processes.
7. Function effectively in teams during classroom exercises and over the course of a team design project.

Course Relevance: Approximately 50 to 90% of the capital cost of a chemical plant and 70% of the ultimate product cost is associated with the purification of the feed streams and the product. Separations are fundamental to both traditional and nontraditional engineering applications. Chemical engineers must be able to separation principles to the design and analysis of a broad range of processes.

**Topics**  
| Thermodynamics of mixtures | Chapter 2 |
| Degree of freedom analysis and cascades | Chapters 4, 5 |
| Adsorption and stripping | Chapters 5, 6 |
| Binary distillation | Chapter 7 |
| Multicomponent and advanced distillation | Chapter 9, 11 |
| Liquid-liquid extraction and leaching | Chapters 4, 5 |
| Batch distillation | Chapter 13 |
| Crystallization | Chapter 5 |
| Adsorption, Ion Exchange and chromatography | Chapter 15 |
| Membrane separations | Chapter 14 |
Instructor: Dr. Barbara Knutson  
175 Anderson Hall  
257-5715  
bknutson@engr.uky.edu

Office Hours: 11:00 – 12:00 MWF or by appointment

Teaching Assistant: Michael Danquah


Grading:  
Homework 20%  
Group Projects/Labs 10%  
Quizzes 10%  
Hour Exams (2) 35%  
Final Exam 25%

Exam Dates: Five quizzes are scheduled for the following dates: January 25, February 8, February 22, March 22, and April 5.

Hour exams are scheduled for March 1 and April 12.

A cumulative final exam is scheduled for Friday, May 5 at 8:00 a.m.
CME 462 Process Control
Spring 2006

Catalog Data: CME 462 Process Control (3 credit hours)

Basic theory of automatic control devices and their application in industrial chemical plants is emphasized. Identification of control objectives, appropriate measurements and manipulations, and possible loops between these, requires integration of the control system with the original process design. Interactions between the process units are analyzed using well-known analytical tools and design strategies.

Outcomes: The student should be able:

11. Apply knowledge of mathematics and science to process dynamics and control;
12. Analyze and interpret different control systems' transient and frequency response data;
13. Identify, formulate and solve linear control problems;
14. Design and compare control systems with emphasis on the control of distillation columns and chemical reactors;
15. Use engineering tools such as computer software for control systems;
16. Function in teams for the completion of projects relating to control analysis and design.

Course Relevance: An effective chemical process control system maintains a desired physical condition of a system in response to a disturbance or responds to changes in the desired value to promote the safety, environmental protection, production rate, product quality, and profitability of an industrial chemical plant.

**Topics**

<table>
<thead>
<tr>
<th>Introduction and Control Strategies</th>
<th>Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control System Modeling and Analysis</td>
<td>Chapt. 1</td>
</tr>
<tr>
<td>Laplace Transforms</td>
<td>Chapt. 2</td>
</tr>
<tr>
<td>Transfer Functions</td>
<td>Chapt. 3</td>
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<tr>
<td>Dynamic Systems</td>
<td>Chapt. 4</td>
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<tr>
<td>Fitting Models to Data</td>
<td>Chapt. 5, 6</td>
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<td>PID Controllers and Instrumentation</td>
<td>Chapt. 7</td>
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<tr>
<td>Closed Loop Transfer Functions</td>
<td>Chapt. 8, 9</td>
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<tr>
<td>Stability</td>
<td>Chapt. 10</td>
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<tr>
<td>Control Loop Analysis and Tuning</td>
<td>Chapt. 11</td>
</tr>
<tr>
<td>Frequency Response Analysis and Control System Design</td>
<td>Chapt. 12, 13</td>
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<tr>
<td>Advanced Control Strategies</td>
<td>Chapt. 14</td>
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</tbody>
</table>

**Reading**

<table>
<thead>
<tr>
<th>Topics</th>
<th>Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chapt. 15, 16, 17, 18</td>
</tr>
</tbody>
</table>
CME 462 Class Policies

Grading Procedure
If your composite class score is in the following ranges, you will receive at least the corresponding grade.

<table>
<thead>
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<td>D</td>
</tr>
<tr>
<td>Below 60</td>
<td>E</td>
</tr>
</tbody>
</table>

Homework
Homework will be assigned on an approximately weekly basis. Homework will be due at the beginning of the class. Late homework is not accepted for credit. Homework is considered late if it is submitted more than ten minutes after the beginning of the class period. The lowest homework grade for each student will be dropped when determining the final grade.

Group discussion of homework problems is not discouraged. However, submitted homework problems should reflect the thought process of the individual. In an attempt to minimize the "copying" of homework as opposed to meaningful group discussions that enhance learning, you are required to document which classmates were involved in your group discussion. Failure to do so will result in partial credit on your homework assignment. Some problems will be specifically designed for groups. These groups will be assigned when the problem is handed out.

Course-Related Reading Assignments
Reading assignments should be completed prior to class.

Quizzes
Five in-class or take-home quizzes will be given on the dates provided in the syllabus. These quizzes will cover topics from the lectures, homework assignments, laboratory experiments, and reading assignments.

Make-Up Exams
Make-up exams will be given only for reasons of absence given in the "Students Rights and Responsibilities Handbook." The instructor must be notified prior to the scheduled time of the exam.
CME 780 Colloids and Interfaces  
Department of Chemical and Materials Engineering  
University of Kentucky  
Fall 2000

Instructor: Dr. Barbara Knutson  
157 Anderson Hall  
257-5715  
bknutson@engr.uky.edu  
Office Hours: Open door policy.

Lectures: MWF 11:00 – 11:50  
Oliver H. Raymond Building 226

Text: D. Fennell Evans and Hakan Wennerstrom  
*The Colloidal Domain: Where Physics, Chemistry, and Biology Meet*  

Supplementary reading material will be provided.

Grading: 
- Homework and Article Critiques 20 %  
- Term Project and Project Updates 25 %  
- Mid-term Exam 20 %  
- Final Exam 35 %

Exams: A mid-term exam is tentatively scheduled for Friday, October 13.  
A cumulative final exam will be given on Wednesday, December 13 at 10:30 a.m.

Make-up exams will be given only under extreme cases and must be scheduled with the instructor prior to the original scheduled exam.

Homework: Homework is due at the beginning of class on the specified dates. No late papers will be accepted.

