

**Iowa State University  
College of Engineering  
2009-2011 Catalog Report  
20 November, 2008**

## I. SIGNIFICANT TRENDS

The College of Engineering responded to the need for programs to address the increasing integration of biology with engineering by introducing two new programs in the 2009-2011 ISU Catalog; a bachelors of science degree in Biological Systems Engineering and an undergraduate minor in Bioengineering. Aware of the continuing need for sustainable energy sources, the college also added an undergraduate minor in nuclear engineering. Both minors are only available to students in engineering.

The Biological Systems Engineering (BSE) degree program was developed by the Department of Agricultural and Biological Systems Engineering. The food and biosystems option was removed from the agricultural engineering program and added as an option in biological systems engineering. Three additional options include: bioenvironmental engineering, biorenewable resources engineering, and the pre-professional/pre-graduate option. The latter will have limited enrollment (maximum 25%) and will provide greater flexibility for students. The goal of the Biological Systems Engineering Curriculum is to ensure students graduate with the ability to combine engineering principles with the biological understanding needed in the food, feed, fiber, and environmental sectors.

The Bioengineering (BIOE) minor is a cross-disciplinary undergraduate engineering program developed by the College of Engineering. It is administered by a supervisory committee with representatives from each engineering department. The minor will provide students with additional insight into interactions between engineering disciplines and biological systems, emphasizing new ways of solving biological problems. Students may choose from one of four formal tracks complementing their major discipline, or with the supervision of their advisers and approval of the supervisory committee, they may develop a track individualized to meet their career goals.

The nuclear engineering (NUC E) minor is an inter-institutional minor available to students in the College of Engineering. The minor is administered by a supervisory committee in the Department of Mechanical Engineering. Since the time that the degree program leading to a bachelor of science in nuclear engineering was dissolved at Iowa State University in the 1990's, there has been a renewed interest in utilizing nuclear power to meet the country's energy needs. This minor will give ISU engineering students an opportunity to broaden their understanding of nuclear energy and its applications by participating in a distance education program developed by the Big 12 Engineering Consortium. An existing mechanical engineering course with nuclear engineering topics will now be offered as nuclear engineering (Nuc E) course. Students will earn the remaining required credits by enrolled in Iowa State University Nuc E distance education courses offered through the web by four other participating Big 12 universities which have undergraduate programs in nuclear engineering.

The new courses reported for the college are primarily related to the Bioengineering Minor (net +9 courses) and Nuclear Engineering Minor (net +5 courses). However, the additional Nuclear Engineering courses will be provided as distance education courses by partner institutions in the Big 12 Engineering Consortium. The BSE major required a net increase of 4 new courses and cross-listing of a significant number of existing courses. A significant number of the remaining new courses, related to professional development and/or learning communities within different departments.

Again, the general trend across the college is an increased emphasis on cross-disciplinary collaboration, and increased offering in courses related to engineering/biology and sustainability.

## II. CURRICULA, MAJORS, MINORS ADDED OR DROPPED:

### **Majors Added:**

Biological Systems Engineering (B.S.)

### **Minors Added:**

Bioengineering

Nuclear Engineering

## III. NEW COURSES:

### **Agricultural Engineering**

A E 451/551 Food and Bioprocess Engineering. (3-0). Cr. 3.

### **Aerospace Engineering**

AER E 522 Design and Analysis of Composite Materials. (3-0). Cr. 3.

AER E 545 Advance Experimental Technique for Thermal-Fluid Studies. (3-0). Cr. 3.

### **Bioengineering**

BIOE 201 Introduction to Bioengineering I. (3-0). Cr. 3.

BIOE 202 Introduction to Bioengineering II. (3-0). Cr. 3.

BIOE 325 Systems Biology for Engineering. (3-0). Cr. 3.

BIOE 341 BioMEMS and Nanotechnology. (3-0). Cr. 3.

BIOE 341L BioMEMS and Nanotechnology Laboratory. (0-3). Cr. 1.

BIOE 352 Molecular, Cellular and Tissue Biomechanics. (3-0). Cr. 3.

BIOE 428 Bio Signals and Image Processing. (3-0). Cr. 3.

BIOE 450 Biosensing. (3-0). Cr. 3.

BIOE 450L Biosensing Laboratory. (0-3). Cr. 1.

### **Biological Systems Engineering**

BSE 110. Experiencing Biological Systems Engineering. (0-2) Cr. 1 (\*Variation of A E 110)

BSE 380. Principles of Biological Systems Engineering. (3-0) Cr. 3. S.

BSE 480/580. Engineering Analysis of Biological Systems. (2-2) Cr. 3.

