ABE 55800

Office of the Registrar
FORM 40G REV. 4/13

PURDUE UNIVERSITY
REQUEST FOR ADDITION, EXPIRATION, OR REVISION OF A GRADUATE COURSE
(50000-60000 LEVEL)

Graduate Council Doc No. 13-18b
EFD 56-13

DEPARTMENT: Agricultural and Biological Engineering | EFFECTIVE SESSION: Spring 2013 201420

INSTRUCTIONS: Please check the items below which describe the purpose of this request.

- [x] 1. New course with supporting documents (complete proposal form)
- [ ] 2. Add existing course offered at another campus
- [ ] 3. Expiration of a course
- [ ] 4. Change in course number
- [ ] 5. Change in course title
- [ ] 6. Change in course credit/type
- [ ] 7. Change in course attributes
- [ ] 8. Change in instructional hours
- [ ] 9. Change in course description
- [ ] 10. Change in course requisites
- [ ] 11. Change in semesters offered
- [ ] 12. Transfer from one department to another

PROPOSED:		EXISTING:	
Subject Abbreviation	ABE	Subject Abbreviation	
Course Number	55800	Course Number	
Long Title	Process Design for Food and Biological Systems		
Short Title	Process Design Food & Bio Syst (Abbreviated title will be entered by the Office of the Registrar if omitted. (30 CHARACTERS ONLY))		

TERMS OFFERED (Check All That Apply): [x] Fall [ ] Spring [ ] Summer

CAMPUS(ES) INVOLVED: [ ] Calumet [ ] N. Central [ ] Cont Ed [ ] Tech Statewide [ ] Ft. Wayne [x] W. Lafayette [ ] Indianapolis

CREDIT TYPE
1. Fixed Credit: Cr. Hrs. 3
2. Variable Credit Range: Minimum Cr. Hrs ____ (Check One) To [ ] Or [ ] Maximum Cr. Hrs ____
3. Equivalent Credit: Yes [ ] No [x]
4. Thesis Credit: Yes [ ] No [x]

COURSE ATTRIBUTES: Check All That Apply
1. Pass/Not Pass Only [ ]
2. Satisfactory/Unsatisfactory Only [ ]
3. Repeatable [ ] Maximum Repeatable Credit: [ ]
4. Credit by Examination [ ]
5. Fees [ ] Coop [ ] Lab [ ] Rate Request
Include comment to explain fee
6. Registration Approval Type: Department [ ] Instructor [ ]
7. Variable Title [ ]
8. Honors [ ]
9. Full Time Privilege [ ]
10. Off Campus Experience [ ]

Schedule Type	Minutes Per Mtg	Meetings Per Week	Weeks Offered	% of Credit Allocated
Lecture	50	2	16	
Recitation				
Presentation				
Laboratory	110	2	16	
Lab Prep				
Studio				
Distance				
Clinic				
Experiential				
Research				
Ind. Study				
Pract/Observ				

Cross-listed Courses

RECEIVED
OCT 22 2013
OFFICE OF THE REGISTRAR

COURSE DESCRIPTION (INCLUDE REQUISITES/RESTRICTIONS):
The course will focus on the design, synthesis, creation, evaluation and optimization of processes to convert basic biological materials into a finished product. Concepts of materials and energy balances, thermodynamics, kinetics, transport phenomena of biological systems will be used to design processes to minimize energy and invironmental impacts,and evaluate economic factors while maintaining product quality. Group projects, written and oral projects. Requisites, Restrictions, and Attributes: ABE 55700 Professor Okos.

*COURSE LEARNING OUTCOMES:
Develop an understanding of Bio and Food Separation Processes. Evaluate the economic aspects of product costs. Develop and conduct an experimental design to identify impact of process variables to improve product quality. Develop processes to minimizing environmental, energy impact. Optimization (zero discharge/minimum energy). Develop Business Plan. Communicate technigical information. Improve computer skills to operate and schedule processes (superPro Designer/Batches). Work in teams to design a biological/food process. Review technical and patent literature.