Course Description: CME 780 COLLOIDS AND INTERFACES (3 credit hours)  
A description of the properties of colloidal systems and interfaces will be developed based on their microscopic and macroscopic interaction forces. This knowledge will then be related to a variety of physical systems including micelles, microemulsions, bilayers, suspensions, and polymers. Applications of colloidal and interfacial properties to chemistry, biology, and engineering will be explored.
The course will initially focus on providing a cohesive picture of the forces and interactions that describe colloidal and interfacial phenomena. The following timetable is proposed for covering this material:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Text-Related Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>August 23-25</td>
<td>Introduction to Colloids and Interfaces</td>
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<td>August 28- Sept. 1</td>
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<td>Chapter 1.5 – 1.7</td>
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<td>Brownian Motion in Colloidal Systems</td>
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<td>September 11 – 15</td>
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<td>Langmuir – Blodgett Films</td>
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<td>September 25 – 29</td>
<td>Electrostatics of Condensed Phases</td>
<td>Chapter 3.5 – 3.9</td>
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<td>Interactions of Charged Interfaces</td>
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<td>October 2 – October 6</td>
<td>Electrostatic Double Layers</td>
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<td>van der Waals Forces and Hamaker Constants</td>
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<td>October 8 – October 13</td>
<td>Colloidal Stability</td>
<td>Chapter 8.1 – 8.2</td>
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Specific reading assignments and supplementary material will be given in class.

After developing a fundamental basis for describing colloidal and interfacial forces, we will then explore the versatility of this fundamental knowledge and apply it to a variety of chemical, biological, and engineering phenomena. These include micelles, macromolecular solutions, and biological membranes. Applications will be explored through class lectures, group discussions and critiques of articles, and individual student-selected projects.
APPENDIX B

SUPPLEMENTAL TEACHING MATERIALS

(i) CME 006 Outstanding Student Chapter Nomination Letter (2002-2003)


(iii) CME 462 Process Control Group Presentation, "Implementation of a Control Strategy on a PI Level Controller." (Spring 2006)

(iv) “Who Wants to be a Process Control Engineer?” – A mechanism for rapid student feedback on their understanding of course concepts. (Spring 2006)
Appendix B (i) CME 006 Outstanding Student Chapter Nomination Letter (2002-2003)

June 30, 2003

Mr. Marvin E. Borgmeyer
Chairman, Awards Committee
ExxonMobil Chemical Company
P.O. Box 1607
Baton Rouge, LA 70821-1607

Dear Mr. Borgmeyer:

I am pleased to nominate the University of Kentucky’s AIChE Student Chapter for the AIChE Student Chapter Award of Excellence following an active year for our 2002-2003 chapter. The voluntary membership included freshmen [4 chapter members (10% of the freshmen class)], sophomores [6 chapter members (20%) and 5 national members (17%)], juniors [27 chapter members (84%) and 21 national members (66%)], and seniors [24 chapter members (92%) and 15 national members (58%)]. This year’s chapter members and officers have continued to build on the University of Kentucky’s long tradition of an outstanding student chapter by promoting leadership and camaraderie among the chemical engineering students and through ongoing service to their community and profession. Emphasis was placed on events and programming that explored professional and technical issues of chemical engineering, enhanced the quality of chemical engineering student life on campus, and increased the public awareness of the chemical engineering profession. Broad student participation was achieved in these balanced programming events, which included meetings, plant trips, service and outreach activities, social activities, and participation in student conferences (See attached programming documents for AIChE Events in Fall 2002 and Spring 2003). An additional highlight of our year has been interaction with our local professional section in Louisville, which has recently become active.

The diverse range of topics addressed in our meetings included professional development, technical issues and state-of-the-art research, and social issues relating to engineering decision making. Our 20 meetings (in addition to officer's meetings) attracted an average of 31 students per meeting. Thirteen of these meetings had industrial speakers (such as Dow and Procter & Gamble) or guest speakers. Professional development topics and industrial speakers (8 meetings, including “Team Training,” “Preparing to Interview,” “Marketing Yourself to Potential Employers,” “An Engineering Degree to a Management Career,” and "Deciding if Engineering Graduate School is Right for You") attracted the largest number of students. The College of Engineering Career Services Center worked closely with AIChE to provide relevant and timely programming on career development and job search techniques to the graduating seniors and potential co-op students. One career development meeting included a hands-on tour of the University of Kentucky’s career services center. The four meetings related to technical issues were led by faculty from outside our department and included topics such as “Pressure Swing Adsorption” “Surfaces and Interfaces,” and “Microemulsions in Drug Delivery.” Visiting faculty members also discussed the following society and policy issues (2 meetings): “Industrial
Ecology” and “Engineering Code of Ethics.” Some of the general information and planning meetings had a distinctly social agenda (2 meetings), where food was provided. Weekly e-mail updates proved to be a very effective means of providing information on meetings and upcoming events.

Additional professional activities included 3 plant trips (Toyota, Kentucky Utilities, and Maker's Mark Bourbon Distillery). The plant trip to Kentucky Utilities, which was conducted in cooperation with an energy and fuel science course, attracted over 20 AIChE members.

Students also made two trips to Louisville to attend the local professional section of AIChE. The local section, which became active again over the past year, met approximately six times. Six students and I attended one of their first dinner meetings in November 2003. The students were very impressed with the willingness of the professional members to aid the seniors in their job search. This professional interaction was well worth the drive. We returned in February to the Louisville professional AIChE meeting with 20 UK student chapter members, predominantly seniors. The students received another warm welcome and enjoyed a very relevant seminar and discussion on Six Sigma. This new interaction with the local professional section was one of the highlights of the 2002-2003 chapter. We are looking forward to creating opportunities to involve more underclassmen in this interaction in the upcoming year.

Community service and outreach activities are viewed as an integral part of representing the chemical engineering profession on campus and in the community. The chapter continued to focus on fewer service activities that attracted broad student participation. The 2nd Annual Canned Good Contest, a contest between the chemical engineering classes to collect non-perishable food for a local food bank, was a particularly successful service project. This event, which became fairly competitive, proved to be a great way to instill class spirit and get the underclassmen, parents, and faculty involved. The department hosted a pizza party for the winning junior class. The event collected 500 lbs. of non-perishable food for God's Pantry and resulted in a near tie between the juniors and seniors, whose individual classes collected almost 200 lbs of food. A clothing drive for a local shelter was initiated by this year’s AIChE student officers and widely supported by the chemical engineering students and faculty. Broad-based student participation was also achieved in other service activities, including fundraising events for the United Way (through events sponsored at the College of Engineering picnic), and the purchase of Christmas gifts for needy children through the Circle of Love. In partnership with the Society of Women Engineers, AIChE members also tutored at a local elementary school.

