TO: The Faculty of the College of Engineering

FROM: The School of Agricultural and Biological Engineering

RE Curriculum Changes - Biological Engineering Plan of Study

The faculty of the School of Agricultural & Biological Engineering has approved the following changes to the curriculum for Biological Engineering. The requested changes to the plan of study reduce the credit hours required for graduation from 135 to 128, incorporate several new courses that were recently developed, and introduce flexibility in several of the classes to allow students to specialize in different aspects of Biological Engineering. Specializations are introduced into the plan of study through options to fulfill plan of study requirements with courses in food science, bio-processing, pharmaceutical sciences, or life sciences.

Summary of Changes:

1. The credit hour reduction was achieved by eliminating PHYS 24100, 1 credit from ABE 45400 (now ABE 45700), 1 credit from ABE 55500 (now ABE 55700), 1 credit from ABE 55600 (now ABE 55800) and 3 credits of biology/science selective.
2. CHE 37700 and CHE 37800 were replaced with ABE 30700, ABE 30800, and a 3 credit hour Bioprocessing Laboratory, ABE 30400. (Note: 1 credit hour of ABE 30400 is from the former ABE 45400).
3. The Biological Sciences and Biochemistry courses and selectives were expanded to include more options. Students interested in food processing can take food science classes. Those interested in working in the life sciences can take ABE 44000 Cell and Molecular Design principles along with a bioinformatics and biotechnology course. Those who want to work in the pharmaceutical industry can take biochemistry and two pharmacy courses. As noted in the table showing "Credit Hours Required for Graduation", the categories of Chemistry, Biochemistry/Foods and Nutrition, and Biological Sciences and Science sum to 21 credit hours.
4. There is increased flexibility in the semester in which humanities and social sciences courses are taken in order to accommodate the biochemistry, biological sciences, and pharmacy selections that may be made. The revised General Education requirements conform to recent changes made by the colleges of Engineering and Agriculture that incorporate University Core requirements.

Reasons:

1. The credit hour reduction is mandated by the State of Indiana Commission on Higher Education.
2. The decision to replace CHE 37700 and 37800 was based on increased enrollments in the Biological Engineering degree program combined with the desire to develop a "hands on" laboratory course to complement the teaching of Transport phenomena and operations.
3. The increased options in selection of Life Sciences and Biochemistry courses will better prepare students to work in food or biological processing, life sciences, or pharmaceutical industries.
4. The changes in General Education requirements allow the curriculum to conform to the recent core curriculum adopted by the University.

Biological Engineering: Minimum Degree Requirements; Credit Hours Required for Graduation