### **Civil Engineering**

C E 105 Introduction to the Civil Engineering Profession. (1-0). Cr. 1.

C E 120 Civil Engineering Learning Community. Cr. R. Repeatable.

C E 205 Economic Analysis and Technical Communication in Civil Engineering. (3-0). Cr. 3.

C E 305 Professional Issues in Civil Engineering. (3-0). Cr. 3.

C E 306 Project Management for Civil Engineers. (2-3). Cr. 3.

C E 411/511 Bioprocessing and Bioproducts. (3-0). Cr. 3.

C E 424/524 Air Pollution. Cr. arr. Repeatable.  
C E 483/583 Pavement Analysis and Design. (3-0). Cr. 3. Nonmajor Graduate Credit.  
C E 556 Transportation Data Analysis. (3-0). Cr. 3.  
C E 563 Experimental Methods in Geo-Engineering. (1-4). Cr. 3.  
C E 576 Environmental Flows. (3-0). Cr. 3.

#### **Construction Engineering**

CON E 121 Cornerstone Learning Community: Orientation to Academic Life. (0-2). Cr. 1.  
CON E 122 Cornerstone Learning Community: Orientation to Professional Life. (0-2). Cr. 1.  
CON E 352 Mechanical Systems in Buildings. (3-0). Cr. 3.  
CON E 353 Electrical Systems in Buildings. (2-0). Cr. 2.

#### **Computer Engineering**

CPR E 294 Program Discovery. Cr. R.  
CPR E 394 Program Exploration. Cr. R.  
CPR E 528 Probabilistic Methods in Computer Engineering. (3-0). Cr. 3.  
CPR E 632 Information Assurance Capstone Design. (3-0). Cr. 3.

#### **Electrical Engineering**

E E 351 Introduction to Energy Systems: An Engineering Perspective. (Cross-listed with E ST.) (3-0).Cr.3.

#### **Engineering Studies**

E ST 490 Independent Study. Cr. 1-3.

#### **Engineering**

ENGR 150 Foundations of Leadership Development and Learning. (1-0). Cr. 1.  
ENGR 490 Independent Study. Cr. 1-3. Repeatable term to term, maximum of 3 credits.

#### **Industrial Engineering**

I E 403/503 Introduction to Sustainable Production Systems. (3-0). Cr. 3.  
I E 571 Occupational Biomechanics. (3-0). Cr. 3.  
I E 577 Human Factors. (3-0). Cr. 3.

#### **Mechanical Engineering**

M E 423 Creativity and Imagination for Engineering and Design. (3-0). Cr. 3.  
M E 450 Engineering Vibrations. (3-0). Cr. 3. Nonmajor Graduate Credit.  
M E 486 Appropriate Technology Design. (3-0). Cr. 3.  
M E 561 Scanning Probe Microscopy. (2-1). Cr. 3.  
M E 563 Micro and Nanoscale Mechanics. (3-0). Cr. 3.

#### **Materials Science and Engineering**

M S E 588 Eddy Current Nondestructive Evaluation. (3-0). Cr. 3. \*(Dual-list Mat E 488)

#### **Materials Engineering**

MAT E 215 Introduction to Materials Science and Engineering I. (3-0). Cr. 3.  
MAT E 215L Introduction to Materials Science and Engineering I - Lab. (0-3). Cr. 1.  
MAT E 216 Introduction to Materials Science and Engineering II. (3-3). Cr. 4.  
MAT E 317 Introduction to Electronic Properties of Ceramic, Metallic, and Polymeric Materials. (3-0). Cr. 3.  
MAT E 425 Glasses and Advanced Ceramics. (2-3). Cr. 3. Nonmajor Graduate Credit.  
MAT E 456 Biomaterials. (3-0). Cr. 3.  
MAT E 488 Eddy Current Nondestructive Evaluation. (3-0). Cr. 3. \*(Dual-list M S E 588)

#### **Nuclear Engineering**

NUC E 401 Nuclear Radiation Theory and Engineering. (3-0). Cr. 3. Nonmajor Graduate Credit.  
NUC E 402 Nuclear Reactor Engineering. (3-0). Cr. 3.

NUC E 405 Radiation Protection and Shielding. (3-0). Cr. 3.  
 NUC E 410 Nuclear Reactor Theory. (3-0). Cr. 3.  
 NUC E 411 Nuclear Reactor Analysis. (3-0). Cr. 3.  
 NUC E 490 Independent Study. Cr. 1-3. Repeatable, maximum of 3 credits.