Two major outreach projects were undertaken by the 2002-2003 student chapter of AIChE. Throughout the year, AIChE students participated in a tutoring program through the College of Engineering. AIChE student members provided over 200 hours of tutoring to the underclassman in the areas of calculus, chemistry and physics. Dr. Bruce Walcott, Associate Dean of Engineering and founder of the tutoring program, has continued to recognize AIChE’s contribution to the success of this tutoring program. AIChE’s involvement with the College of Engineering tutoring program was seen as a significant opportunity to improve retention within the college while acquainting underclassmen with AIChE. The most significant community outreach activity in the College of Engineering is Engineering Week and Engineering Open House, which typically attracts two thousand people from around the state. In addition to
leading tours of the chemical engineering facilities, the chapter sponsored the 6th Annual Volcano Contest for K-12 students. The 20 AIChe chapter members and 7 Chemical Engineering faculty worked hard to make this event a success. AIChe also participates in the Welcome Week events for the incoming engineering freshmen. Through these activities, our student chapter raised awareness of the role of chemical engineers in the workplace and in society.

As in past years, our members were enthusiastic participants in the AIChe Annual Meeting (Indianapolis, 2002). The 25 student chapter members attending the Annual Meeting participated in a variety of professional development activities. Undergraduate research results were presented by 4 student chapter members. Two undergraduates, Noah Scherrer and Emma Paez, received 1st and 2nd place awards, respectively, in their divisions of the Student Poster Paper Competition. A recent tradition at the Annual Student Conference meeting is a dinner hosted by the department in honor of the student chapter. This year's dinner was attended by 25 UK student chapter members, 6 UK-Paducah program student chapter members, 7 UK Chemical Engineering faculty, and 9 recent graduates and guests. This level of participation is an example of the high value that the University of Kentucky and the Department of Chemical and Materials Engineering faculty place on this student organization. The students were also very involved in the Southern Regional Conference held at the Florida Institute of Technology in April, 2003. Our attendance was 16 student members and 2 faculty. Two of these students (the maximum allowable presenters from a school) presented their research results and one presenter received a 3rd place award. In addition to the traditional paper competition, FIT hosted an undergraduate poster competition at the Southern Regional Conference. Two of our students participated in the poster contest, and one received 1st prize.

Our level of participation at conferences and on campus requires significant fundraising. This year’s officers diligently pursued funding opportunities within the University, through alumni, and through industry. In addition to the membership dues ($5), we obtained significant financial support from the Chemical Engineering Department. AIChe is also a student organization affiliated with the College of Engineering Student Council, thereby participating in the yearly phone-a-thon and receiving money from the College of Engineering. This year's officers continued to solicit money from the AIChe alumni (see attached sample letter) and expanded our database of alumni and industrial contacts.

The teamwork required to make this past year so successful was possible because of the cohesiveness of the chemical engineering student body, particularly the seniors. AIChe participated in intramural flag football (Fall 2002) and an intramural soccer (Fall 2002). The organization also had group tickets to the football games and the students obtained basketball seating through the lottery together. Although faculty participated in a variety of meetings (with an average of 2 of 12 faculty in attendance), the strongest faculty participation was at social or professional events outside the regular meeting times. AIChe held both a Fall and Spring picnic at a faculty members house, with an average attendance of 27 students and 5 faculty. The most attended social event for the 2002-2003 AIChe student chapter was a Holiday party, which was held on campus. Thirty-four students and eight faculty participated in the festivities, which included food and a gag-gift exchange. We hope to continue this highly successful event in the future.
This year's student chapter members of AIChE have truly been ambassadors of the Chemical Engineering profession within our department, university, and community. This outstanding team of officers and committee chairs has worked together seamlessly, and through their hard work and innovation set a very high standard of leadership for the future. The 2002-2003 student chapter has contributed new and creative programming to address the challenges that face our AIChE chapter (such as fundraising, freshman and sophomore participation, and student recruitment and retention), while building on the strengths of this student chapter (Fifteen Consecutive AIChE Student Chapter Awards of Excellence). This year's AIChE student chapter activities in meetings, student conferences, community service and outreach, and social events truly “bridge the gap between the classroom and the workplace.” I hope that the selection committee will commend the hard work of this group of officers and members and consider our chapter for the Award of Excellence.

Sincerely,

Barbara Knutson
Associate Professor
AIChE Student Chapter Advisor
Appendix B (ii) *Separation Processes* Group Design Project

CME 415  
Fall 2004  
Dr. Knutson

Group Design Project: "Downstream Processing of Acetone Butanol Ethanol (ABE) Fermentation and Recovery by Gas Stripping"

**Important Dates**
- Team Plan and Literature Survey: November 23 in class
- Final Written Report Date: December 8 at 4:00 p.m.
- Group Presentations: Prepare a 10 minute in-class presentation for December 9

**Description of Project and Final Report**

The fermentation of carbohydrates to the products acetone, butanol, and ethanol by solvent-forming bacteria has the potential to reduce the dependence on fossil fuels. This fermentation was utilized on an industrial scale to produce acetone and butanol until the 1950’s, when solvents derived from the petrochemical industry became more economically favorable.\(^1\)\(^2\) Recent advances in the fermentation process, as well as rising petroleum prices, suggest that acetone/butanol/ethanol fermentation may again be feasible on an industrial scale. The recovery of these products from dilute aqueous fermentation stream constitutes a major portion of the cost associated with solvent production. Advances in recovery technologies, particularly in-situ technologies, have also contributed to the renewed interest in ABE fermentation. Gas stripping, in particular, has been suggested as an important initial unit operation in this solvent recovery.

The purpose of your design project is to evaluate the cost associated with recovering acetone/butanol/ethanol for two different fermentation cases. Case I (5 g/liter acetone, 12 g/liter butanol and 1 g/liter ethanol)\(^3\) is representative of the product concentrations previously achieved in industrial fermentations,\(^2\) which were generally limited to approximately 20 g/liter of total product due to product inhibition and toxicity.\(^4\) Case II (19 g/liter acetone, 46 g/liter butanol and 4 g/liter ethanol) with product concentrations that appear achievable using clostridial bacteria.\(^3\) For simplification, the same relative proportions of the products are used in both cases. Your calculations should be based on producing 1000 tons/year of a butanol stream at a purity of 99.5 wt%. Ethanol and acetone should be recovered at 99 wt% and 98 wt% purity.

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respectively. Note that the mixture recovered from the gas stripper will contain water, ethanol, butanol, and acetone. Thus, additional separation steps will be required. Water-ethanol and water-butanol systems are both azeotropic systems. The selection and sequencing of your unit operations should be based on heuristics presented in class.

