

***UNIVERSITY OF MISSOURI-COLUMBIA***

***DEPARTMENT  
OF  
CHEMICAL ENGINEERING***

***UNDERGRADUATE HANDBOOK***

***2008-09***

For further information, contact:

Dr. Paul Chan, Director of Undergraduate Studies  
Department of Chemical Engineering  
University of Missouri-Columbia  
Columbia, MO 65211  
(573) 882-7684

[chanp@missouri.edu](mailto:chanp@missouri.edu)

<http://che.missouri.edu>

*The Chemical Engineering Profession*

Chemical Engineering deals with the application of scientific and engineering principles to the production of chemicals. The general purpose is to make products of high quality, safely and profitably. In so doing, chemical engineers use methods which are unfamiliar to chemists but which require a strong background in chemistry. Chemical engineers may become process supervisors in industry, go into technical sales, design factories in part or in whole, do research and development, and often have the opportunity for promotion into management. Traditional employers of chemical engineers include the petroleum, chemical, paper, food and utilities industries.

Chemical engineers have always been at the forefront in solving society's technical problems. For example, important current issues such as air and water pollution control, alternative energy sources, waste minimization and energy conservation have been the domain of chemical engineers for the past thirty years. While chemical engineers will continue to address the needs of the chemical and allied industries, the current trend sees the involvement of chemical engineers in the development of new technologies of an interdisciplinary nature. Recent advances in areas such as microelectronics, genetic engineering, composite materials, pharmaceuticals and biomedical engineering would not have been possible without the participation of chemical engineers.

Because of their broad background in mathematics, physics, and chemistry, as well as in engineering practice, chemical engineers are exceptionally versatile professionals who can fit into several different areas. Consequently the average salary of chemical engineers is the highest among engineering disciplines. Many chemical engineers use the flexibility of their degree to enter other fields such as business, law and medicine. Others start their own companies after a few years of industrial experience.

### *Chemical Engineering at the University of Missouri-Columbia*

The Chemical Engineering program at MU is about medium-sized among the Big Twelve schools, with approximately 40 B.S. graduates per year. The department was established in 1903. It was nationally accredited in 1940, the first in the state and the fifth west of the Mississippi, and has been continuously accredited ever since. It has the first student chapter of the American Institute of Chemical Engineers (AIChE), and participates in the first chapter of Tau Beta Pi (engineering honor society), both within the state. The 50th Chapter of Omega Chi Epsilon (chemical engineering honorary society) was established in 1991.

The Department is located on a campus that has many different academic programs. As a result, all the courses taken by our students are offered to majors in that field. The variety of intellectual disciplines to which our students are exposed helps broaden their outlook, both professionally and culturally.

The Accrediting Board for Engineering and Technology (ABET) and the AIChE periodically review all chemical engineering curricula for accreditation. Thus, all accredited programs tend to have much in common. Where they differ is in the individual attention paid to students, in the quality of the teaching staff, and in the breadth of education received. At MU we strive to excel in all areas. For example, we pride ourselves in the fact that the success rate of our students taking the Fundamentals of Engineering (FE, formerly EIT)

examination is considerably higher than the state average. We believe that fact to be due to the long-term quality of our program, the high ability of the students, and the commitment of the faculty.

Besides the standard curriculum, the MU Chemical Engineering Department also offers special emphasis areas in biochemical engineering, environmental engineering, and materials engineering. The biochemical engineering emphasis was originally designed in 1984 to prepare students to enter the growing biochemical industry, but has turned out to be also an exceptionally strong pre-medical degree program. Similarly, the environmental engineering emphasis was introduced in 1991, in response to growing demand in industry for chemical engineering graduates who are prepared to work on environmental issues such as waste minimization, pollution control, and waste management. The newest emphasis, materials engineering, was developed several years ago as a consequence of existing faculty expertise, and the constant demand for our graduates to work in this area. Students in these emphasis areas typically take a slightly heavier course load than other students, so enhancement happens not at the expense of the core program. Upon graduation, participants in these programs are prepared to work in their specialty areas as well as in traditional chemical engineering areas.