#### IV. COURSES DROPPED:

##### **Agricultural Engineering**

A E 505I Watershed Modeling and GIS. Cr. 4.  
 A E 480/580. Engineering Analysis of Biological Systems. . (2-2) Cr. 3.

##### **Chemical Engineering**

CH E 539 Fluidized Bed Processes. (3-0). Cr. 3.

##### **Civil Engineering**

C E 104 Civil Engineering Projects. (1-0). Cr. 1.  
 C E 203 Civil Engineering Synthesis I. (2-0). Cr. 2.  
 C E 204 Civil Engineering Synthesis II. (2-0). Cr. 2.  
 C E 303 Professional Issues in Civil Engineering. (2-0). Cr. 2.  
 C E 304 Civil Engineering Project Management. (2-0). Cr. 2.  
 C E 582 Advanced Pavement Analysis and Design. (3-0). Cr. 3.

##### **Construction Engineering**

CON E 110 Introduction to Construction Engineering. (1-0). Cr. 1.  
 CON E 120 Cornerstone Learning Community. (0-2). Cr. 1.  
 CON E 351 Mechanical and Electrical Systems. (3-0). Cr. 3.

##### **Computer Engineering**

CPR E 483 Hardware Software Integration. (3-3). Cr. 4.

##### **Engineering**

ENGR 201 Engineering Transfer Learning Community Seminar. Cr. R.

##### **Mechanical Engineering**

M E 431 Nuclear Radiation Theory and Engineering. (3-0). Cr. 3.  
 M E 539 Fluidized Bed Processes. (3-0). Cr. 3.

##### **Materials Engineering**

MAT E 211 Introduction to Materials Science and Engineering. (4-3). Cr. 5.  
 MAT E 331L Laboratory for the Introduction to Electronic Properties of Materials  
 MAT E 341 Metals Processing and Fabrication. (2-3). Cr. 3.  
 MAT E 394 Principles of Materials Science and Engineering II. (1-3). Cr. 2.  
 MAT E 423 Glass Science and Engineering. (2-3). Cr. 3.  
 MAT E 424 Advanced Ceramic Engineering. (3-0). Cr. 3.

V. NUMBER, CREDIT, AND TITLE CHANGES:

**Agricultural Engineering**

- A E 201 Cross list to: (Cross-listed with BSE, TSM.)  
A E 216 Cross list to: (Cross-listed with BSE.)  
A E 301 Cross list to: (Cross-listed with BSE, TSM.)  
A E 316 Number changed from: 203. Title to: Applied Numerical Methods for Agricultural and Biosystems Engineering.  
A E 401 Cross list to: (Cross-listed with BSE, TSM.)  
A E 415 Cross list to: (Cross-listed with BSE)  
A E 416 Cross list to: (Cross-listed with BSE)  
A E 598 Title to: Technical Communications for a Master's Degree.  
A E 698 Title to: Technical Communications for a Doctoral Degree.

**Aerospace Engineering**

- AER E 422 Title to: Aeroelasticity.

**Civil Engineering**

- C E 360 Title to: Geotechnical Engineering.  
C E 388 Cross list to: (Cross-listed with A E, E E, M E.)  
C E 428 Contact Hrs to: (2-2).  
C E 460 Title to: Foundation Engineering.  
C E 524 Contact Hrs to: 0. Credit Hrs to: Cr. arr.  
C E 594 Credit Hrs to: Cr. arr.

**Electrical Engineering**

- E E 592 Title to: Seminar in Electromagnetics, Microwave, and Nondestructive Evaluation.  
E E 466 Cross list to: (Cross-listed with AER E, CPR E, E E, I E, M E.)

**Engineering Mechanics**

- E M 450 Cross list to: (Cross-listed with M E.)

**Industrial Engineering**

- I E 501 Credit Hrs to: Cr. R.  
I E 601 Credit Hrs to: Cr. R.

**Mechanical Engineering**

- M E 412 Title to: Ethical Responsibilities of a Practicing Engineer

**Materials Engineering**

- MAT E 334 Number changed from: 331. Title to: Electronic Properties of Materials. Contact Hrs to: (2-2).  
MAT E 342 Title to: Structure/Property Relations in Nonferrous Metals.  
MAT E 443 Title to: Physical Metallurgy of Ferrous Alloys.