Your cost analysis and optimization should be based on the payout period. A handout describing the payout period assumptions will be provided. On the basis of substrate costs, assume that the fermentation and substrate costs make up 60% of the total cost. The capital investment and manufacturing costs should also be estimated. Your calculations should be based on both graphical methods (when appropriate) and a simulation package results.

**Evaluation of Design Project**

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<td>Literature Survey</td>
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<td>Group Journal</td>
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<td>Final Report</td>
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<td>1. Style and Format</td>
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</tr>
<tr>
<td>2. Technical Content</td>
<td>150</td>
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</table>

**Team Plan and Teamwork**

Everyone on the team should participate and contribute to the all aspects of the project including the literature survey, the design, and the report writing. In addition, the team should select a leader who is responsible for organizing meeting times and attempting to resolve personal issues.

A team plan is due on Nov 23. This plan should be 1-2 pages in length and address how you will work on the project, the role of each member, and how often you will meet. Also address conflict resolution and your team’s criteria for success.

**Literature Survey**

*Two copies* of a literature survey will be due on November 23. This literature survey will form the basis of the background of the Introduction of your design report (described below). The following points should be addressed in your literature survey: issues that limit ABE fermentation for the production of commodity solvents/fuels, recent advances that suggest that solvent production by bacteria may become an economically viable alternative to petrochemical solvent production, general techniques for the downstream processing and recovery of ABE products, and the advantages and disadvantages of gas stripping for solvent recovery.

Identify the literature that you have found relative to this project and the sources that you employed (SciFinder Scholar, ScienceDirect, etc.). If you find a reference from the 70’s or 80’s, the Web of Science can be used to do a forward search to more recent articles that cite that reference. Do not rely solely on web-based citations. Web sources are not peer reviewed and may not be reliable. Web citations are generally not acceptable in technical reports unless they
contain facts (costs, for example) which are not subject to further interpretation or government documents.

Group Journal
Keep a log of your group activities over the entire course of the project. This log should contain a description of the activity, the names of the group members involved, the time spent on this activity, and a summary of the result. Please have all group members sign each log entry, verifying the correctness of the entry. The purpose of this log is two-fold. I should be able to tell how the work was divided and how the group members were contributing based on these log entries. In addition, keep in mind that in industry there is a cost associated with your time.

The group journal is the only portion of the grade that is individual. This grade will reflect the contribution of the individual to the group project. Lack of participation, short of removing a group member, will be addressed in this way.
Lab Assignment for Group Project:
Tuning a PI Level Controller

- Use the level system: \( CV = \) height of fluid
- Obtain PI parameters using Ziegler Nichols ¼ decay ratio and continuous cycling.
- Obtain the response of the process to a change in controller output. Use this information to tune a PI level controller for tight level control and linear averaging level control.
- Using SIMULINK, compare the ability of the three resulting control parameters to reject two magnitudes of disturbance: the tight level control disturbance and the linear averaging level control disturbance. Your process response will serve as the basis for your transfer function in Simulink.

Statement of Problem

Notes on Level Control

- A typical process reaction curve used to tune a controller (changing %CO, observing \( y_m \) as a function of time) comes to a new steady state. An integrator process does not.
- Two common approaches to tuning PI level control: tight level control (focus on the performance of the level) and linear averaging level control (variations in manipulated variables) (See Marlin Notes).
- Additional tuning variables: Characteristics of the desired response (\( ? \)), the magnitude of the disturbance (\( ?F_{\text{max}} \)), and the maximum acceptable range of height deviation (\( ?H_{\text{max}} \) or \( ?L_{\text{max}} \)).
- Find “A” from your response curve, where \( G_p = G_d = 1/As \). Usually a proportionality constant has to be introduced to account for \( K_m \) and \( K_v \) in a real process. However, your response curve includes these gains. (See Riggs Notes).
- Tune for tight level control (maximum allowable height change of ± 2.5% of the height range) and linear average level control (maximum allowable height change of ± 40% of the height range) for a maximum disturbance of 10% of normal value. Let \( ?=1 \).
Group Project Deliverables: Tuning a PI Level Controller

- PowerPoint Slides (limited to 6 slides). You must include the following:
  - One block diagram slide (include all known units and variables). Use block diagram to explain the difference in the tuning approaches.
  - Comments on tuning results and the effect of the tuning approaches on disturbance rejection
- Add one paragraph of notes to each slide that provide the approximate text for that slide.

Content of Presentations

- Your boss/supervisor is presenting your lab results to a technical team from your company. The team is predominantly engineers. However, it has been several years since the audience has taken Process Control.
  - Ability to tailor talk to audience
  - Quality of visual aids
  - Organization
  - Technical content

What are the project deliverables?

Who is my audience?
Who is Presenting?

- A volunteer from another group will be making your presentation. Organize your presentation so your boss can step in and make it work!
- Prior to presentation day, presenters will be randomly selected from the class volunteers.
- Your presenter will be assigned at the beginning of class. You have 15 minutes to train them on the technical aspects of your work and how you envision them giving the presentation.

- 10-minute presentations on Wednesday, April 26
  - 10 bonus points for volunteering
  - 20 bonus points for being randomly selected to present

The twist… Your “boss” is presenting your work.

One of the most effective aspects of this project was having the students “teach” someone else (their “boss”) how to give their group’s presentation. It pushed them to think about how each step of their analysis was conducted and analyzed. Groups had approached the problems slightly differently, so they also had the opportunity to convince their “boss” of the correctness of their approach.

This was a fun assignment and there was no shortage of volunteer presenters.
APP B (iv). “Who Wants to be a Process Control Engineer?” – A mechanism for rapid student feedback on their understanding of course concepts.

Multiple choice questions relating to the lecture are prepared and embedded within the lecture (approximately 5 questions per lecture). Students are provided with a copy of the lecture (in PowerPoint) prior to class, but not with the questions. When we reach a prepared question in the lecture, a student is selected by random number to address the question. A sample question is shown below.

As in the original “Who Wants to be a Millionaire?”, the selected student has the option of a) answering the question directly; b) calling a “lifeline” (asking a classmate to help); c) polling the audience; or d) having one of the multiple choice answers eliminated.

This technique has been very effective in my classroom because students want to understand the material as it is being presented, anticipating a game question. The game questions themselves also generate further discussions and questions. Finally, the format of the game is not intimidating. Even the most reserved students feel comfortable playing because they have the input of their classmates.

