EP.06.10

PROPOSAL TO THE SENATE COMMITTEE ON EDUCATIONAL POLICY

TITLE OF THE PROPOSAL:

Addition of a Concentration in Biomolecular Engineering within the B.S. in Chemical Engineering

SPONSOR:

Daniel W. Pack, Associate Professor, Department of Chemical and Biomolecular Engineering
Phone: 244-2816; email: dpack@uiuc.edu

BRIEF DESCRIPTION:

The Department of Chemical and Biomolecular Engineering proposes to establish a concentration in Biomolecular Engineering to be offered under the existing B.S. in Chemical Engineering. The new curriculum builds upon the traditional principles of chemical engineering, but specializes in biological and biotechnological systems in order to better prepare students who seek employment in the food, pharmaceutical, and biotechnology industries. The concentration will differ from the standard curriculum in three aspects:

- Introductory Biochemistry (MCB 450) replaces a second semester of Organic Chemistry (CHEM 436)
- 9 h of "Biomolecular Engineering" required, to be chosen from courses such as CHBE 471, 472, 473 or 474.
- 6 h (of remaining 9 h of technical electives) must be "bio"-technical electives.

JUSTIFICATION:

Chemical Engineering has undergone rapid changes in response to the shifting needs of the chemical process industry. The fraction of our graduates hired into the petrochemical industry has not grown in recent years while the fraction going into the food, pharmaceutical and biotechnology industries is growing tremendously. These industries clearly value the education imparted through the traditional chemical engineering curriculum, but the increased emphasis on applications of chemical engineering principles to biological processes, afforded by the proposed concentration, will better prepare chemical engineering students for this growing job market.

Given the foundation of the proposed Biomolecular Engineering concentration in the principles of chemical engineering, this degree will prepare students for very different job markets in comparison to the Bioengineering program offered within the College of Engineering.

BUDGETARY AND STAFF IMPLICATIONS:

a. Additional staff and dollars needed.
None. The additional courses will be taught by current faculty.

b. Internal reallocations (changes in class size, teaching loads, student-faculty ratio, etc.)
We expect that overall changes in enrollment in the department will be small. Rather, we anticipate that a fraction of our existing students will choose the BmE concentration. All of the courses required to implement the concentration are currently being taught within our department

c. Effect on course enrollments in other departments and explanations of discussions with representatives of those departments.
Students opting for the Biomolecular Engineering concentration will be required to take MCB 450. However, this class is currently an elective chosen by many of our students; approximately 20-30 Chemical Engineers enroll in MCB 450 each year (total enrollment in MCB 450 is ~600 per year). Thus the Biomolecular Engineering concentration is expected to have only minor impact on this class. We have discussed this change with representatives of MCB who have given their approval (see attached).

d. Impact on library, computer use, laboratory use, equipment, etc.
None

GUIDELINES FOR UNDERGRADATE EDUCATION:

The proposed Biomolecular Engineering concentration will meet the UIUC Guidelines for Undergraduate Education as effectively as the existing B.S. in Chemical Engineering. The concentration is designed to better prepare chemical engineering students for careers in the food, pharmaceutical, personal care, and biotechnology industries, while maintaining the deep scientific and engineering training inherent in the Chemical Engineering degree.

CLEARANCES:

Daniel W. Pack, Sponsor — Date 9/14/05

Chemical and Biomolecular Engineering — Date 9/19/05

College of Liberal Arts and Sciences — Date 9/23/05

PROPOSED EFFECTIVE DATE: Fall 2006

STATEMENT FOR PROGRAMS OF STUDY CATALOG:

CHEMICAL AND BIOMOLECULAR ENGINEERING

www.scs.uiuc.edu/chem_eng

Students may pursue chemical engineering by one of two concentrations (Chemical Engineering concentration or Biomolecular Engineering concentration).

The chemical engineering concentration is designed to prepare students for careers in the chemical, food, energy, pharmaceutical, semiconductor processing, personal care, fiber and materials industries where chemical processes are coupled with heat, mass, and momentum transfer. The Biomolecular Engineering concentration builds upon the traditional principles of chemical engineering, but specializes in biological and biotechnological systems in order to better prepare students who seek employment in the food, pharmaceutical, and biotechnology industries.

The curriculum is arranged in a flexible manner to permit students to use their elective hours and to substitute courses in order to arrange programs incorporating various specific areas of chemical engineering or interdisciplinary areas. For example, sequences can be set up in conjunction with the student's adviser to emphasize environmental engineering, bioengineering, food science, computer science, or one of many other concentrations. It will be advantageous to the student to plan course sequences with an adviser as early in the student's academic career as possible.

The program emphasizes fundamentals required to develop models for the design, control, and operation of chemical processes. Students entering without adequate preparation in mathematics and chemistry may find it difficult to complete the chemical engineering curriculum in four years. A typical program, including all required courses and electives, is shown below. Individual students may vary the order in which the various courses are taken to suit their individual needs. However, care must be exercised in scheduling to ensure that necessary course prerequisites are met.

