APPLICATION FOR CHANGE IN EXISTING COURSE MAJOR and MINOR

1. Submitted by the College of: Engineering Date: 10/19/2010

   Department/Division offering course: Chemical Engineering

2. What type of change is being proposed? ☑ Major ☐ Minor*

   *See the description at the end of this form regarding what constitutes a minor change. Minor changes are sent directly from the dean of the college to the Chair of the Senate Council. If the Senate Council chair deems the change not to be minor, the form will be sent to the appropriate Council for normal processing and an email notification will be sent to the contact person.

3. Current Distance Learning (DL) status: ☑ N/A ☐ Already approved for DL† ☐ *Please Add* ☐ *Please Drop*

   If ADDING, check one of the methods below that reflects how the majority of the course content will be delivered.

   Internet/Web-based ☐ *Interactive Video* ☐ *Extended Campus* ☐

   †If already approved for DL, a new Distance Learning Form must be submitted with this form unless the department affirms (by checking this box) ☐ that the proposed course changes will not affect DL delivery.

PROPOSED CHANGES

Please complete all "Current" fields.

Fill out the "Proposed" field only for items being changed. Enter N/A if not changing.

Circle the number for each item(s) being changed. For example: (6.)

4. Current prefix & number: CME 455 *Proposed prefix & number:* CME 455

5. Current Title: Chemical Engineering Process Design I

   Proposed Title†: Chemical Engineering Product and Process Design I

   †If title is longer than 24 characters, offer a sensible title of 24 characters or less: Design I

6. Current number of credit hours: 3 *Proposed number of credit hours:* 3

7. Currently, is this course repeatable? YES ☑ NO ☐ If YES, current maximum credit hours: _____

   Proposed to be repeatable? *YES* ☑ *NO* ☐ *If YES, proposed maximum credit hours:* _____

8. Current grading system: ☑ Letter (A, B, C, etc.) ☐ Pass/Fail

   Proposed grading system: ☑ *Letter (A, B, C, etc.)* ☐ *Pass/Fail*

9. Courses must be described by at least one of the categories below. Include number of actual contact hours per week for each category.

   Current:

   ☐ CLINICAL ☐ COLLOQUIUM ☐ DISCUSSION ☐ LABORATORY ☐ 3x LECTURE
   ☐ INDEPEND. STUDY ☐ PRACTICUM ☐ RECITATION ☐ RESEARCH ☐ RESIDENCY
   ☐ SEMINAR ☐ STUDIO ☐ OTHER – Please explain: _____

   Proposed:

   ☐ *CLINICAL* ☐ *COLLOQUIUM* ☐ *DISCUSSION* ☐ *LABORATORY* ☐ 3x *LECTURE*
   ☐ *INDEPEND. STUDY* ☐ *PRACTICUM* ☐ *RECITATION* ☐ *RESEARCH* ☐ *RESIDENCY*
   ☐ *SEMINAR* ☐ *STUDIO* ☐ *OTHER – Please explain:* _____

10. Requested effective date (term/year): Fall / 2011

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11. Supplementary teaching component: ☑ N/A ☐ Community-Based Experience ☐ Service Learning ☐ Both

Proposed supplementary teaching component: ☐ *Community-Based Experience* ☐ *Service Learning* ☐ *Both*

12. Cross-listing: ☑ N/A or _____ / _____
Current Prefix & Number — printed name — Current Cross-listing Department Chair — signature

a. Proposed -- REMOVE current cross-listing: ☐ _____ / _____
printed name — Current Cross-listing Department Chair — signature

b. Proposed -- ADD cross-listing: _____ / _____
Prefix & Number — printed name — Proposed Cross-listing Department Chair — signature

13. Current prerequisites:

CME 415, CME 420, CME 425, ME 330, CS 221 and Engineering Standing

Proposed prerequisites:

CME 220, CME 330, CME 415, CME 420, CME 425, Prereq or concur CME 550, Engineering Standing.