Who Wants to Be a Process Control Engineer?
Which is the correct transfer function relating $Y(s)$ to a change in $Y_{sp}(s)$ for the previous example?

\[
\begin{align*}
\text{a)} \quad \frac{Y(s)}{Y_{sp}(s)} &= \frac{G_1 G_2 G_H}{1 + G_1 G_2 G_H} \\
\text{b)} \quad \frac{Y(s)}{Y_{sp}(s)} &= \frac{G_1 G_2}{1 + G_1 G_2 G_H} \\
\text{c)} \quad \frac{Y(s)}{Y_{sp}(s)} &= \frac{G_1 G_2 G_H}{1 + G_1 G_2 G_H} \\
\text{d)} \quad \frac{Y(s)}{Y_{sp}(s)} &= \frac{K G_1 G_2 G_3}{1 + G_1 G_2 G_3 G_4} \\
\end{align*}
\]

Answer - c
APPENDIX C

TEACHING EVALUATIONS

(i) Sample of ABET-based evaluations of CME 462 Process Control (Spring 2006)

(ii) All other University-based evaluations
APPENDIX C (i)  Example of BLK Evaluation of the Ability of Students to Achieve Course Outcomes. As part of this process, the instructor also suggests approaches to improve the effectiveness of the course at achieving these outcomes. Students also evaluate their ability to achieve these outcomes, which are presented in the course syllabus. The students’ evaluation of their ability to achieve these tasks (on a scale of 5.0) are also provided.

Instructor – Dr. B. Knutson
CME 462 – Process Control
Spring 2005

At the conclusion of this course, students will be able to:

37) Apply knowledge of mathematics and science to process dynamics and control

Method of Assessment: The overall homework grade (homework grade > 75%) was used to assess this outcome because the knowledge of mathematics and science required to complete these problems was more advanced than in the shorter problems associated with quizzes and exams.

% of students meeting outcome: 95%  
Student Evaluation of (37):  4.2/5.0

38) Analyze and interpret different control systems' transient and frequency response data

Method of Assessment: Score on Final Exam Problem 3 (frequency response) and Final Exam Problem 4 (transient response) >70%

% of students meeting outcome: 60%  
Student Evaluation of (38):  4.1/5.0

39) Identify, formulate and solve linear control problems

Method of Assessment: Score on Exam 1 (Problems 1 and 2) and Final Exam Problem 2 and Final Exam Problem 4 (transient response) >70%

% of students meeting outcome: 65%  
Student Evaluation of (39):  4.1/5.0

40) Design and compare control systems with emphasis on the control of distillation columns and chemical reactors

Method of Assessment: Score on Exam 2 Problem 2 (exothermic chemical reactor) > 70%.
% of students meeting outcome: 75%  \hspace{1cm} \text{Student Evaluation of (40): 3.9/5.0}

41) Use engineering tools such as computer software for control systems

\textit{Method of Assessment:} Average score of Quiz 2 (testing MATLAB Simulink skills individually), Quiz 4 (testing MATLAB Simulink skills in teams), and Group Project 1 (tuning controllers using MATLAB Simulink) > 75%

% of students meeting outcome: 100%  \hspace{1cm} \text{Student Evaluation of (41): 4.1/5.0}

42) Function in teams for the completion of projects relating to control analysis and design

\textit{Method of Assessment:} Composite score of group project (tuning a laboratory PI controller using Simulink) and individual memos describing a lab that was conducted in a group >75%

% of students meeting outcome: 100%  \hspace{1cm} \text{Student Evaluation of (42): 4.2/5.0}

\textit{Suggested Improvements in the Course:} A Process Control Laboratory was implemented for the first time in this course. These hands-on experiments are a strong complement to the text and are conducted throughout the semester. Implementing these experiments highlighted the strengths and weaknesses of the individual experiments. The students responded well to the increased use of Simulink in this course. During next year’s course, improved integration of these experiments should be possible. Further opportunities to link Simulink, the laboratory component, and the lecture topics should be explored.
APPENDIX C (ii). Other University-Based Evaluations

The results of the scanned evaluation forms are provided. If the students provided written comments, these comments are also attached.
# UNIVERSITY OF KENTUCKY - Fall 2001 TEACHER AND COURSE EVALUATION RESULTS

**COLLEGE = Engineering**  
**DEPARTMENT = Chemical & Materials Engineering**  
**COURSE = CME 200 002L1**  
**PROCESS PRINCIPLES**  
**INSTRUCTOR EVALUATED = Knutson, Barbara**

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## SECTION B - COURSE ITEMS

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<th>% Agree</th>
<th>% Strongly Agree</th>
<th>Mean</th>
<th>SD</th>
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## SECTION C - INSTRUCTOR ITEMS

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## SECTION D - LEARNING OUTCOMES

<table>
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<th>N</th>
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<th>% Fair</th>
<th>% Good</th>
<th>% Excellent</th>
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## SECTION E - SUMMARY ITEMS

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</table>
Outstanding teacher - really helped me to understand subject matter. Enjoyed class greatly.

Dr. Knutson was an excellent professor. She was very easy to understand and always available outside of class. She presented the material very effectively.

Please get a book that explains more. Homework should be a week behind lecture so that we are already taught by the time we do it. Please give us solutions! How can we learn if we never find out the correct answers! Dr. Knutson is the best professor that I have had a UK!

I think the class was taught really well, it's just really hard stuff to think about (and sometimes it's dry, boring topics to).
### SECTION A - STUDENT INFORMATION

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<tr>
<th>Classification</th>
<th>Number</th>
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<th>Expected grade</th>
<th>Number</th>
<th>Percent</th>
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<th>Number</th>
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### SECTION B - COURSE ITEMS

1. Outlined course material and grading
2. Textbook contributed to understanding
3. Suppl read & assign helped understand
4. Exams reflected what was taught
5. Grading was fair and consistent
6. Assignments were distributed evenly
7. Graded assignments returned promptly
8. Graded assignments included comments

### SECTION C - INSTRUCTOR ITEMS

9. Presented material effectively
10. Had good knowledge of subject matte
11. Was available for consultation
12. Satisfact answered class questions
13. Stimulated interest of the subject
14. Encouraged class participation

### SECTION D - LEARNING OUTCOMES

15. Learned respect different viewpoint
16. Inc my abil to analyze & evaluate
17. Course helped abil to solve problem
18. Gained undrstnd of concepts & prin.
19. Course stimulated me to read furthe

### SECTION E - SUMMARY ITEMS

20. Overall value of the course
21. Overall quality of teaching
SECTION A - STUDENT INFORMATION

<table>
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<th>Number</th>
<th>Percent</th>
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Reason for taking course  Number  Percent  Hrs/week spent  Number  Percent
Required by University  
  Studies Program        1       4.8  1 hour or less  0       0.0
Required by my major    20      95.2  2 hours         5       23.8
Other (e.g. elective)   0       0.0  3 hours         4       19.0