Major in Specialized Curriculum in Chemical Engineering

Students must select one concentration.

Chemical Engineering Concentration

E-mail: chemeng@uiuc.edu

Degree title: Bachelor of Science in Chemical Engineering

Students in the chemical engineering concentration must maintain a 2.5 general average, excluding military training in order to be accepted by the department as juniors and seniors.

For information regarding the cooperative education program and internships in the School of Chemical Sciences, see the Chemistry major in the Science and Letters curriculum.

General education: All campus general education requirements must be satisfied.

Minimum hours required for graduation: 129 hours including 16 hours of approved general education courses. This must include at least six hours in Social or Behavioral Sciences and at least six hours in Literature and the Arts or Historical and Philosophical Perspectives. Students must satisfy the distribution requirements in Western and Non-Western Cultures.

Departmental distinction: A student is recommended for departmental distinction on the basis of grade point average and work presented in CHBE 499-Senior Thesis.

First Year

Hours	First Semester
3	CHEM 202[1]–Accelerated Chemistry I
1	CHEM 203–Accelerated Chemistry Lab I
5	MATH 220–Calculus I
4	RHET 105 or 108–Composition I writing requirement
3	Elective[2,3,4]
16	Total

Hours	Second Semester
1	CHBE 121–CHBE Profession
3	CHEM 204–Accelerated Chemistry II
2	CHEM 205–Accelerated Chemistry Lab II
3	CS 101–Intro to Computing, Eng & Sci
3	MATH 230–Calculus II
4	PHYS 211–Univ Physics, Mechanics
16	Total

Second Year

Hours	First Semester
3	CHBE 221–Principles of CHE
4	CHEM 236–Fundamental Organic Chem I
2	CHEM 237–Structure and Synthesis
3	MATH 242–Calculus of Several Variables[5]

4	PHYS 212–Univ Physics, Elec & Mag
16	Total

Hours	Second Semester
4	CHBE 321–Thermodynamics
3	CHEM 436[6]–Fundamental Organic Chem II
2	MATH 225[7]–Introductory Matrix Theory
3	MATH 385[8]–Intro Differential Equations
2	PHYS 214–Univ Physics, Quantum Phys
3	Electives[2,3,4]
17	Total

Third Year

Hours	First Semester
4	CHBE 421–Momentum and Heat Transfer
2	CHEM 315–Instrumental Chem Systems Lab
2	CHEM 420–Instrumental Characterization
4	CHEM 442–Physical Chemistry I
3	Electives[2,3,4]
15	Total

Hours	Second Semester
4	CHBE 422–Mass Transfer Operations
4	CHEM 444–Physical Chemistry II
3	CHBE 424–Chemical Reaction Engineering
6	Electives[2,3,4]
17	Total

Fourth Year

Hours	First Semester
4	CHBE 430–Unit Operations Laboratory
4	CHBE 440–Process Control and Dynamics
9	Electives[2,3,4]
17	Total

Hours	Second Semester
4	CHBE 431–Process Design
11	Electives[2,3,4]
15	Total

1. Students who do not place into CHEM 202, or who do not satisfy the mathematics prerequisite for CHEM 202, may substitute the sequence CHEM 102, 103, 104, 105, 222, and 223 for CHEM 202, 203, 204, and 205.
2. All Campus General Education requirements must be satisfied, including those in approved course work in the Humanities/Arts, Social/Behavioral Sciences, and Cultural Studies, including the Western, Non-Western and/or U.S. Minorities components. The requirements for the Campus General Education categories Natural Sciences/Technology, Quantitative Reasoning I and II, and Composition I and II are fulfilled through required course work in the curriculum.
3. Three semesters of college credit in one foreign language is required. Three years of high school credit in one foreign language are equivalent to three semesters of college credit.
4. Students must take at least 18 hours of approved technical electives in areas of engineering science. Students may obtain a current list of courses that may be used to satisfy this requirement in Room 209 RAL. Distribution requirements for these 18 hours are:
a) At least 9 hours must be in 400-level courses and the remaining can be any level.
b) At least 6 hours must be in 400-level Chemical engineering courses.
c) At least 3 hours must be in 400-level chemical engineering courses other than CHBE 499.
5. MATH 243 (4 hours) may be substituted for MATH 242 (3 hours). The additional credit hour earned for MATH 243 will be counted as a technical elective hour.
6. MCB 450 may be substituted for CHEM 436.
7. MATH 415 (3 hours) may be substituted for MATH 225 (2 hours). The additional credit hour earned for MATH 415 will be counted as 400-level technical elective hour. Students electing to take MATH 415 in place of MATH 225 should be sure they meet the prerequisites for MATH 415.
8. MATH 441 may be substituted for MATH 385. MATH 386 (4 hours) may be substituted for MATH 385. The additional credit hour earned for MATH 386 will be counted as a technical elective hour.

Biomolecular Engineering Concentration

Students in the Biomolecular Engineering concentration must maintain a 2.5 cumulative grade-point average, excluding military training in order to be accepted by the department with junior and senior level standing.