The standard chemical engineering program can also be modified by careful selection of humanities, social studies, and elective courses to prepare for careers in management, law, and so on. Minors in mathematics and chemistry are also popular.

The department encourages participation of students in the co-op and internship programs of the college. With suitable planning and guidance, co-op students (those who alternate semesters working in industry and attending MU) can usually finish their program of study without additional delays. Participation in these programs is known to be extremely valuable to the students' job opportunities at graduation. Typically, students who are in the top half of their graduating class, have some co-op or internship experience, and have developed good leadership abilities and oral and written communication skills are the ones most sought after by employers.

### Chemical Engineering Staff

#### 1. Faculty

Matthew Benards (University of Washington)	W2033	882-4877
Paul Chan (Cal. Inst. of Tech.) Dir. of Undergraduate Studies	W2029	882-7684
John Gahl (Texas Tech) Interim Chair & Dir. of Graduate Studies	W2033A	882-4877
William Jacoby (Colorado) Joint Appt with BE	W2027	882-5037
Stephen Lombardo (California-Berkeley) Joint Appt with MAE	W2025	884-1644
Thomas Marrero (Maryland)	W2015	882-3802
David Retzloff (Pittsburgh)	W2026	882-4036
Galen Suppes (Johns Hopkins)	W1013	884-0562
Qingsong Yu (Missouri) Joint Appt with MAE	W2010	882-8076

#### 2. Staff

Stacy Bono, Administrative Associate	W2033	882-4877
--------------------------------------	-------	----------

### Student Advising

Advising of students can be classified into three categories: academic, career and personal. Clearly, part of the faculty's mission is to provide students with academic and career advisement. In personal matters, you may or may not be comfortable discussing your problems with the departmental faculty. In general, the faculty is willing to help whenever possible, but it must be remembered that we are not trained in personal counseling. Therefore, in crisis situations, professional assistance is strongly recommended. On the other hand, the advisor must be made aware when personal problems are having detrimental effects on academic performance.

The department maintains a file on each student and a curriculum check sheet is updated at the end of each semester. The Director of Undergraduate Studies monitors the progress of each student towards graduation. Students are encouraged to examine their own files regularly to make sure that records are accurate. Because of the relative small size of the department, and for the purpose of uniformity, all students are currently advised by Dr. Chan (Director of Undergraduate Studies). However, if you cannot get the advising you need, feel free to seek out other faculty members for academic advice.

For Early Registration, each student should find his or her “appointment time” assigned by myZou. This appointment time is the time after which a student will be allowed to register. Prior to registration, all engineering students need the academic advisor’s approval of course selections. It is suggested that you sign up to see your advisor at a time slightly earlier than the “appointment time”, using the sign-up sheets outside the advisor’s office. After you have discussed course selections with your advisor, you will be able to enter course selections directly from his computer terminal.

Career advisement may also be obtained through the academic advisor. However, depending on the career goal, there may be other departmental faculty who is more suitable. Students who are interested in these areas should seek out the appropriate departmental faculty and obtain guidance as needed. The following is a partial list:

Catalysis	Jacoby
Environmental	Jacoby, Marrero
Electronics and semiconductors	Retzloff, Gahl
Biochemical and biomedical	Suppes
Polymers	Yu
Renewable Energy	Jacoby
Materials	Lombardo, Gahl
Medical school	Chan
Graduate school	Chan, Gahl

### Chemical Engineering Curriculum

#### 1. Introduction

The Chemical Engineering curriculum is designed to provide a professional-level education to our graduates. In doing so it must conform to requirements placed on it by a number of institutions:

The State of and University of Missouri  
The Accrediting Board for Engineering and Technology  
The American Institute of Chemical Engineers

Within the constraints imposed, several different curricula have been developed. These include the standard chemical engineering program for the majority of students, and the biochemical, environmental and materials engineering emphasis areas for students with special interests. Sample curricula are included in this document. All programs are subject to change. When changes are made to improve the quality of the curriculum, they will be implemented immediately unless the changes would cause hardship on students already in the program.