\%

SECTION B - COURSE ITEMS
1. Outlined course material and grading 21 0.0 0.0 47.6 52.4 3.5 0.51
2. Textbook contributed to understanding 21 9.5 19.0 38.1 33.3 3.0 0.97
3. Suppl read & assign helped understan 21 0.0 4.8 47.6 47.6 3.4 0.60
4. Exams reflected what was taught      21 0.0 0.0 47.6 52.4 3.5 0.51
5. Grading was fair and consistent      21 0.0 0.0 38.1 61.9 3.6 0.50
6. Assignments were distributed evenly  21 0.0 0.0 47.6 52.4 3.5 0.51
7. Graded assignments returned promptly 21 0.0 9.5 38.1 52.4 3.4 0.68
8. Graded assignments included comments 21 0.0 4.8 47.6 47.6 3.4 0.60

SECTION C - INSTRUCTOR ITEMS
9. Presented material effectively      21 0.0 0.0 47.6 52.4 3.5 0.51
10. Had good knowledge of subject matte 21 0.0 0.0 38.1 61.9 3.6 0.50
11. Was available for consultation     21 0.0 0.0 33.3 66.7 3.7 0.48
12. Satisfact answered class questions  21 0.0 0.0 42.9 57.1 3.6 0.51
13. Stimulated interest of the subject 21 0.0 9.5 42.9 47.6 3.4 0.67
14. Encouraged class participation     21 0.0 0.0 47.6 52.4 3.5 0.51

SECTION D - LEARNING OUTCOMES
15. Learned respect different viewpoint 16 12.5 6.3 37.5 43.8 3.1 1.02
16. Inc my abil to analyze & evaluate   21 0.0 0.0 52.4 47.6 3.5 0.51
17. Course helped abil to solve problem 21 0.0 0.0 47.6 52.4 3.5 0.51
18. Gained undrstd of concepts & prin.  21 0.0 0.0 52.4 47.6 3.5 0.51
19. Course stimulated me to read furthe 21 4.8 23.8 38.1 33.3 3.0 0.89

SECTION E - SUMMARY ITEMS
20. Overall value of the course 21 0.0 9.5 42.9 47.6 3.4 0.67
21. Overall quality of teaching      21 0.0 4.8 28.6 66.7 3.6 0.59
My best professor ever at UK, too bad I had to wait until my last semester to have her!

Excellent teacher, truly cares about students and their learning experience!!

Dr. Knutson was the best teacher I have had in my 4 years of college. She actually wanted us to learn and succeed on tests.

Dr. Knutson is an excellent professor. She is the best professor I have had in the entire college. I know exactly what she expects from me as a student, therefore I am better able to perform on tests and HW. I greatly appreciate her organization, thank you, thank you, finally a professor I can follow in class.

It takes the TA much too long to grade HW. Drop the final project - it was not beneficial. This is probably the worst textbook I have ever used in college. It does not explain the material at all.
Section A - Student Information

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<th>Percent</th>
<th>Expected Grade</th>
<th>Number</th>
<th>Percent</th>
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Response Scale: SD=Strongly Disagree D=Disagree A=Agree SA=Strongly Agree

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<th>%</th>
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Section B - Course Items

1. Outlined course material and grading | 26 | 11.5 | 42.3 | 23.1 | 39.5 | 0.056 | 3.3 | 3.3 | 0.0 |
2. Textbook contributed to understanding | 26 | 11.5 | 53.8 | 23.1 | 30.8 | 0.098 | 2.9 | 3.0 | -0.1 |
3. Suppl. read & assign helped understan | 26 | 11.5 | 53.8 | 23.1 | 30.8 | 0.098 | 2.9 | 3.2 | -0.3 |
4. Exams reflected what was taught | 26 | 0.0  | 44.0 | 36.0 | 0.83 | 1.036 | 3.1 | 2.6 | -0.1 |
5. Grading was fair and consistent | 26 | 0.0  | 38.5 | 42.3 | 0.76 | 3.2 | 3.2 | 0.0 |
6. Assignments were distributed evenly | 26 | 0.0  | 63.0 | 25.6 | 0.58 | 3.2 | 3.2 | 0.0 |
7. Graded assignments returned promptly | 26 | 0.0  | 57.7 | 34.6 | 0.60 | 3.3 | 3.2 | 0.1 |
8. Graded assignments included comments | 26 | 11.1 | 40.7 | 29.6 | 18.5 | 0.93 | 2.6 | 2.9 | -0.3 |

Section C - Instructor Items

9. Presented material effectively | 26 | 7.7  | 23.1 | 61.5 | 7.7 | 0.74 | 2.7 | 3.1 | -0.4 |
10. Had good knowledge of subject matte | 26 | 7.7  | 26.9 | 42.3 | 23.1 | 0.90 | 2.8 | 3.5 | -0.7 |
11. Was available for consultation | 26 | 0.0  | 30.8 | 61.5 | 0.65 | 3.5 | 3.3 | 0.2 |
12. Satisfact answerd class questions | 27 | 7.4  | 22.2 | 51.9 | 18.5 | 0.83 | 2.8 | 3.3 | -0.5 |
13. Stimulated interest of the subject | 27 | 11.1 | 55.6 | 25.9 | 7.4 | 0.78 | 2.3 | 3.0 | -0.7 |
14. Encouraged class participation | 26 | 0.0  | 15.4 | 61.5 | 23.1 | 0.63 | 3.1 | 3.1 | 0.0 |

Section D - Learning Outcomes

15. Learned respect different viewpoint | 17 | 5.9  | 11.8 | 76.5 | 5.9 | 0.64 | 2.8 | 3.0 | -0.2 |
16. Inc my abil to analyze & evaluate | 27 | 7.4  | 74.1 | 11.1 | 0.70 | 2.9 | 3.2 | -0.3 |
17. Course helped abil to solve problem | 27 | 7.4  | 14.8 | 70.4 | 7.4 | 0.70 | 2.8 | 3.2 | -0.4 |
18. Gained undrstood of concepts & prin. | 27 | 3.7  | 11.1 | 74.1 | 11.1 | 0.62 | 2.9 | 3.2 | -0.3 |
19. Course stimulated me to read furthe | 26 | 26.9 | 38.5 | 26.9 | 7.7 | 0.92 | 2.2 | 2.9 | -0.7 |

Response Scale: P=Poor F=FAIR G=GOOD E=EXCELLENT

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Section E - Summary Items

20. Overall value of the course | 27 | 11.1 | 29.6 | 48.1 | 11.1 | 0.84 | 2.6 | 3.1 | -0.5 |
21. Overall quality of teaching | 27 | 7.4  | 29.6 | 51.9 | 11.1 | 0.78 | 2.7 | 3.2 | -0.5 |
CME 462
Process Control
Barbara Knutson
Spring Semester 2004

- Dr. Knutson, you seem to teach in a bubble. It seems like your lectures are scripted, rather than a conversation between you and the students. It would be helpful if you a little more forceful in the class. It's OK to be demanding.