Calumet Department Head	Date	Calumet School Dean	Date	Calumet Director of Graduate Studies	Date
Fort Wayne Department Head	Date	Fort Wayne School Dean	Date	Fort Wayne Director of Graduate Studies	Date
Indianapolis Department Head	Date	Indianapolis School Dean	Date	IUPUI Associate Dean for Graduate Education	Date
North Central Department Head	Date	North Central School Dean	Date	North Central Director of Graduate Studies	Date
West Lafayette Department Head	6/4/13 Date	West Lafayette College/School Dean	Shawn Donkin ✓ 6.13.13 Date	Date Approved by Graduate Council	APPROVED 10/17/13 Date
Graduate Area Committee Convener	10/17/13 Date	Graduate Dean	Andrew W Fentiman 8/14/13 Date	Graduate Council Secretary	Tina L. Payne 10/18/13 Date
				West Lafayette Registrar	10/30/13 Date

OFFICE OF THE REGISTRAR
(Grad Form 40G [Excel format] - Does not include the Graduate Council's required supporting document. See pdf version of Form 40G)

11/21/13

Office of the Registrar
FORM 40 REV. 10/10

PURDUE UNIVERSITY
REQUEST FOR ADDITION, EXPIRATION,
OR REVISION OF AN UNDERGRADUATE COURSE
(10000-40000 LEVEL)

EFD 56-13

DEPARTMENT: Agricultural and Biological Engineering
EFFECTIVE SESSION: Spring 2013

INSTRUCTIONS: Please check the items below which describe the purpose of this request.

- [x] 1. New course with supporting documents
- [ ] 2. Add existing course offered at another campus
- [ ] 3. Expiration of a course
- [ ] 4. Change in course number
- [ ] 5. Change in course title
- [ ] 6. Change in course credit/type
- [ ] 7. Change in course attributes (department head signature only)
- [ ] 8. Change in instructional hours
- [ ] 9. Change in course description
- [ ] 10. Change in course requisites/restrictions
- [ ] 11. Change in semesters offered (department head signature only)
- [ ] 12. Transfer from one department to another

PROPOSED:		EXISTING:	
Subject Abbreviation	ABE	Subject Abbreviation	
Course Number	55800	Course Number	
Long Title	Process Design for Food and Biological Systems		
Short Title			

Abbreviated title will be entered by the Office of the Registrar if omitted. (30 CHARACTERS ONLY)

TERMS OFFERED
Check All That Apply:
[ ] Fall [x] Spring [ ] Summer

CAMPUS(ES) INVOLVED
[ ] Calumet [ ] N. Central
[ ] Cont Ed [ ] Tech Statewide
[ ] Ft. Wayne [x] W. Lafayette
[ ] Indianapolis

CREDIT TYPE
1. Fixed Credit: Cr. Hrs. 3
2. Variable Credit Range:
Minimum Cr. Hrs
(Check One) To [ ] Or [ ]
Maximum Cr. Hrs
3. Equivalent Credit: Yes [ ] No [ ]

COURSE ATTRIBUTES: Check All That Apply
1. Pass/Not Pass Only [ ]
2. Satisfactory/Unsatisfactory Only [ ]
3. Repeatable [ ]
Maximum Repeatable Credit: [ ]
4. Credit by Examination [ ]
5. Special Fees [ ]
6 Registration Approval Type
Department [ ] Instructor [ ]
7 Variable Title [ ]
8 Honors [ ]
9 Full Time Privilege [ ]
10 Off Campus Experience [ ]

Schedule Type	Minutes Per Mtg	Meetings Per Week	Weeks Offered	% of Credit Allocated
Lecture	50	2		
Recitation				
Presentation				
Laboratory	110	2		
Lab Prep				
Studio				
Distance				
Clinic				
Experiential				
Research				
Ind. Study				
Pract/Observ				

Cross-Listed Courses

COURSE DESCRIPTION (INCLUDE REQUISITES/RESTRICTIONS):

The course will focus on the design, synthesis, creation, evaluation and optimization of processes to convert basic biological materials into a finished product. Concepts of materials and energy balances, thermodynamics, kinetics, transport phenomena of biological systems will be used to design processes to minimize energy and environmental impacts, and evaluate economic factors while maintaining product quality. Group projects, written and oral reports.
Requisites, Restrictions, and Attributes: ABE 55700

*COURSE LEARNING OUTCOMES

Develop an understanding of Bio and Food Separation Processes. Evaluate the economic aspects of product costs. Develop and conduct an experimental design to identify impact of process variables to improve product quality. Develop processes to minimizing environmental, energy impact. Optimization (zero discharge/minimum energy). Develop Business Plan. Communicate technical information. Improve computer skills to operate and schedule processes (SuperPro Designer/Batches). Work in teams to design a biological/food process. Review technical and patent literature.