## 2. Summary of Graduation Requirements

Total Hours	129 hours for standard program, more for special emphasis areas. Honors students may use 6 hours of graduate credit to reduce the undergraduate hours to 123. (See the Engineering section of the Undergraduate Catalog).
Math Science	16 hours beyond trigonometry. These include Math 1500, 1700, 2300, 4100.
Basic Sciences	33 hours required. Chem 1310, 1320, 1330, Phys 2750, 2760, plus 15 hours of advanced chemistry, usually Chem 2100, 2110, 2130, 3200, and an advanced chemistry elective.
Engineering Science and Design	50 hours required. These include six hours of approved chemical engineering science electives.
Humanities and Social Sciences	9 hours minimum in each category. These must include (see the Engineering section of the Undergraduate Catalog): i) an upper level course in either category, ii) a course in economics, iii) a course satisfying the state law on constitution study (normally chosen from Hist 1100, 1200, 1400, PolSc 1100, 1700).
Others	12 hours total. These include Engl 1000, statistics elective (Stat 4710 or ChE 4270), technical elective (may not be used to fulfill Math minor), and general elective (Comm 1200 strongly recommended).

## 3. Grade Point Average and Other Requirements

i. A minimum GPA of 2.00 is required in all UM engineering courses. When courses are repeated, only the last grade will be counted for this purpose. Furthermore, a grade of C or better is required in ChE 2225. These requirements are in addition to the 2.00 UM GPA requirement imposed by the Board of Curators.

ii. No chemical engineering student enrolled on this campus shall be allowed to transfer, for credit toward the chemical engineering degree, course work taken simultaneously elsewhere. Also, no transfer credits shall be awarded for any course work taken outside Missouri with a grade lower than C. There are no time limitations on transfer credits, specifically, transfer credits are allowed even if a student has accumulated more than 60 hours at MU.

iii. No student shall be permitted hearer status in a required course before taking it for credit. Also, no chemical engineering student shall be permitted to choose the Satisfactory/Unsatisfactory grading option in a required course specified by number (e.g. Math 1500, Chem 3200).

### Common Questions and Answers

1. *A course that I took before I transferred to MU has a different number of credit hours from the corresponding one offered at MU. What is the policy?*

Generally, you do not have to retake the course if it is only one hour less than what is offered at MU. For example, if you took Calculus I for 4 credit hours, you may proceed to Calculus II (Math 1700). However, if you end up with insufficient hours in that ABET category (Math in this case), you may need to take additional courses to make up the deficit. On the other hand, if the course is for more hours than its MU equivalent, all the hours will be accepted for credit, although the extra hours cannot be used to substitute for a more advanced course.

2. *Are the prerequisites for all courses enforced?*

No. The prerequisites are listed for informational purposes only. You can usually attempt classes without the specified prerequisites, but you do so at your own risk. Occasionally, an instructor may choose to enforce the prerequisites for his/her class. Also, for Math, Chemistry and Physics courses, grades of C or better are often required in order to proceed to the subsequent courses.

Along the same line, you are not forced to follow every suggestion made by your advisor. The fact that the advisor's signature appears on a registration form means that the advisor has seen the proposed course load; it is not necessarily an endorsement. In fact, quite often an advisor will choose to note his objection in your file.

3. *I did not make a C in ChE 2225. What are the consequences?*

ChE 2225 is the most basic course in the chemical engineering curriculum. The fact that you had difficulty in this course suggests that you may have similar difficulties in subsequent chemical engineering courses. You are urged to visit your advisor to discuss your situation.