- Lectures were good for showing steps to solve problems, however, there was rarely a good correlation between what's on the board and real-life process controls. I don't feel like I learned anything I'll ever use.

- Dr. Knutson is the worst professor I have had at this University. Her knowledge of the subject is not evident. She totally relies on notes and an answer key. A question in class was never satisfactorily answered. The design project was a joke as was all the homework, copying was rampant and obvious but no action was ever taken.

- The class was extremely useless. Need somebody to teach this class that knows about controllers.

- Homeworks didn't have any comments from the grader on where errors were made.
SECTION A - STUDENT INFORMATION

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RESPONSE SCALE: SD=STRONGLY DISAGREE D=DISAGREE A=AGREE SA=STRONGLY AGREE

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SECTION B - COURSE ITEMS

1. Outlined course material and grading 20 0.0 0.0 50.0 50.0 0.51 3.5 3.3 0.2
2. Textbook contributed to understanding 19 10.5 21.1 57.9 10.5 0.82 2.7 3.0 -0.3
3. Suppl read & assign helped understand 20 0.0 5.0 65.0 30.0 0.55 3.3 3.2 0.1
4. Exams reflected what was taught 20 0.0 5.0 35.0 60.0 0.60 3.6 3.2 0.4
5. Grading was fair and consistent 20 0.0 15.0 45.0 40.0 0.72 3.3 3.2 0.1
6. Assignments were distributed evenly 20 10.0 10.0 55.0 25.0 0.89 3.0 3.2 -0.2
7. Graded assignments returned promptly 20 0.0 35.0 55.0 10.0 0.64 2.8 3.1 -0.3
8. Graded assignments included comments 20 15.0 35.0 50.0 0.0 0.75 2.4 2.9 -0.5

SECTION C - INSTRUCTOR ITEMS

9. Presented material effectively 20 0.0 0.0 50.0 50.0 0.51 3.5 3.1 0.4
10. Had good knowledge of subject matter 20 0.0 0.0 50.0 50.0 0.51 3.5 3.5 0.0
11. Was available for consultation 20 0.0 0.0 70.0 30.0 0.47 3.3 3.3 0.0
12. Satisfact answered class questions 20 0.0 5.0 60.0 35.0 0.57 3.3 3.3 0.0
13. Stimulated interest of the subject 20 5.0 10.0 60.0 25.0 0.76 3.1 2.9 0.2
14. Encouraged class participation 20 5.0 0.0 55.0 40.0 0.73 3.3 3.1 0.2

SECTION D - LEARNING OUTCOMES

15. Learned respect different viewpoint 7 0.0 0.0 100.0 0.0 . 3.0 3.0 0.0
16. Inc my abil to analyze & evaluate 20 0.0 0.0 65.0 35.0 0.49 3.4 3.2 0.2
17. Course helped abil to solve problem 20 0.0 0.0 70.0 30.0 0.47 3.3 3.2 0.1
18. Gained undrstood concepts & prin. 20 0.0 0.0 70.0 30.0 0.47 3.3 3.2 0.1
19. Course stimulated me to read further 20 0.0 60.0 25.0 15.0 0.76 2.6 2.8 -0.2

RESPONSE SCALE: P=POOR F=FAIR G=GOOD E=EXCELLENT

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SECTION E - SUMMARY ITEMS

20. Overall value of the course 20 0.0 5.0 50.0 45.0 0.60 3.4 3.1 0.3
21. Overall quality of teaching 20 0.0 0.0 55.0 45.0 0.51 3.5 3.1 0.4
• Design project should be given much earlier in the semester.

• Homework grading was unfair and inconsistent. We are juniors and seniors. It should be our responsibility to hold a grad. Student’s hand through the problems. All work cannot be shown.
**UNIVERSITY OF KENTUCKY**  
Spring 2005 TEACHER AND COURSE EVALUATION RESULTS  
COLLEGE = Engineering  
DEPARTMENT = Chemical & Materials Engineering  
COURSE = CME 462 001L1 PROCESS CONTROL  
INSTRUCTOR EVALUATED = Knutson, Barbara  

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**RESPONSE SCALE:**  
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D=DISAGREE  
A=AGREE  
SA=STONGLY AGREE

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**SECTION B - COURSE ITEMS**

1. Outlined course material and grading  
2. Textbook contributed to understandin  
3. Suppl read & assign helped understan  
4. Exams reflected what was taught  
5. Grading was fair and consistent  
6. Assignments were distributed evenly  
7. Graded assignments returned promptly  
8. Graded assignments included comments

**SECTION C - INSTRUCTOR ITEMS**

9. Presented material effectively  
10. Had good knowledge of subject matte  
11. Was available for consultation  
12. Satisfact answered class questions  
13. Stimulated interest of the subject  
14. Encouraged class participation

**SECTION D - LEARNING OUTCOMES**

15. Learned respect different viewpoint  
16. Inc my abil to analyze & evaluate  
17. Course helped abil to solve problem  
18. Gained undrstsnd of concepts & prin.  
19. Course stimulated me to read furthe

**RESPONSE SCALE:**  
P=POOR  
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**SECTION E - SUMMARY ITEMS**

20. Overall value of the course  
21. Overall quality of teaching
- It doesn’t matter what we write, nothing changes.

- I liked this class. It actually was applicable to industry, which our other classes have not been. Plus, I liked the who wants to be a controls engineer. (??typed exactly as written)

- Good job teaching a subject that could be very dry and boring.

- The out of class requirements @ times seemed to be too much. Could help by designating an extra class meeting, or setting each group time, because scheduling was difficult.

- The powerpoint presentations help me learn the material much better than when I was in your separations class. Keep that trend up. There was also just enough simulink for me to learn the program but not hate it. Thanks for a great class.