Calumet Department Head	Date	Calumet School Dean	Date
Fort Wayne Department Head	Date	Fort Wayne School Dean	Date
Indianapolis Department Head	Date	Indianapolis School Dean	Date
North Central Faculty Senate Chair	Date	Vice Chancellor for Academic Affairs	Date
West Lafayette Department Head	Date	West Lafayette College/School Dean	Date
		West Lafayette Registrar	Date

OFFICE OF THE REGISTRAR

TO: The Faculty of the College of Engineering

FROM: The Faculty of Agricultural and Biological Engineering

RE: New Course ABE 55800

The faculty of the Department of Agricultural and Biological Engineering has approved the following new course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

ABE 55800 Process Design for Food and Biological Systems
Sem. 2, Class 2. Lab 4. Cr. 3.
Requisites, Restrictions, and Attributes: ABE 55700

Description: The course will focus on the design, synthesis, creation, evaluation and optimization of processes to convert basic biological materials into a finished product. Concepts of materials and energy balances, thermodynamics, kinetics, transport phenomena of biological systems will be used to design processes to minimize energy and environmental impacts, and evaluate economic factors while maintaining product quality. Group projects, written and oral reports.

Reason: This course is replacing ABE 55600 (4 credits) with a 3 credit course with the most essential information from that course. The reduction in course content and credit hours will help the Department meet the 128 credit constraint for the Biological Engineering plan of study.

Bernard A. Engel, Professor and Head
Agricultural and Biological Engineering Department

APPROVED FOR THE FACULTY
OF THE SCHOOLS OF ENGINEERING
BY THE ENGINEERING
CURRICULUM COMMITTEE
ECC Minutes #13
Date 5/10/2013
Acting ECC

ABE 55800 Process Design for Food and Biological Systems

COURSE CONTACT INFORMATION:

Name: Martin Okos
Phone Number: 494-1211
E-mail Address: okos@purdue.edu
Campus Address: NLSN 1169

Catalog Description. The course will focus on the design, synthesis, creation, evaluation and optimization of processes to convert basic biological materials into a finished product. Concepts of materials and energy balances, thermodynamics, kinetics, transport phenomena of biological systems will be used to design processes to minimize energy and environmental impacts, and evaluate economic factors while maintaining product quality. Group projects, written and oral reports.

Requisites, Restrictions, and Attributes: ABE 55700

COLLEGE (AGRICULTURE) LEARNING OUTCOMES ADDRESSED BY THIS COURSE

_____ Professional Preparation: Demonstrate proficiency in their chosen discipline that incorporates knowledge skills, technology, and professional conduct.

__X__ Scientific Principles: Demonstrate use of the scientific method to identify problems, formulate and test hypotheses, conduct experiments and analyze data, and derive conclusions.

__X__ Critical Thinking: Demonstrate critical thinking by using data and reasoning to develop sound responses to complex problems.

__X__ Communication: Demonstrate the ability to write and speak with effectiveness while considering audience and purpose.

__X__ Teamwork: Demonstrate the ability to work effectively as part of a problem-solving team.

_____ Cultural Understanding: Demonstrate knowledge of a range of cultures and an understanding of human values and points of view of other than their own.

_____ Social Science Principles: Demonstrate ability to apply social, economic, political, and environmental principles to living in a global community.

_____ Civic Responsibility: Demonstrate awareness of civic responsibility to community and society at large.

__X__ Lifelong Learning: Demonstrate skills necessary for lifelong learning.

DEPARTMENTAL/PROGRAM LEARNING OUTCOMES ADDRESSED BY THIS COURSE

__X__ an ability to apply knowledge of mathematics, science, and engineering

__X__ ability to design and conduct experiments, as well as to analyze and interpret data.

__X__ an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

__X__ an ability to function on multidisciplinary teams
__X__ an ability to identify, formulate, and solve engineering problems
__X__ an understanding of professional and ethical responsibility
__X__ an ability to communicate effectively
__X__ the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
__X__ a recognition of the need for, and an ability to engage in life-long learning
__X__ a knowledge of contemporary issues
__X__ an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

GRADUATE STUDENT LEARNING OUTCOMES ADDRESSED BY THIS COURSE

__X__ Identify and conduct original research, scholarship and creative endeavors
__X__ Effectively communicate their field of study
__X__ Think critically, creatively and solve problems in their field of study
_____ Conduct research in an ethical and responsible manner
__X__ Demonstrate attributes of professional development consistent with expectations within their field of study

Course outline of Topics/Syllabus

- Process Cost Estimation and Engineering Economics and Analysis (2 weeks)
- Profitability and Alternative Investment (2 weeks)
- Process Design Considerations and Flowsheet Synthesis (Super Pro/Batches) (1 week)
- Evaluation of Alternatives (2 weeks)
- Optimal Design and Performance (2 weeks)
- Optimal Material Handling Equipment Design (2 weeks)
- Optimal Heat Transfer Equipment Design and Reactor Design (2 weeks)
- Optimal Separation and Purification Design (2 weeks)

Reading List/Textbook

Geankoplis, Christie, 2003, Transport Processes and Separation Process Principles. 4th Edition, Prentice-Hall, Inc., Upper Saddle River, New Jersey.