Departmental rule requires that you repeat ChE 2225 if you did not make a C. In some cases, your choice of courses to take during the semester when you repeat ChE 2225 may be very limited. However, you are strongly advised against taking other ChE courses in that same semester, but once again, it is your right to reject sensible advice. You should at least talk to the course instructor if you wish to proceed.

4. *How many students actually complete the B.S. program in 4 years?*

Among regular program students, the percentage is roughly one third of the graduating class. Most of these students had Advanced Placement credits or took summer courses. It is important for you to realize that whether or not you graduate in four years is of little significance to a prospective employer. The important considerations are GPA, job experience, and leadership and communication skills.

5. *Should I take any of the three emphasis areas? What are the advantages and disadvantages? Do I need approval to go into (or get out of) these emphasis areas?*

In general, the emphasis areas are for students who are looking for the extra challenge. Participants should already be doing well in math, physics, chemistry and engineering. If a student is struggling, he/she should concentrate on improving the performance in the core courses (or look for another major), but should not take on additional challenges which will likely do further damage to his/her GPA.

There is no need to declare your intentions before the end of the third semester, since there is no difference between the various programs up to that point. To declare after the fourth semester, you simply indicate to the advisor what you plan to do. No approval is needed to go in or to get out. If you declare biochemical, your assigned advisor will be switched to Prof. Darcy.

6. *I am just a freshman taking Mathematics, Chemistry and Physics. I don't even know if I will be staying with this major. Why should I waste my time going to the professional meetings or participating in other activities?*

You have just proved why you should go to these meetings! If you are not sure about chemical engineering, these meetings can help you decide. Also, the department offers the course "Introduction to Chemical Engineering". If you do not know enough about the discipline, you can find out in this class. Besides learning some of the basic chemical engineering principles, you will also hear presentations from industry speakers and upperclassmen that have gone through what you are going through. Someone may even give you suggestions on how to get an internship!

7. *It seems that I have signed up for too many credit hours. What should I do?*

Talk to your advisor. As long as the drop deadline has not passed, you will have the option of dropping some classes. Note that there are several types of drops. If you drop a class before the fifth week, it will not appear on your record. From fifth week to tenth week, you will be assigned a grade of W or F. From the tenth week to stop day, you may withdraw from the university. In general, these deadlines are followed very rigidly and it is not possible to obtain backdated drops.

A common misconception among students is that their advisors will not allow them to drop classes. While it is not good to have a pattern of W's on a transcript, most advisors understand that occasionally students will "bite off more than they can chew", and that although W's do not look good, D's and F's are much, much worse. Good advisors, however, will point out that there may be delays in later semesters if the students are dropping key classes in the curriculum.

8. *I have been put on probation. What should I do?*

Take the initiative and talk to your advisor and/or the Director of Undergraduate Studies. If you are a freshman or sophomore, this usually means that you need to repeat a course in Math, Physics or Chemistry. It is much easier to make schedule changes immediately than to wait until the start of the next semester.

In general, do not try to take an excessive load while you are on probation. On the other hand, you are required to maintain a full time course load, unless you are working more than 20 hours per week. Options are available if you really need to drop a class in the middle of the semester. Your advisor will be able to help you.

It is not possible for a student who is on probation to change divisions. Therefore, even if the student has decided to get out of engineering, he/she must remain in this division and clear probation before transferring out. College of Engineering rules do not allow any student to take two consecutive semesters of "non-engineering" courses, but it is permissible to have one such semester, then transfer out as soon as probation is cleared. Students who have cleared probation but fail to process their transfers in a timely manner may have their registrations cancelled by the Dean's Office.

9. *I have been dismissed. What should I do?*

Re-examine your career goals. If you still want to pursue a degree in chemical engineering, talk to the Director of Undergraduate Studies. He will explain to you the procedure for a petition to the Academic Appeals Committee and give you his evaluation of your chance of being readmitted into the college.