For information regarding the cooperative education program and internships in the School of Chemical Sciences, see the Chemistry major in the Science and Letters curriculum.

E-mail: chemeng@uiuc.edu

Degree title: Bachelor of Science in Chemical Engineering

General education: All campus general education requirements must be satisfied.

Minimum hours required for graduation: 129 hours including 16 hours of approved general education electives. This must include at least six hours in social perspectives or behavioral sciences and at least six hours in literature and the arts or historical and philosophical perspectives. Students must satisfy the distribution requirements in Western and Non-Western Cultures.

Departmental distinction: A student is recommended for departmental distinction on the basis of grade point average and work presented in CHBE 499-Senior Thesis.

Admission requirements: Admission requirements are the same as for the Chemical Engineering concentration. Students will have the choice of selecting the Biomolecular Engineering concentration at any time.

First year

HOURS	FIRST SEMESTER
3	CHEM 202[1]-Accelerated Chemistry I
1	CHEM 203-Accelerated Chemistry Lab I
5	MATH 220-Calculus I
4	RHET 105 or 108-Composition I writing requirement
3	Elective [2,3,4]
16	Total

HOURS	SECOND SEMESTER
1	CHBE 121-CHBE Profession
3	CHEM 204-Accelerated Chemistry II
2	CHEM 205-Accelerated Chemistry Lab II
3	CS 101-Intro to Computing, Eng & Sci
3	MATH 230-Calculus II
4	PHYS 211-Univ Physics, Mechanics
16	Total

Second year

HOURS	FIRST SEMESTER
3	CHBE 221-Principles of CHE
4	CHEM 236-Fundamental Organic Chem I
2	CHEM 237-Structure and Synthesis
3	MATH 242-Calculus of Several Variables[5]
4	PHYS 212-Univ Physics, Elec & Mag
16	Total

HOURS	SECOND SEMESTER
4	CHBE 321- Thermodynamics
3	MCB 450-Introductory Biochemistry
2	MATH 225[6]-Introductory Matrix Theory
3	MATH 385[7]-Intro Differential Equations
2	PHYS 214-Univ Physics, Quantum Phys
3	Elective[2,3,4]
17	Total

Third year

HOURS	FIRST SEMESTER
4	CHBE 421-Momentum and Heat Transfer
2	CHEM 315-Instrumental Chem Lab
2	CHEM 420-Instrumental Characterization
4	CHEM 442-Physical Chemistry I
3	Elective[2,3,4]
15	Total

HOURS	SECOND SEMESTER
4	CHBE 422-Mass Transfer Operations
4	CHEM 444-Physical Chemistry II
3	CHBE 424-Chemical Reaction Engineering
3	Biomolecular Engineering Elective[8]
3	Elective[2,3,4]
17	Total

Fourth year

HOURS	FIRST SEMESTER
4	CHBE 430-Unit Operations Laboratory
4	CHBE 440- Process Control and Dynamics
6	Electives[2,3,4]
3	Biomolecular Engineering Elective[8]
17	Total

HOURS	SECOND SEMESTER
4	CHBE 431-Process Design
8	Electives[2,3,4]
3	Biomolecular Engineering Elective[8]
15	Total

1. Students who do not place into CHEM 202, or who do not satisfy the mathematics prerequisite for CHEM 202, may substitute the sequence CHEM 102, 103, 104, 105, 222, and 223 for CHEM 202, 203, 204, and 205.

2. All Campus General Education requirements must be satisfied, including those in approved course work in the Humanities/Arts, Social/Behavioral Sciences, and Cultural Studies, including the Western, Non-Western and/or U.S. Minorities components. The requirements for the Campus General Education categories Natural Sciences/Technology, Quantitative Reasoning I and II, and Composition I and II are fulfilled through required course work in the curriculum.

3. Three semesters of college credit in one foreign language is required. Three years of high school credit in one foreign language are equivalent to three semesters of college credit.

4. Students must take at least 9 hours of technical electives in areas of engineering science. At least 6 hours must be from the list of Bio-technical Electives. Students may obtain a current list of courses that may be used to satisfy this requirement in Room 209 RAL.

5. MATH 243 (4 hours) may be substituted for MATH 242 (3 hours). The additional credit hour earned for MATH 243 will be counted as a technical elective hour.

6. MATH 415 (3 hours) may be substituted for MATH 225 (2 hours). The additional credit hour earned for MATH 415 will be counted as 400-level technical elective hour. Students electing to take MATH 415 in place of MATH 225 should be sure they meet the prerequisites for MATH 415.

7. MATH 441 may be substituted for MATH 385. MATH 386 (4 hours) may be substituted for MATH 385. The additional credit hour earned for MATH 386 will be counted as a technical elective hour.

8. Students must take at least three "Biomolecular Engineering" courses offered by the Department of Chemical and Biomolecular Engineering (for example, including CHBE 471, 472, 473, and 474). Students may not count both CHBE 472 and 473 toward meeting this requirement. Students may obtain a current list of courses that may be used to satisfy this requirement in Room 209 RAL.