VI. COURSES ADDED FOR NONMAJOR GRADUATE CREDIT

C E 483  
 M E 428  
 M E 450  
 MAT E 425  
 NUC E 401

VII. COURSES DROPPED FOR NONMAJOR GRADUATE CREDIT

CON E 351  
 CPR E 483  
 M E 431  
 M E 488  
 M E 489  
 MAT E 331L  
 MAT E 341  
 MAT E 423  
 MAT E 424

VIII. SUMMARY OF CHANGES:

*Note: a cross-listed course should be counted only once - with the "primary" department or program. So in Section III New Courses and Section IV Courses Dropped, a cross-listed course should be listed only once.*

Department	New*	Dropped	Number	Credit	Title**
A E	1	2	1	1	10
AER E	2	0	0	0	1
BIOE	9	0	0	0	0
BSE***	3	0	0	0	0
C E	10	6	0	2	3
CH E	0	1	0	0	0
CON E	4	3	0	0	0
CPR E	4	1	2	0	0
E E	1	0	0	0	2
E M	0	0	2	0	1
E ST	1	0	0	0	0
ENGR	2	1	0	0	0
I E	3	0	0	2	0
M E	4	2	0	0	1
M S E	1	0	0	0	0
MAT E	6	6	2	0	3
NUC E****	6	0	0	0	0
S E	0	0	0	0	0
Total College of Engineering	57	22	7	5	21

Notes:  
 \*All dual listed courses are counted as a single course in summary of changes.  
 \*\*Includes addition of new cross-listing for courses.  
 \*\*\*The BSE program will utilize existing courses and cross listed new courses  
 \*\*\*\*Five of 6 new courses in the nuclear engineering minor will be offered through distance education from partner universities within the Big 12 Engineering Consortium.

## **CHANGES SINCE PROPOSED DEPARTMENTAL CHANGES FOR GENERAL REVIEW**

### **Aerospace Engineering**

Changes:

Aer E 261 Title to "Introduction to Performance and Design".

### **Bioengineering**

Courses dropped:

BIOE 402/502 Correction to new courses previously listed.

### **Biological Systems Engineering**

Courses added:

BSE 101 Experiencing Biological Systems Engineering.I (0-2). Cr. 1.

BSE 380 Principles of Biological Systems Engineering . (3-0). Cr. 3.

### **Civil Engineering**

Courses dropped:

C E 517 Analytical Photogrammetry and Geographic Information Systems.

C E 569 Environmental Geotechnology.

### **Mechanical Engineering**

Courses dropped:

M E 428 Analysis and Design of Mechanisms. (3-0). Cr. 3. Nonmajor Graduate Credit. (dropped as a new course)

M E 560 Surface Engineering. (3-0). Cr. 3. (dropped as a new course)

M E 443 Compressed Air Systems.

Designator and number change:

M E 431 To Nuc E 401. Reported above as course dropped and course added.

## **JUSTIFICATION FOR NEW COURSES (ATTACH EXCEL SPREADSHEET)**

### **Process:**

**August 15:** Proposed Changes for General Review report is compiled and available for download.

**September-November:** FSCC begins review and approval of college reports.

**December:** Final approval by the Faculty Senate.

### Summary Table

Department / Program Name	Designator and Course Number	Nonmajor graduate credit		Required in Program		Experimental Offering				<b>Justification for:</b> •courses offered experimentally •not required in a program
		No	Yes	No	Yes	No	Term	Year	Enroll.	
<b><u>Agricultural Engineering</u></b>										
	A E 451/551	x			x	x				Reinstated course. New Faculty available to teach. Dual-list 451/551
<b><u>Aerospace Engineering</u></b>										
	Aer E 522					x	F	05,06	6	Distance Education Course for industry
	Aer E 545						S	07,08	13	For use in new Howe Hall wind tunnel
<b><u>Bioengineering</u></b>										
	BIOE 201				x					Required in program, Bioengineering Minor
	BIOE 202				x					Required in program, Bioengineering Minor
	BIOE 325	x			x					Required in program, Bioengineering Minor
	BIOE 341	x			x					Required in program, Bioengineering Minor
	BIOE 341L	x			x					Required in program, Bioengineering Minor
	BIOE 352	x			x					Required in program, Bioengineering Minor
	BIOE 428	x			x					Required in program, Bioengineering Minor
	BIOE 450	x			x					Required in program, Bioengineering Minor
	BIOE 450L	x			x					Required in program,



										Bioengineering Minor
<b>Biological Systems Engineering</b>										
	BSE 110				x					Required in program, BSE Major. Variation of AE 110 for BSE students
	BSE 380	x			x					Required in program, BSE Major.
	BSE 480/580	x			x					Required in program, BSE Major. Direct replacement for dropped course A E 480/580
<b>Civil Engineering</b>										
	C E 105				x					Required in program, Replacement for dropped course CE 104
	C E 120				x					Required in program, Learning community course
	C E 205				x					Required in program, Remake for dropped course CE 203 204
	C E 305	x			x					Required in program, Remake for dropped course CE 303
	C E 306	x			x					Required in program, Remake for dropped course CE 304
	C E 411/511	x			x					Developed for BIOE minor. Cross list with AE, BioE, BSE and BRT (511 only). Dual-list 411/ 511.
	C E 424/524	x		x						Cross-listed A E, ENSCI 424/524. Dual-list 424/524.
	C E 556			x			S	08	12	Material covers transp. planning beyond normal Stat course
	C E 563				x					For use with new state-of-the-art soil testing equipment (geotech & materials grad students.