Courses	Credit Hours	Courses	Credit Hours
Mathematics and Basic Sciences		**Mathematics and Basic Sciences**	
Calculus: MA16500, 16600, 26100, 26500, 26600	18	Calculus: MA16500, 16600, 26100, 26500, 26600	18
Chemistry: CHM 11500, 11600, 25700	12	*Chemistry: CHM 11500, 11600, 25700 (or 25500 and 255001)	12 - 13
Physics: PHYS 17200, 24100	7	Physics: PHYS 17200	4
Biological and Food Sciences		**Biological and Food Sciences**	
Biological Sciences: BIOL 22100, 23000, IT 22600	9	Biological Sciences or Biotechnology: BIOL 11000 and 221 or IT 22600 with Biological Sciences selective and BIOL 23000 or BIOL 23100	8
BCHM 22100 or FN 20500	3	*BCHM 30700 or NUTR 20500 or CNIT 22700 or IT 22700; (option to add BCHM 30900, 1 cr. lab)	2 - 4
Biological or Food Science Selectives	7	*Biological Sciences & Science Selectives	3- 6
Engineering Tools and Skills		**Engineering Tools and Skills**	
ENGR 13100, ENGR 13200, CHE 32000	7	ENGR 13100, ENGR 13200, CHE 32000	7
Professional Development		**Professional Development**	
ABE 29000, 49000	2	ABE 29000, 49000	2
Communication		**General Education:**	
English Composition: ENGL 10600	4	Students must satisfy the requirements of both the College of Engineering's General Education Program and the College of Agriculture's Core. Selections must be chosen from approved lists in accordance with counsel from a faculty advisor. ENGL 10600 and COM 11400 are required, 3 credit hours must be in economics (UCC approved) and 3 must be in the humanities (UCC approved). The remaining credit hours needed to attain the minimum of 24 should be chosen carefully and should also be used to meet College of Agriculture requirements for International Understanding and Multicultural Awareness.	24
Speech: COM 11400	3		
Humanities and Social Sciences General Education Must be chosen in accordance with the approved general education list and the help of a faculty advisor. Of the 18 credit hours, 6 must meet College of Agriculture international understanding requirements, 3 must be an additional communication elective, and 3 must be economics	18		
Core Engineering Courses		**Core Engineering Courses**	
Thermodynamics: ABE 20100, 20200, 30100, 30300	13	Thermodynamics and Bioprocessing: ABE 20100, 20200, 30100, 30300	13
Momentum, Heat and Mass Transfer: CHE 37700, 37800	8	Bioprocessing; Momentum, Heat and Mass Transfer: ABE 30400,30700, 30800	9
Kinetics and Reaction Engineering: ABE 37000	3	Kinetics and Reaction Engineering: ABE 37000	3
Sensors and Process Control: ABE 460000	3	Sensors and Process Control: ABE 460000	3
Transport Processes and Unit operations: ABE 45400, 55500	8	Transport Processes and Operations: ABE 45700, 55700	6

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Plant Design and Economics: ABE 55600	4	Biol. and Food Process Design: ABE 55800	3
Process Engineering: ABE 58000	3	Process Engineering: ABE 58000	3
Technical Elective	3	Technical Elective or Design of Electric Systems (ABE 31400)	3
		Free Elective	1

***The total number of credit hours in these categories sum to 21.**

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

Date: April 1, 2013

APPROVED FOR THE FACULTY
OF THE SCHOOLS OF ENGINEERING
BY THE ENGINEERING
CURRICULUM COMMITTEE

ECC Minutes 9-6-13

Date 10-3-2013

Chairman ECC

BE Plan of Study revisions (BFPE major):

Present				Proposed			
Freshman Year							
First Semester							
(4)	CHM	11500	General Chemistry I				
(4)	ENGL	10600	English Composition I				
(2)	ENGR	13100	Transforming Ideas to Innovation I				No Change
(4)	MA	16500	Plane Analytic Geometry and Calculus I				
(3)			Approved Humanities Selective				
17				**17**			
Second Semester							
(4)	CHM	11600	General Chemistry II				
(3)	COM	11400	Fundamentals of Speech Communications				
(4)	MA	16600	Plane Analytic Geometry and Calculus II				No Change
(4)	PHYS	17200	Modern Mechanics				
(2)	ENGR	13200	Transforming Ideas to Innovation II				
17				**17**			
Sophomore Year							
Third Semester							
(4)	ABE	20100	Thermodynamics of Biological Systems I	(4)	ABE	20100	Thermodynamics of Biological Systems I
(4)	MA	26100	Multivariate Calculus	(4)	MA	26100	Multivariate Calculus
(4)	CHM	25700	Organic Chemistry I	(4)	CHM	25700	Organic Chemistry or Organic Chemistry I 25500 and Organic Chemistry Lab I 25501
(3)	BIOL	23000	Biology of the Living Cell	(4/5)	BIOL	11000	Fundamentals of Biology I or IT 22600 (Biotech. Lab – 2 cr) with 3 cr. BIOL 23000 (Biology of the Living Cell) or BIOL 23100 (Cell Structure & Function)
(2)	IT	22600	Biotechnology Laboratory I				
(1)	ABE	29000	Sophomore Seminar	(1)	ABE	29000	Sophomore Seminar
18				**17/18**			
Fourth Semester							
(3)	ABE	20200	Thermodynamics of Biological Systems II	(3)	ABE	20200	Thermodynamics of Biological Systems II
(3)	CHE	320	Statistical Modeling	(3)	CHE	32000	Statistical Modeling
(3)	BCHM	22100	Analytical Biochemistry or F & N 205 Food Science	(3/4/5)	NUTR	20500	Food Sci. I; or Biochemistry (BCHM 30700) option to add 1 cr. Lab (BCHM 30900); or take Econ. Selective along with Bioinformatics (CNIT 22700) or Biotech. Lab (IT 22700)
(3)	MA	26500	Linear Algebra	(3)	MA	26500	Linear Algebra
(3)	MA	26600	Ordinary Differential Equations	(3)	MA	26600	Ordinary Differential Equations
(3)			General Education Elective	(3/0/0)			Humanities or Social Science Selective
18				**18/16/17**			