### *Undergraduate Research Opportunities*

The department encourages the participation of undergraduate students in research. This can be done by registering in ChE 4995 for honors students (over 3.0 GPA) or in ChE 4990 for others. A maximum of three credits from research may count as "Approved chemical engineering elective". To participate, a student will approach a faculty member of his/her choice. A project may be selected upon mutual agreement between the student and the research advisor. Upon completion of the required work, "honors scholars" will present a thesis to be approved by two faculty members (including thesis advisor). A bound copy of the thesis must be submitted to the department. There is no thesis requirement for ChE 4990 students.

The departmental faculty actively participate in research. Projects that have been attractive to undergraduate students in the past include bioprocessing and bioremediation

(Prof. Suppes), materials science (Prof. Lombardo), environmental catalyses (Prof. Jacoby), environmental engineering (Prof. Marrero), and polymeric processes (Prof. Yu).

Students are encouraged to present their research at professional meetings. A suitable forum is the AIChE Regional Meeting held every year around March, usually at one of the former Big Eight schools. There is a paper contest for these presentations and stipends are available for students who are committed to entering the competition.

### *Professional and Honorary Societies*

1. American Institute of Chemical Engineers (AIChE). This is the professional society in chemical engineering. Students may participate as student members through the national organization, and also more directly as members of the student chapter on campus. The local chapter meets about once a month, usually including on the agenda a brief business meeting, followed by an industry speaker, and finishing with refreshments (trip to Shakespeare's Pizza is typical). The local chapter also organizes field trips to area industries, and sends representatives to regional and national meetings. The chapter often subsidizes expenses of chapter officers and students who present papers at these meetings. For 2008-2009, Peter Cosgrove ([PHCHW6@mizzou.edu](mailto:PHCHW6@mizzou.edu)) is the chapter president. Faculty advisor is Dr. Chan.
2. Omega Chi Epsilon ( $\Omega\chi\epsilon$ ). This is the honorary society in chemical engineering. To be eligible, a student must rank in the top 20% of the junior class or the top 30% of the senior class. The local chapter is active in student relations, community activities, and the Engineers' Week laboratory exhibits. Faculty advisor is Dr. marrero.
3. There are student organizations in the college that are not restricted to specific disciplines. Some of these are: Society of Women Engineers, Society of Black Engineers, Tau Beta Pi, Engineering Student Council, and Engineers' Club.

## Suggested Plan of Study

### Regular Emphasis

First Semester			Second Semester		
Math 1500	Analytic Geometry & Calculus I	5	Math 1700	Calculus II	5
Chem 1320 <sup>1</sup>	General Chemistry II	3	Chem 1330 <sup>1</sup>	General Chemistry III	3
Engl 1000	Exposition & Argumentation	3	Phys 2750	University Physics I	5
HSS	Humanities & Social Science	3	HSS	Humanities & Social Science	3
ChE 1000	Introduction to Chem Engineering	2			
		16			16
Third Semester			Fourth Semester		
Math 2300	Calculus III	3	Math 4100	Differential Equations	3
Chem 2100	Organic Chemistry I	3	Chem 2110	Organic Chemistry II	3
Phy 2760	University Physics II	5	Chem 2130	Organic Laboratory I	2
ChE 2225	Material & Energy Balance	3	Elective <sup>2</sup>	Approved Elective	3
HSS	Humanities & Social Science	3	Stat Elec <sup>3</sup>	Approved Statistics Elective	3
			HSS	Humanities & Social Science	3
		17			17
Fifth Semester			Sixth Semester		
Chem 3200	Quantitative Methods of Analysis	4	Ch Elec <sup>5</sup>	Advanced Chemistry Elective	3
ChE 2226	Computer-aided Calc in Chem Engr	3	ChE 3242	Chemical Process Meas Lab	3
ChE 3234	Momentum, Heat & Mass Transfer	3	ChE 3235	Unit Operations	3
ChE 3261	Chem Engr Thermodynamics I	3	ChE 3262	Chem Engr Thermodynamics II	3
Tech Elec <sup>4</sup>	Approved Technical Elective	3	HSS	Humanities & Social Science	3
		16			15
Seventh Semester			Eighth Semester		
ChE 3243	Unit Operations Laboratory	3	ChE 4370	Chemical Process Control	3
ChE 4363	Chemical Reaction Engineering	3	ChE 4980	Process Simulation and Design	3
ChE 4385	Chemical Engineering Design	3	ChE Elec <sup>6</sup>	Approved Chem Engr Elective	3
ChE Elec <sup>6</sup>	Approved Chem Engr Elective	3	Engr 1200	Statics & Elem Str of Materials	3
Engr 2100	Circuit Theory I	3	HSS	Humanities & Social Science	3
		15			15