14. Current Bulletin description:

A lecture and problem solving course devoted to the study of economics as it applies to the design of chemical process units and systems.

Proposed Bulletin description:

A lecture and problem solving course emphasizing process economic evaluation, product design, and process synthesis as they apply to chemical units and systems. Appropriate use of software for simulation and design of chemical systems will also be emphasized.

15. What has prompted this change?

Discussions with our constituencies and research on design courses elsewhere have indicated that its important for our students to learn product design in addition to process design.

16. If there are to be significant changes in the content or teaching objectives of this course, indicate changes:

This course will continue to emphasize economics as related to process design but will also include an emphasis on product design.

17. Please list any other department that could be affected by the proposed change:

None

18. Will changing this course change the degree requirements for ANY program on campus? ☐ YES ☑ NO

If YES[1], list below the programs that require this course:

[1] In order for the course change to be considered, program change form(s) for the programs above must also be submitted.

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19. Is this course currently included in the University Studies Program? ☐ Yes ☑ No

20. ☐ Check box if changed to 400G or 500. If changed to 400G- or 500-level, *you must include a syllabus showing differentiation* for undergraduate and graduate students by (i) requiring additional assignments by the graduate students; and/or (ii) the establishment of different grading criteria in the course for graduate students. (See *SR 3.1.4*)

21. Within the department, who should be contacted for further information on the proposed course change?

Name: Kimberly W. Anderson Phone: 7-4815 Email: kanderson@engr.uky.edu

22. Signatures to report approvals:

August 18, 2010	Douglass Kalika / D R Kalika 10/20/10	
DATE of Approval by Department Faculty	printed name	Reported by Department Chair signature
1/27/11	Richard J. Swigard / Richard J Swigard	
DATE of Approval by College Faculty	printed name	Reported by College Dean signature
09/20/2011	Sharon Gill /	
*DATE of Approval by Undergraduate Council	printed name	Reported by Undergraduate Council Chair signature
*DATE of Approval by Graduate Council	printed name	Reported by Graduate Council Chair signature
*DATE of Approval by Health Care Colleges Council (HCCC)	printed name	Reported by Health Care Colleges Council Chair signature
*DATE of Approval by Senate Council		Reported by Office of the Senate Council
*DATE of Approval by the University Senate		Reported by the Office of the Senate Council

*If applicable, as provided by the *University Senate Rules*. (http://www.uky.edu/USC/New/RulesandRegulationsMain.htm)

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Excerpt from *University Senate Rules:*

SR 3.3.0.G.2: Definition. A request may be considered a minor change if it meets one of the following criteria:

a. change in number within the same hundred series;
b. editorial change in the course title or description which does not imply change in content or emphasis;
c. a change in prerequisite(s) which does not imply change in content or emphasis, or which is made necessary by the elimination or significant alteration of the prerequisite(s);
d. a cross-listing of a course under conditions set forth in *SR 3.3.0.E*;
e. correction of typographical errors.

General Education Course Approval Form **Date of Submission:** 10/19/2010

1. Check which area(s) this course applies to.

Inquiry – Arts & Creativity	X	Composition & Communications - II	
Inquiry – Humanities		Quant Reasoning – Math	
Inquiry – Nat/Math/Phys Sci		Quant Reasoning – Stat	
Inquiry – Social Sciences		Citizenship – USA	
Composition & Communications - I		Citizenship - Global	

2. Provide Course and Department Information.

Department: Chemical and Materials Engineering

Course Prefix and Number: CME 455 Credit hours: 3

Course Title: Chemical Engineering Product and Process Design I

Expected Number of Students per Section: 35 Course Required for Majors in your Program? yes

Prerequisite(s) for Course? CME 220, CME 330, CME 415, CME 420, CME 425, Prereq or concur CME 550, Engineering Standing

Departmental Contact Information

Name: Kimberly Ward Anderson Email: kanderson@engr.uky.edu

Office Address: 163A Paul Anderson Tower Phone: 257-4815

3. In addition to this form, the following must be submitted for consideration:

- A major course change form for revision of existing courses or a new course form for new courses.
- A syllabus that conforms to the Senate Syllabi Guidelines, including listing of the Course Template Student Learning Outcomes.
- A narrative that explains:
  - how the course will address the General Education and Course Template Learning outcomes.
  - active learning activities for students.
  - the course assignment(s) that can be used for Gen Ed course assessment.

