TO: The Faculty of the College of Engineering

FROM: The Faculty of Agricultural and Biological Engineering

RE: New Course ABE 45700

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 45700 Transport Operations in Food and Biological Engineering I
Sem. 2, Class 3. Lab 0. Cr. 3.
Requisites, Restrictions, and Attributes: ABE 30800

Description: Application of momentum and heat transfer to biological and food process engineering. Viscosity, non-Newtonian fluids, experimental methods of rheological characterization of food and biological systems; viscoelasticity; design equations for pipeflow, pumps, mixing, emulsification, extrusion, sheeting, heat exchangers, aseptic processing, sterilization, freezing, and evaporation.

Reason: This course is replacing ABE 45400 (4 credits) with a 3 credit version; the lab is being dropped to reduce credit hours from 4 to 3. The laboratory is being incorporated into ABE 30400. This reduction in course content and credit hours will help the program meet the 128 credit hour constraint.

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

Chairman ECC

EFD 54-13

Office of the Registrar
FORM 40 REV. 10/10

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

DEPARTMENT: Agricultural and Biological Engineering EFFECTIVE SESSION: ~~Spring 2013~~ (201410)

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	45700	Course Number	
Long Title	Transport Operations in Food and Biological Engineering I		
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	60	3		
Recitation				
Presentation				
Laboratory				
Lab Prep				
Studio				
Distance				
Clinic				
Experiential				
Research				
Ind. Study				
Pract/Observ				

RECEIVED
JUN - 6 2013
OFFICE OF THE REGISTRAR

Cross-Listed Courses
RECEIVED
MAY 2 3 2013
OFFICE OF THE REGISTRAR

COURSE DESCRIPTION (INCLUDE REQUISITES/RESTRICTIONS):

Application of momentum and heat transfer to biological and food process engineering. Viscosity, non-Newtonian fluids, experimental methods of rheological characterization of food and biological systems; viscoelasticity; design equations for pipeflow, pumps, mixing, emulsification, extrusion, sheeting, heat exchangers, aseptic processing, sterilization, freezing, and evaporation.
Requisites, Restrictions, and Attributes: ABE 30800

*COURSE LEARNING OUTCOMES

Gain an understand the principles, design and analysis of biological and food process engineering operations .
Know the characteristics and analysis of the flow of biological fluid.
Gain an understanding of the principles, design and analysis of thermal processing operations.
Gain an understanding of the principles and analysis of freezing.

	Date		Date
Calumet Department Head		Calumet School Dean	
Fort Wayne Department Head		Fort Wayne School Dean	
Indianapolis Department Head		Indianapolis School Dean	
North Central Faculty Senate Chair		Vice Chancellor for Academic Affairs	
West Lafayette Department Head	5/17/13	West Lafayette College/School Dean	5-17-13
		West Lafayette Registrar	6/11/13

OFFICE OF THE REGISTRAR

UD 6/10/13

Office of the Registrar
FORM 40 REV. 10/10

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OR REVISION OF AN UNDERGRADUATE COURSE
(10000-40000 LEVEL)

EFD 54-13

DEPARTMENT: Agricultural and Biological Engineering

EFFECTIVE SESSION: Spring 2013

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Long Title	Transport Operations in Food and Biological Engineering I		
Short Title			

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

CAMPUS(ES) INVOLVED
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[ ] Ft. Wayne [x] W. Lafayette
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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	[ ]	6 Registration Approval Type	
2. Satisfactory/Unsatisfactory Only	[ ]	Department [ ]	Instructor [ ]
3. Repeatable	[ ]	7 Variable Title	[ ]
Maximum Repeatable Credit:	[ ]	8 Honors	[ ]
4. Credit by Examination	[ ]	9 Full Time Privilege	[ ]
5. Special Fees	[ ]	10 Off Campus Experience	[ ]

Schedule Type	Minutes Per Mtg	Meetings Per Week	Weeks Offered	% of Credit Allocated
Lecture	50	3		
Recitation				
Presentation				
Laboratory				
Lab Prep				
Studio				
Distance				
Clinic				
Experiential				
Research				
Ind. Study				
Pract/Observ				