1. Student can request credit for Chem 1310 upon successful completion of Chem 1320. Chem 1310 is required for graduation.
2. Elective choices: Comm 1200, extra HSS, business/management, geology, honors colloquium, or anything that qualifies under items 4, 5 or 6. Must be approved by advisor.
3. Stat 4710 or ChE 4270.
4. Technical elective choices: Biology, chemistry, math, physics or engineering. Normally must be 2000 or above and approved by adviser. Course contents must not substantially duplicate another required course. BioSc 1500 and Engr 1100 are acceptable. May not apply towards math minor.
5. Advanced chemistry choices: 2400, 2140, 3330, 4200, 4160, 4170, 4280, 4290, 4600.
6. ChE elective choices: 4085, 4001, 4311, 4312, 4314, 4315, 4317, 4319, 4335, 4220, 4990, 4995.

## Biochemical Emphasis

First Semester			Second Semester		
Math 1500	Analytic Geometry & Calculus I	5	Math 1700	Calculus II	5
Chem 1320 <sup>1</sup>	General Chemistry II	3	Chem 1330 <sup>1</sup>	General Chemistry III	3
Engl 1000	Exposition & Argumentation	3	Phys 2750	University Physics I	5
HSS	Humanities & Social Science	3	HSS	Humanities & Social Science	3
ChE 1000	Introduction to Chem Engineering	2			
		16			16
Third Semester			Fourth Semester		
Math 2300	Calculus III	3	Math 4100	Differential Equations	3
Chem 2100	Organic Chemistry I	3	Chem 2110	Organic Chemistry II	3
Phy 2760	University Physics II	5	Chem 2130	Organic Laboratory I	2
ChE 2225	Material & Energy Balance	3	BioSc 1500	General Biology	5
HSS	Humanities & Social Science	3	Stat Elec <sup>3</sup>	Approved Statistics Elective	3
		17			16
Fifth Semester			Sixth Semester		
Chem 3200	Quantitative Methods of Analysis	4	ChE 3242	Chemical Process Meas Lab	3
ChE 2226	Computer-aided Calc in Chem Engr	3	ChE 3235	Unit Operations	3
ChE 3234	Momentum, Heat & Mass Transfer	3	ChE 3262	Chem Engr Thermodynamics II	3
ChE 3261	Chem Engr Thermodynamics I	3	BioSc 2300	Introduction to Cell Biology	4
BioSc 2200	General Genetics	4	HSS	Humanities & Social Science	3
		17			16
Seventh Semester			Eighth Semester		
ChE 3243	Unit Operations Laboratory	3	ChE 4370	Chemical Process Control	3
ChE 4363	Chemical Reaction Engineering	3	ChE 4980	Process Simulation and Design	3
ChE 4385	Chemical Engineering Design	3	ChE 4314	Biochemical Engineering Operation	3
ChE 4315	Intro to Biochemical Engineering	3	Engr 1200	Statics & Elem Str of Materials	3
Bioch 4270	Biochemistry I	3	Engr 2100	Circuit Theory I	3
HSS	Humanities & Social Science	3	HSS	Humanities & Social Science	3
		18			18