Submit all proposals electronically to:
Sharon Gill
Office of Undergraduate Education
Sharon.Gill@uky.edu

Intellectual Inquiry: Arts and Creativity Outcome	Course section tied to outcome	Design Project tie-in	Deliverable	Assessment Methodology
Define and distinguish different approaches to "creativity" as appropriate to the disciplinary practices specific to the subject.	Introduction to Chemical Product Design, Product Charter and Concept Stage	Design team brainstorming-initial development work	Summary report Selected Project: • include how ideas were developed • how the selected idea was arrived at • Give general view of expected advantages/ disadvantages of method	Scoring based upon completeness of creative process statement
Apply the Logic, laws, or constraints of the area of study	Feasibility Stage	Design Project Decision table		Scoring based upon decision table
Demonstrate the ability to critically analyze work produced by other students in this course and in co-curricular events using appropriate tools.	Feasibility Stage, Development and Manufacturing Stages	¾ project review in front of class.	Students will submit blackboard critique of other groups' concepts.	Evaluation of Blackboard critiques
Evaluate results of their own creative endeavors and, using that evaluation, reassess and refine their work.	Product Charter and Concept Stage Case Studies	Final Product design presentation to faculty Committee	Finalized Written Report, and Report Addressing Peer comments	Students will submit blackboard comment regarding how they addressed student comments.

General purpose of the Course:

The engineering curriculum is designed to meet the needs of engineers in today's workforce. We place emphasis on the understanding of fundamental physical principles that govern reality (e.g., mathematical, engineering, sciences). However, it is the engineer's job to use these principles to create and implement technology to better serve humanity. Whether this is through the invention of a new device, the implementation of existing technologies to serve communities or by improving existing systems to make them more economically affordable, the engineer must be able to think creatively and appreciate the effect that artistic design can have in new systems.

Indeed, the learning outcomes for the Intellectual Inquiry into Creativity and the Arts is in direct alignment with many of the already existing ABET outcomes:

Intellectual Inquiry-Arts&Creativity	ABET Outcome
Define and distinguish different approaches to "creativity" as appropriate to the disciplinary practices specific to the subject.	c. An ability to design a system, component, or process to meet desired and applicable Surveying Engineering related needs. e. An ability to identify, formulate, and solve engineering problems.
Apply the Logic, laws, or constraints of the area of study	c. An ability to design a system, component, or process to meet desired and applicable Surveying Engineering related needs.
Demonstrate the ability to critically analyze work produced by other students in this course and in co-curricular events using appropriate tools.	d. An ability to function on multi-disciplinary teams.
Evaluate results of their own creative endeavors and, using that evaluation, reassess and refine their work.	b. An ability to design and conduct experiments, as well as to analyze and interpret data.

Most importantly, the engineer must be able to apply creatively his knowledge of engineering and sciences. Clearly, this requires a near complete engineering education and aligns well with the conceptual goals of the engineering capstone course methodology. However, the existing course syllabus (see attached), does not fully provide creative education. As such, we believe that updating our senior course to meet the Inquiry requirements, a course that better fulfills ABET requirements and University requirements can be developed without adding to the already extensive educational burden placed upon the chemical engineering undergraduate student.