Cross-Listed Courses

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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 5/8/13
		West Lafayette Registrar	Date

OFFICE OF THE REGISTRAR

ABE 45700 Transport Operations in Food and Biological Engineering I

COURSE CONTACT INFORMATION:

Name: Ganesan Narsimhan
Phone Number: (765)494-1199
E-mail Address:narsimha@purdue.edu
Campus Address: NLSN 2247

Course Description. Application of momentum and heat transfer to biological and food process engineering. Viscosity, non-Newtonian fluids, experimental methods of rheological characterization of food and biological systems; viscoelasticity; design equations for pipe flow, pumps, mixing, emulsification, extrusion, sheeting, heat exchangers, aseptic processing, sterilization, freezing, and evaporation.

Requisites, Restrictions, and Attributes: ABE 30800

COLLEGE (AGRICULTURE) LEARNING OUTCOMES ADDRESSED BY THIS COURSE

__x__ 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.

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

_____ 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.

_____ 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

_____ 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

_____ an ability to function on multidisciplinary teams

__x__ an ability to identify, formulate, and solve engineering problems

_____ an understanding of professional and ethical responsibility

_____ an ability to communicate effectively

_____ the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

_____ a recognition of the need for, and an ability to engage in life-long learning

_____ a knowledge of contemporary issues

_____ an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Course outline of Topics/Syllabus

1. Non-Newtonian fluid behavior
2. Techniques for characterization of Non-Newtonian fluids
3. Design equations for pipe flow
4. Pump characteristics
5. Mixing
6. Emulsification
7. Extrusion
8. Heat exchangers
9. Thermal processing
10. Aseptic processing
11. Unsteady state heat transfer
12. Freezing

Reading List/Textbook

1. ABE 454 Class Notes from Boiler Book Store.
2. Transport Processes and Unit Operations by Christie J. Geonkopolis, Prentice Hall (Fourth edition)

Example syllabus

ABE 45700 Transport Operations in Food and Biological Engineering I

Textbook and/or other recommended material

- ABE 454 Class Notes from Boiler Book Store.
- Transport Processes and Unit Operations by Christie J. Geonkopolis, Prentice Hall (Fourth edition)

Course Learning Objectives:

Successful completion of the course will enable the students to:

1. Gain an understand the principles, design and analysis of biological and food process engineering operations
2. Know the characteristics and analysis of the flow of biological fluid
3. Gain an understanding of the principles, design and analysis of thermal processing operations.
4. Gain an understanding of the principles and analysis of freezing.

Grading:

Homeworks	40%
Quiz	10%
Exams	50%

Tentative scale for grades is as follows:

> 97.5%	A^+
92.5-97.5%	A
90-92.5%	A^-
87.5-90%	B^+
82.5-87.5%	B
80-82.5%	B^-
77.5-80%	C^+
72.5-77.5%	C
70-72.5%	C^-
67.5-70%	D^+
62.5-67.5%	D
60-62.5%	D^-
< 60%	F

Weekly Syllabus

Week 1	Introduction, Non-Newtonian Fluids calculations	2.7F (G)
Week 2	Capillary Rheometer	Ch 2 and 3, Class Notes
Week 3	Rotational Rheometer	Ch 3 and 4, Class Notes
Week 4	Viscoelasticity	Ch 5, Class Notes
Week 5	Emulsification	Ch 6, Class Notes
Week 6	Pumps	3.3 (G)
	Exam I	
Week 6	Mixing	3.4,3.5 (G)
Week 7	Flow in packed and fluidized beds	3.1C,3.1D (G)
Weeks 8,9	Extrusion Equipment	Ch 7.1,7.2 , Class Notes
	Design Equations for Extrusion	Ch 7.3, Class Notes
Week 10	Shell and Tube Heat Exchangers	4.9 (G)
	Exam II	
Week 10	Plate Heat Exchangers	Handout
Week 11,12	Sterilization	Class Notes, 9.12 (G)
Week 13,14	Evaporation	8 (G)
Week 15	Unsteady State Heat Transfer	5 (G)
Week 16	Freezing	5.5 (G)
	Review	