- Your slides are very helpful.
UNIVERSITY OF KENTUCKY
Fall 2005 TEACHER AND COURSE EVALUATION RESULTS
COLLEGE = Engineering
DEPARTMENT = Chemical & Materials Engineering
COURSE = CME 620 001L1 EQUILIBRIUM THERMODYNAM
INSTRUCTOR EVALUATED = Knutson, Barbara

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RESPONSE SCALE: SD=STRONGLY DISAGREE D=DISAGREE A=AGREE SA=STRONGLY AGREE

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SECTION B - COURSE ITEMS

1. Outlined course material and grading 7 0.0 0.0 42.9 57.1 . 3.6 3.3 0.3
2. Textbook contributed to understanding 7 14.3 14.3 28.6 42.9 . 3.0 2.9 0.1
3. Suppl read & assign helped understand 7 0.0 14.3 42.9 42.9 . 3.3 3.2 0.1
4. Exams reflected what was taught 7 0.0 42.9 14.3 42.9 . 3.0 3.2 -0.2
5. Grading was fair and consistent 7 0.0 0.0 14.3 85.7 . 3.9 3.2 0.7
6. Assignments were distributed evenly 7 0.0 0.0 28.6 71.4 . 3.7 3.3 0.4
7. Graded assignments returned promptly 7 0.0 0.0 57.1 42.9 . 3.4 3.2 0.2
8. Graded assignments included comments 7 0.0 0.0 14.3 85.7 . 3.9 3.0 0.9

SECTION C - INSTRUCTOR ITEMS

9. Presented material effectively 7 0.0 28.6 14.3 57.1 . 3.3 3.1 0.2
10. Had good knowledge of subject matter 7 0.0 0.0 57.1 42.9 . 3.4 3.5 -0.1
11. Was available for consultation 7 0.0 0.0 42.9 57.1 . 3.6 3.3 0.3
12. Satisfact answered class questions 7 0.0 0.0 57.1 42.9 . 3.4 3.3 0.1
13. Stimulated interest of the subject 7 0.0 14.3 42.9 42.9 . 3.3 3.0 0.3
14. Encouraged class participation 7 0.0 0.0 71.4 28.6 . 3.3 3.1 0.2

SECTION D - LEARNING OUTCOMES

15. Learned respect different viewpoint 4 0.0 0.0 75.0 25.0 . 3.3 3.0 0.3
16. Inc my ablal to analyze & evaluate 7 0.0 14.3 28.6 57.1 . 3.4 3.2 0.2
17. Course helped abl to solve problem 7 0.0 0.0 42.9 57.1 . 3.6 3.2 0.4
18. Gained undrstnd of concepts & prin. 7 0.0 14.3 57.1 28.6 . 3.1 3.3 -0.2
19. Course stimulated me to read furthe 7 14.3 42.9 14.3 28.6 . 2.6 2.9 -0.3

RESPONSE SCALE: P=POOR F=FAIR G=GOOD E=EXCELLENT

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SECTION E - SUMMARY ITEMS

20. Overall value of the course 7 0.0 14.3 57.1 28.6 . 3.1 3.1 0.0
21. Overall quality of teaching 7 0.0 0.0 42.9 57.1 . 3.6 3.2 0.4
I don’t know how to improve the class, but I hope someone does – not the class itself so much as the subject.

Multiple textbooks was a pain – although it seemed clear that there was no other option to this.
UNIVERSITY OF KENTUCKY
Spring 2006 TEACHER AND COURSE EVALUATION RESULTS
COLLEGE = Engineering DEPARTMENT = Chemical & Materials Engineering
COURSE = CME 462 001L1 PROCESS CONTROL
INSTRUCTOR EVALUATED = Knutson, Barbara

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SECTION B - COURSE ITEMS

1. Outlined course material and grading
2. Textbook contributed to understanding
3. Suppl read & assign helped understand
4. Exams reflected what was taught
5. Grading was fair and consistent
6. Assignments were distributed evenly
7. Graded assignments returned promptly
8. Graded assignments included comments

SECTION C - INSTRUCTOR ITEMS

9. Presented material effectively
10. Had good knowledge of subject material
11. Was available for consultation
12. Satisfact answered class questions
13. Stimulated interest of the subject
14. Encouraged class participation

SECTION D - LEARNING OUTCOMES

15. Learned respect different viewpoint
16. Inc my abil to analyze & evaluate
17. Course helped abil to solve problem
18. Gained undrstd of concepts & prin.
19. Course stimulated me to read furthe

RESPONSE SCALE: P=POOR F=FAIR G=GOOD E=EXCELLENT

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SECTION E - SUMMARY ITEMS

20. Overall value of the course
21. Overall quality of teaching
Dr. Knutson was fair, and helpful outside of class.

Slides are helpful to learning more material too quickly covered. Writing on board helps info to be retained.
APPENDIX D. Samples of Unsolicited Student Letters
Dr. Knutson,

I was visiting for the weekend and thought I would drop by and try my luck with getting to see you! Unfortunately, you aren't here!! My first year of mid-school went fabulous... I am actually making A's these days! It must be due to my remarkable undergrad professors!! Thank you for all of the encouragement and help along the way; it feels great to finally love what I am learning about! Hope things are great and Ana + Kirk are growing beautifully! (I am sure they are!!) Hope to see you sometime soon! Have a wonderful summer!

Pray for... 

Jessica Smith

June 2006
June 6, 2006

Dear Dr. Kriete,

I just wanted to let you know that I graduated from Duke University last month with my Master's degree in public policy.

SO MUCH!

Thank you so much for writing me the letters of recommendation for my application back in November/December 2003. I had a great two years at Duke and am ready to pursue a career in public policy, preferably doing policy research at a think tank in the DC area.

Thanks once again for writing the letters of recommendation and being a great professor during my time at Duke.

Sincerely,

[Signature]

Meeiti Aron
Dr. Knudsen,

Thank you

I wanted to let you know how much I appreciate your help and support this semester. Your advice as an advisor for research, as a professor, and about employment and graduate school have been so wonderful. Hope you enjoy your summer.

Sincerely,

Amy Kelbrook
Dear Dr. Knutson,

I would like to thank you for your time. You helped me answer a lot of questions about Engineering and just UK in general. I especially liked the tours of the labs.

Thanks again for your time, and have a wonderful holiday season!

Sincerely,

Matt Under

December 2005
Dr. Knutson,

Thank you so much for your help. I really appreciate everything you have done for me. You have helped me in my job search, education, and now with this letter of recommendation. I am very grateful to you. Take care and have a great summer.

Sincerely,
Wendell Lake
Just wanted to say thanks for taking time to chat with me during my visit. It was great to see you again. Your advice and discussions were a major influence on my eventual decision to pursue an academic career. Thanks for being such a good teacher and mentor.

I hope that your class was able to glean something from my talk. Regardless, it felt nice to have a large and diverse audience.

Best,
Jamey
--
Jamey D. Young
Purdue University
765-494-6605
jameyy@ecn.purdue.edu