Examples of Active Learning in Engineering Design:

The active learning modules to be used in CME 455 can be summarized into three specific domains: 1.) exercises in creativity, 2.) Case study reviews of existing designs and 3.) Product Design Project. The following descriptions of active learning modules are given as examples to be used for each domain and should not be taken as the exact modules to be used. To fit with the professor's teaching style, flexibility in the exact active learning sections for domains 1 and 2 will be left to the instructor's discretion. However, the design project will be implemented as described with refinements made in subsequent years.

Exercises in Creativity. As an ice breaker and a chance to open students up to the idea of group creative activities, students will be given in class exercises in brainstorming. As a first demonstration, the whole class will participate in brainstorming on a non-technical topic (e.g., What game changes can be made to basketball so that players shorter than 5'9" can be more competitive? What are some next generation accessories cars should have? Slogans for the Senior Chemical Engineering Class). The instructor will moderate the session and keep it to 5 minutes. Afterwards, student's answers will be compared to past answers. Following this practice, students will then be tasked to break into teams of 3-4 and brainstorm on a technical topic and generate the greatest number of ideas. Example topics include generating fresh water on ocean vessels, storage of pharmaceutical drugs in a world health setting, methods of reducing CO2 footprint in a chemical plant. After the 5 minutes, team ideas will be counted and categorized. This exercise will then follow a take home group assignment where students will be tasked with developing 108 ideas on a technical topic using the 6-3-5 method.

Case study reviews of existing designs. Throughout the course, Think-pair-share style active learning sessions will be used as a means of emphasizing key point. These early sessions will be brief (1-3minute) dealing with very simply questions (e.g., how would a change in the federal interest rate effect an economic plan? Out of a list of needs, which do you think are more relevant and why?). This will help students become accustomed to the practice and open up greater interaction in case study review. Students will be presented with a series of case studies throughout the semester. Note that the course syllabus has case studies listed in weeks 14 and 15, but this is merely to serve as a placeholder allowing sufficient time in the semester to review the cases. For each case study, students will be asked to review the concept and discuss any flaws in the design process. Very specific leading questions will be provided to help students start to see where some design developments succeed and where some fail. This active learning exercise will provide students ample time to develop critical thinking skills that can be used in evaluating each other's work in the final active learning domain.

Product Design Project. The final active learning module will be the group design project and design project evaluation. Each group will be assigned a unique challenge. They will be expected to go through the creative process taught to develop a new idea. They will be expected to select the top several best design ideas using a decision table. And in their best 2 ideas, they will be charged with running a simplified economic analysis to determine which project is the most feasible. The will summarize their concept and analysis into a final project report.

Taking advantage of the blackboard system, students will submit a draft report online. These reports will then be randomized and students from OTHER teams will be given access to review them. These student reviewers will assess the design idea, the accuracy of the cost analysis and provide positive critical feedback that the teams can use to improve the design. Students will be assessed for the quality of their critique and the design teams will be assessed for their ability to evaluate and incorporate the reviews into their project.

UNIVERSITY OF KENTUCKY

Department of Chemical and Materials Engineering

CME 455 – Product and Process Design I

Fall 2011

Required Textbook: ***"Product and Process Design Principles – Synthesis, Analysis and Evaluation"*** 3rd edition, by Warren Seider, J. D. Seader, Daniel Lewin and Soemantri Widagdo, John Wiley & Sons (2009)

You can find further details about the book from www.wiley.com/college/seider

MIT Open CourseWare See http://ocw.mit.edu/OcwWeb/web/home/home/index.htm

REFERENCE:

"Systematic Methods of Chemical Process Design" by Biegler, Grossman and Westerberg, Prentice Hall (1997)

"Nonlinear and Mixed-Integer Optimization: Fundamentals and Applications" by Christodoulos A. Floudas, Oxford (1995)

"Chemical Process: Design and Integration" by Robin M. Smith, John Wiley & Sons Inc. (2005)

"Chemical Process Design" by Dimian and Bildea, John Wiley & Sons Inc. (2008)