	C E 576			x						The proposed course is a fundamental course for the graduate students interested in hydraulics, water resources, and physical transport in environmental engineering.
<b><u>Construction Engineering</u></b>										
	Con E 121				x					Required in program, Replacement for dropped course ConE 120 (Fall)
	Con E 122				x					Required in program, Replacement for dropped course ConE 120 (Spring)
	Con E 352	x			x					Required in program, Replacement for dropped course ConE 351.
	Con E 353	x			x					Required in program, Replacement for dropped course ConE 351.
<b><u>Computer Engineering</u></b>										
	Cpr E 294				x					Required in program, Cross listed E E 294
	Cpr E 394	x			x					Required in program, Cross listed E E 394
	Cpr E 528						F	07	12	Fill gap in the curriculum on the use of probability in designing discrete algorithms, and for graduate students whose research involves the design and implementation of novel algorithms.
	Cpr E 632				x			S08	5	Cross listed INFAS 632. Replaces final oral for INFAS MS distance students
<b><u>Electrical Engineering</u></b>										

	E E 351	x				S	08	13	Cross-list E St 351. Developed for E St minor courses.
<b>Engineering Studies</b>									
	E St 490	x						NA	To allow for independent topics in Engineering Studies minor.
<b>Engineering</b>									
	Engr 150			x		x	F,S	07,08	15+ ea. For ELP (leadership) program
	Engr 490	x				x		NA	Colleges participating in the Entrepreneurship interdisciplinary minor in the College of Business must identify a 490 independent topics course for students.
<b>Industrial Engineering</b>									
	I E 403/503	x		x			S	07	13 Sustainability concepts not covered in traditional courses. Dual-listed 503
	I E 571			x					New faculty member with expertise in physical ergonomics, and requires course for graduates in occupational biomechanics
	I E 577			x		NA			New faculty hire with expertise in human performance in systems, therefore course reactivated from 05 catalog
<b>Mechanical Engineering</b>									
	M E 423	x		x			S	07	25 New approach to conceptual design.
	M E 486	x		x			F	08	32 Design approach for 3rd world countries.

	M E 561			x			F	08	13	Course has been offered twice and the department will continue support for the course.
	M E 563			x			F	07	14	Complement the small number of nanotechnology related courses , offered successfully as an X course and the department will continue to support the course.
<b>Materials Science and Engineering</b>										
	M S E 588 (See Mat E 488)									(see below)
<b>Materials Engineering</b>										
	Mat E 215				x					Required in program, Replacement for dropped course Mat E 211 (5 cr.)
	Mat E 215L				x					Required in program, Replacement for dropped course Mat E 211 (5 cr.)
	Mat E 216				x					Required in program, Replacement for dropped course Mat E 211 (5 cr.)
	Mat E 317	x			x					Required in program, Serves need for increase in core topics
	Mat E 425		x		x					Required in program, Serves need for increase in core topics
	Mat E 456/556	x		x			S	08	??	Large enrolment in important and emerging field
	Mat E 488/MSE 588	x		x			F	08	8	Cross-listed with E E 488/588. Developed for use for NDE minor. Dual-list MSE 588.
<b>Nuclear Engineering</b>										
	Nuc E 401				x					Required in program, Nuclear Engineering Minor, Direct

										replacement for dropped ME 431
	Nuc E 402				x					Required in program, Nuclear Engineering Minor, Off campus Distance Ed. Course supported by Engineering Consortium.
	Nuc E 405				x					Required in program, Nuclear Engineering Minor, Off campus Distance Ed. Course supported by Engineering Consortium.
	Nuc E 410				x					Required in program, Nuclear Engineering Minor, Off campus Distance Ed. Course supported by Engineering Consortium.
	Nuc E 411				x					Required in program, Nuclear Engineering Minor, Off campus Distance Ed. Course supported by Engineering Consortium.
	Nuc E 490				x					Required in program, Nuclear Engineering Minor, Off campus Distance Ed. Course supported by Engineering Consortium.