Peters, M, K. Timmerhaus, R. West, 2003, Plant Design and Economics for Chemical Engineers. 5th Edition, McGraw Hill , NY, NY

Example syllabus

ABE 55800 Process Design for Food and Biological Systems

Prerequisite(s): ABE 55700

Textbook and/or other recommended material:

Geankoplis, Christie, 2003, Transport Processes and Separation Process Principles. 4th Edition, Prentice-Hall, Inc., Upper Saddle River, New Jersey.

Peters, M, K. Timmerhaus, R. West, 2003, Plant Design and Economics for Chemical Engineers. 5th Edition, McGraw Hill , NY, NY.

Course Learning Objectives:

Successful completion of the course will enable the students to:

Overall Objectives

1. Incorporate engineering and scientific principles into the analysis and design of a process to convert biological materials into higher valued products given economic, environmental, labor and energy constraints.

Topics

1. Develop an understanding of Bio and Food Separation Processes
2. Evaluate the economic aspects of product costs
3. Develop and conduct an experimental design to identify impact of process variables to improve product quality
4. Develop processes to minimizing environmental, energy impact
5. Optimization (zero discharge/minimum energy)
6. Develop Business Plan

Emphasis

7. Communicate technical information
8. Improve computer skills to operate and schedule processes (SuperPro Designer/Batches)
9. Work in teams to design a biological/food process
10. Review technical and patent literature

Grading scale:

Homework	10%
Algorithms	10%
Exam 1	15%
Exam 2	15%
Semester Project	
Presentations	25%
Final Report	25%

Course Outline - Topics:

- Process Cost Estimation and Engineering Economics and Analysis
- Profitability and Alternative Investment
- Process Design Considerations and Flow sheet Synthesis (Super Pro/Batches)
- Evaluation of Alternatives
- Optimal Design and Performance
- Equipment Materials Selection
- Material Handling Equipment Design
- Heat Transfer Equipment Design and Reactor Design
- Separation and Purification Design

Current Topic Lecture (40 min lecture per group) Current hot/controversial topics related to your group's product/process highlighting the ethical, moral, societal, implications

Plant Design Lectures (40 min lecture per group) (lectures begin Mar)

- Material handling / Plant layout / Material of construction -3A / Packaging
- Water Purification, Treatment, and Reuse Byproduct recovery / conversion / Plant sanitation - CIP
- Refrigeration and Steam Production/ Refrigeration cycles / Condensers - Evaporators / Compressors / Load Calculations/ heat recovery
- Energy Recovery and Integration Hot water production - Steam / Distribution / Heat recovery

Presentations:

40 min group presentations each week and written report (due one week after presentation). Gear your presentations toward the evaluation and synthesis levels of Bloom's Taxonomy. All members of class are required to attend and provide evaluation.

April xx Hot Topics presentation Current issues related to your group's project Ethical, Global, Societal, Technical

April xxx Plant Design presentation Specific design for your facility regarding the minimization of energy or zero discharge of water/waste

April xxx Business Plan presentation From "How to Prepare a Business Plan" with emphasis on Design and Development, and Manufacturing and Operation

Process and Plant Design Project:

The overall objective of the process design project is to develop optimal quality product using a zero discharge minimum energy plant, applying concepts covered in any of your classes at

Purdue to the processes initiated in ABE 555. The project consists of two technical reports (Product/process development/improvement) and Process and Plant design). The project is broken into 5 phases. A written report and a 40 minute oral presentation (by all group members) will be required at the completion of each phase. The format for the technical report for phases 1-3 is:

(1) Title page
(2) Abstract
(3) Problem statement
(4) Project objectives
(5) Corrected results of previous phases
(6) Recommendation and conclusions
(7) References
(8) Appendices (i.e. spreadsheet information)

Phase 1: (Due Feb xx)

Technical report:

1. Detailed review of technical and patent literature for product/process (emphasis on process research needs). Conduct morphological, functional and evolutionary analysis of process (determine the function of each unit operation)
2. Develop outline of Plackett-Burman (PB) experimental design with an estimate of the range of variables. If estimate of ranges unknown please outline experiments to produce performance curves. The goal for your group is to perform a PB experimental design and develop response surface plots of the results. Please make as much progress as you can. If estimate of ranges not known, conduct performance curves, develop PB experimental design, conduct experiments, develop response surface equations and plots. If data is available and time permits conduct a Principle Component Analysis between objective quality measurements and subjective sensory quality measurements.
3. Detailed process flow diagram (flows, temperatures, concentrations) along with recipes and procedures
4. Equipment sizing of all unit operations, heat exchangers, pumps, mixes, storage tanks... as per vendor selection. Include in an appendix all relevant vendor materials specifications.
5. Process scheduling of batch processes (each process should have several batch operation) (also relates to equipment sizing)
6. Determination of all process related resource requirements (labor, water, heating and cooling loads with temperature ranges. Give a table of load breakdowns by equipment and load totals.
7. Emissions (water and air) amount of waste from each unit operation.
8. Economic Evaluation (Costs - preliminary cost estimation)
   a Purchase equipment cost - use the most recent 2003 MSI index

   b Estimation of capital investment cost and total product costs - refer to text chapter 6 and use Table 9 to estimate plant ratio factors for a solid/fluid type of process. Include tables with headings as shown in text Table 18 with ratios used to perform estimations of total product costs.

Overall Schedule:

1. Complete a schedule for the entire project (using Microsoft Project, for example). Start at the third week of the semester and end with completion of the design and development.
2. Discuss activities most likely to cause schedule slippage and the actions to be taken to correct such slippage.
3. Identify mentor company and contact

Phase 2: (Due March xx)

Technical report:

1. Plackett-Burman experimental design final report
    a) Conduct experiments to determine effect of major variables on quality
    b) Develop performance curves for major variables
    c) Provide a more accurate estimate of PB range of variables
    d) Perform PB experimental design
    e) Develop response surface plots
2. Summary of plant trip

Optimal Design-Each member of group develop an economic optimal design of a specific unit operation.

Design and Development Plans - (Costs - preliminary cost estimation)

1. Update
2. Purchase equipment cost
3. Estimation of capital investment cost and total product costs.

Financial Plan:

1. Profit and loss forecast
2. Discounted cash flow analysis
3. Break-even chart (Fig 6-3)
4. Business Plan

Process/plant design presentation during week of Apr xx

Suggested Poster outline

Title/Group Members/

Overall Objective To develop a profitable business
Subobjectives (Design Zero Discharge Minimum Energy Plant)
Phase I
Market
Process Description, literature, patents
Process Flow Process systems review
Phase II
Experimental Design, Procedure, Results

Summary of laboratory experiments (samples)
Phase III
Plant Design
Each Members contribution
Phase IV Economic Results TCI, TPC. ROI
Handouts with flow sheets, engineering and economic summaries

Phase 3: (Due April xx)
Technical report:

1. Application of HACCP concepts - include process diagram(s) and chart(s) Quality Assurance,/HACCP/ Safety and Validation// Ventilation/ air quality
2. Control systems for major unit operations
3. Design of plant systems
    a) Material handling / Plant layout / Material of construction -3A / Packaging
    b) Water Purification, Treatment and Reuse
    c) Byproduct recovery / conversion / Plant sanitation - CIP / Ventilation
    d) Energy Integration: Hot water production - Steam / Distribution / Heat recovery - Refrigeration cycles / Condensers - Evaporators / Compressors / Load Calculations
4. Patent disclosure

Phase 4: (Dead Week)

The final group poster and oral presentation will include

1. Brief process summary
2. Process systems review
3. Summary of laboratory experiments (samples)
4. Handouts with flow sheets, engineering and economic summaries

Phase 5: (Due May xx)
Technical report:

Submit final written report in a business plan format:

Title page
Abstract
Executive Summary
Project objectives
Corrected technical report phases
Evaluations & Recommendation
Conclusions
Notation
References
Appendices
Experimental data

Patent Disclosure

Please complete the group evaluations after each phase and submit to me (This is required)

Your final presentation should include the important results from each phase of your entire project and form the basis for your executive summary. Include specific facts. You should provide samples of your product. It would be interesting to show how process conditions affect product quality.

Final reports must be turned in by Fri May xxx including copies of major papers and patents referenced also please submit entire report electronically. Please follow format outlined in course outline. Please include in your final report revised copies of each of your various reports for each Phase. Please pay particular attention to the executive summary which presents in specific detail a shorten version of your project report giving the important facts from each phase.