"Pinch Analysis and Process Integration: A User guide on process Integration for the Efficient Use of Energy" 2nd edition by Ian Kemp, Butterworth-Heinemann (2007)

"Analysis, Synthesis, and Design of Chemical Processes" 3rd edition by Turton, Bailie, Whiting and Shaeiwitz, Prentice Hall (2009)

"Chemical Product Design" by Cussler and Moggridge, Cambridge (2001)

"Product Engineering: Molecular Structure and Properties" by James Wei, Oxford (2007)

"Green Engineering: Environmentally Conscious Design of Chemical Processes" by Allen and Shonnard, Prentice Hall (2002)

"Chemical Process Safety: Fundamentals with Applications" by Crowl and Louvar, Prentice Hall (2002)

"Rules of Thumb in Engineering Practice" by Donald R. Woods, John Wiley & Sons (2007)

"Plant Design and Economics for Chemical Engineers" 5th edition by Peters, Timmerhaus and West, McGraw Hill (2003)

"Chemical Engineering Design" by Towler and Sinnott, Elsevier (2008)

"Conceptual Design of Chemical Processes" by James M. Douglas, McGraw Hill (1988)

"Conceptual Design of Distillation Systems" by Doherty and Malone, McGraw Hill (2001)

"Encyclopedia of Chemical Technology" **Kirk – Othmer,** Vol. 1 – 24, Wiley

"Encyclopedia of Industrial Chemistry" **Ullmann's,** Vol. 1 – 40, Wiley

"Encyclopedia of Chemical Processing and Design" **McKetta,** Vol. 1 – 68, Dekker

"Riegel's Handbook of Industrial Chemistry" 10th edition, James Kent, Kluwer (2003)

INSTRUCTOR:

GRADER:

WEBSITE: http://courses.engr.uky.edu/CME/cme455-001

GOALS: In this course, we emphasize concepts, process economic evaluation, product design, process synthesis and the use of appropriate software for simulation and design. You are advised to work on your homework problems individually. You are required to form a team of four students for the ***Product Design Project.***

COURSE MEETING THE FOLLOWING ABET OUTCOMES

With this course, the students should have:

- An ability to apply knowledge of mathematics, science, and engineering (Outcome A)
- An ability to design a system, component, or process to meet desired need within realistic constraints such as economic, environmental, social, political, ethical, health, and safety, manufacturability, and sustainability (Outcome C)
- An ability to function on multidisciplinary teams (Outcome D)
- An ability to communicate effectively (Outcome G)
- An ability to use the techniques, skills and modern engineering tools necessary for engineering practice (Outcome K)

COURSE MEETING THE FOLLOWING INTELLECTUAL INQUIRY-ARTS&CREATIVITY OUTCOMES

With this course, the students will be able to

- Define and distinguish different approaches to "creativity" as it applies to engineering design.
- Apply the logic, laws, or constraints of chemical engineering to create a realistic design
- Demonstrate the ability to critically analyze work produced by other using appropriate tools.
- Evaluate results of their own design and, using this evaluation and the evaluation of peers, reassess and refine their design.

SPECIFIC OUTCOMES

In this course, students are expected:

1.) to be able to describe the product design process and the engineer's role in it.
2.) to be able to effectively identify gaps/needs from available market report materials
3.) to be able to assess the financial condition of a company from its annual report
4.) to be able to explain standard economic concepts including, time value of money, effects of inflation, rate of return, and depreciation.
5.) To be able to compare alternative designs using either present, future or annual worth analysis
6.) To be able to describe how green engineering principles impact the development and manufacturing cycle
7.) to communicate effectively by writing a design report
8.) to effectively identify and communicate the strengths and weaknesses in a peer's project
9.) to be able to improve one's design through self and peer review.
10.) to work effectively in teams on a product design project

COURSE OUTLINE:

Week	Course section	Example topics to be covered
1	Introduction to Chemical Product Design	Elements of Design (overview of design process, including Product Charter, Concept Stage, Feasibility, Development, Manufacturing, Product Introduction)
2	Product Charter	Needs/Gap analysis, marketability
3	Concept Stage	Techniques in creative thinking, Problem solving strategies and Idea selection
4	Feasibility Stage (Engineering Design Constraints)	Time value of money
5		Investment strategies (borrowing, lending…)
6		Investment strategies (borrowing, lending…) cont.
7		Present/Future/annual worth analysis
8		Present/Future/annual worth analysis cont.
9		Rate of Return
10		Profitability analysis
11		Profitability analysis cont.
12	Development and Manufacturing Stages	Sustainability, Green Engineering
13		LEED certification and Safety
14	Case Studies	Industry examples of successful and unsuccessful product development cycles
15		Industry examples of successful and unsuccessful product development cycles cont.

IMPORTANT DATES:

September xx – Last day to drop a course without it appearing on the student's transcript.
October xx – Midterm of 2011 Fall Semester
October xx – Last day to withdraw from the University or reduce course load.

GRADING:

Homework and Computer Projects .....10 %
2 Examinations ..... 30 %
Design Report..... 20 %
Final Design Presentation.....10 %
Peer Assessment.....10 %
Final Examination ....20 %

If your composite class score is in the following ranges, you will receive *at least* the corresponding grade; A (Greater than 90), B (80 – 90), C (70 – 79), D (60-69), E (Below 60).
Students will receive a Midterm evaluation by the established midterm date.

The PRODUCT DESIGN PROJECT:

Students are required to follow **Chapter 26** for the preparation of their written reports on the product design project. A written report of the design project will be due XXX.

Team-work

Each team should have four members (though one or two teams may have 3 members, depending on the class enrollment), and each team should elect team-leaders (rotated on monthly basis), who represent the team and oversee the progress of team-work. The following are essential for successful team-work,

- Good communication among team members
- Proper job assignments for each member
- Help each other to finish job assignments
- Have schedule to follow for each task
- Each member contributes to the project
- Each learns to be a good team-member
- Each learns to be a good leader

Team meetings with the instructor

Each team should prepare for a Gantt Chart for the Product Design Project and should meet for discussion and review for the team's progress on the design project. Each team is required to turn in a one-page progress report to the instructor to summarize the work done before the meeting with the instructor.

Each team is required to have an outline of the milestones for completion of the design project. Please turn in this outline in the first team meeting with the instructor.

Expected Project Milestones

Week	Milestone
1	
2	
3	
4	Project Assigned
5	
6	Faculty meeting – Gantt Chart Due
7	
8	Progress report 1 due
9	
10	Faculty Meeting-50% Draft Report Due on blackboard
11	Peer Review of Report due
12	Progress Report 2 due – Addressing comments of Peers
13	
14	Faculty meeting – Final report due
15	

PEER Review Process

A critical aspect of engineering is to assess the work of individuals and provide constructive feedback to act as an aide in refining the work of others. Each group will be expected to submit a "50% draft Report" onto the blackboard system. These 50% reports will contain all sections of the final report, and should convey a clear vision for your overall design. For sections that have not been completed yet (e.g., economic costs, HAZOP assessment, etc.), a brief paragraph should be used as a placeholder explaining how these sections will be finalized. Each student will be randomly assigned one project to review. You will have 1 week to critique of the project based upon its technical merits, innovation, creativity of design, level of scientific detail and ability to convey this information clearly. While clarity of presentation is a factor in this critique, the focus of this critique should be technical in nature. Students will submit their detailed critiques using blackboard.

General Information

(1) Grades will be based upon the quality of the critiques you provide others.
(2) Critiques must be of a constructive nature. Providing both the positive aspects of the design and aspects which can be improve upon is expected.
(3) Grading will be made individually and not to the group.