Present			Proposed		
Junior Year					
Fifth Semester					
(3)ABE	30100	Modeling. & Cmptnl.. Tools in Bio. Engr.	(3) ABE	30100	Modeling. & Cmptnl. Tools in Bio. Engr.
(3)ABE	30300	App of Phys. Chemistry to Biol. Processes	(3) ABE	30300	App of Phys. Chemistry to Biol. Processes
(4)CHE	37700	Momentum Transfer	(3) ABE	30700	Momentum Transfer
(3)PHYS	24100	Electricity and Optics	(4) BIOL	22100	Introduction to Microbiology or 3 cr Biology Selective
(3)		General Education Elective	(2)		Humanities and Social Sciences Selective
			(1/2)		Free Elective (2 cr. if Biol 23000/23100 taken 3rd semester
16			**16/17**		
Sixth Semester					
(3)ABE	37000	Biol./Microbial Kinetics & Reaction Engr.	(3) ABE	37000	Biol./Microb. Kinetics & React. Engr.
(4)ABE	45400	Transport Processes in Biological and Food Process Systems	(3) ABE	45700	Transport Processes in Biol. & Food Process Systems
(4)CHE	37800	Heat and Mass Transfer	(3) ABE	30800	Heat & Mass Tran. in Food & Biol. Sys.
(4)BIOL	22100	Microbiology	(3) ABE	30400	Bioprocess Engineering Laboratory
(3)		General Education Elective	(3/6)	ABE 314	Design of Electronic Systems; or Humanities & Social Sci. Sel. (can also add HSS Selective to give 18 hrs.)
18			**15/18**		
Senior Year					
Seventh Semester					
(4)ABE	55500	Biol. & Food Processing Unit Operations	(3) ABE	55700	Transport Operations in Food & Biol. Engr. II
(1)ABE	49000	Professional Practice in Agr. & Biol. Engr.	(1) ABE	49000	Professional Practice in Agr.& Biol. Engr.
(4)		Biological or Food Science Selective	(3) ABE	46000	Sensors and Process Control
(3)		Engineering Elective	(3)		Biol., Food Sci. or Pharmacy Selective
(3)		General Education Elective	(3/4)		Written & Oral Communication Selective (can add 1 cr. free elective from 5th sem.)
15			**13/14**		
Eighth Semester					
(3)ABE	58000	Process Engineering of Renewable Resources	(3) ABE	58000	Process Engr. of Renewable Resources
(4) ABE	55600	Biological and Food Process Design	(3) ABE	55800	Process Design for Food & Biol. Systems
(3)ABE	46000	Sensors and Process Controls	(3/2)		Biol., Food Sci., or 2 cr. Pharm. Selective or Cell & Molecular Des. Prin. (ABE 440)
(3)		General Education Elective	(3)		Humanities or Social Sciences or Engineering Selective
(3)		Biological or Food Science Elective	(3)		Humanities or Social Science Selective (300+ level)
16			**15/14**		
Total	**135**		**Total**	**128**	