## Environmental Emphasis

First Semester			Second Semester		
Math 1500	Analytic Geometry & Calculus I	5	Math 1700	Calculus II	5
Chem 1320 <sup>1</sup>	General Chemistry II	3	Chem 1330 <sup>1</sup>	General Chemistry III	3
Engl 1000	Exposition & Argumentation	3	Phys 2750	University Physics I	5
HSS	Humanities & Social Science	3	HSS	Humanities & Social Science	3
ChE 1000	Introduction to Chem Engineering	2			
		16			16
Third Semester			Fourth Semester		
Math 2300	Calculus III	3	Math 4100	Differential Equations	3
Chem 2100	Organic Chemistry I	3	Chem 2120	Organic Chemistry II	3
Phy 2760	University Physics II	5	Chem 2130	Organic Laboratory I	2
ChE 2225	Material & Energy Balance	3	CE 3200	Introduction to Envir Engineering	4
HSS	Humanities & Social Science	3	Stat Elec <sup>3</sup>	Approved Statistics Elective	3
			HSS	Humanities & Social Science	3
		17			18
Fifth Semester			Sixth Semester		
Chem 3200	Quantitative Methods of Analysis	4	Chem 4280	Environmental Chemistry	3
ChE 2226	Computer-aided Calc in Chem Engr	3	ChE 3242	Chemical Process Meas Lab	3
ChE 3234	Momentum, Heat & Mass Transfer	3	ChE 3235	Unit Operations	3
ChE 3261	Chem Engr Thermodynamics I	3	ChE 3262	Chem Engr Thermodynamics II	3
HSS	Humanities & Social Science	3	ChE 4311	Chemodynamics	3
		16			15
Seventh Semester			Eighth Semester		
ChE 3243	Unit Operations Laboratory	3	ChE 4370	Chemical Process Control	3
ChE 4363	Chemical Reaction Engineering	3	ChE 4980	Process Simulation and Design	3
ChE 4385	Chemical Engineering Design	3	ChE 4220	Hazardous Waste Management	3
ChE 4312	Air Pollution	3	Engr 1200	Statics & Elem Str of Materials	3
Law 5545	Environmental Law	3	Engr 2100	Circuit Theory I	3
HSS	Humanities & Social Science	3			
		18			15

## Materials Emphasis

First Semester			Second Semester		
Math 1500	Analytic Geometry & Calculus I	5	Math 1700	Calculus II	5
Chem 1320 <sup>1</sup>	General Chemistry II	3	Chem 1330 <sup>1</sup>	General Chemistry III	3
Engl 1000	Exposition & Argumentation	3	Phys 2750	University Physics I	5
HSS	Humanities & Social Science	3	HSS	Humanities & Social Science	3
ChE 1000	Introduction to Chem Engineering	2			
		16			16
Third Semester			Fourth Semester		
Math 2300	Calculus III	3	Math 4100	Differential Equations	3
Chem 2100	Organic Chemistry I	3	Chem 2110	Organic Chemistry II	3
Phy 2760	University Physics II	5	Chem 2130	Organic Laboratory I	2
ChE 2225	Material & Energy Balance	3	Stat Elec <sup>3</sup>	Approved Statistics Elective	3
HSS	Humanities & Social Science	3	Engr 1200	Statics & Elem Str of Materials	3
			HSS	Humanities & Social Science	3
		17			17
Fifth Semester			Sixth Semester		
Chem 3200	Quantitative Methods of Analysis	4	Ch Elec <sup>5</sup>	Advanced Chemistry Elective	3
ChE 2226	Computer-aided Calc in Chem Engr	3	ChE 3242	Chemical Process Meas Lab	3
ChE 3234	Momentum, Heat & Mass Transfer	3	ChE 3235	Unit Operations	3
ChE 3261	Chem Engr Thermodynamics I	3	ChE 3262	Chem Engr Thermodynamics II	3
MAE 3200	Engineering Materials	4	HSS	Humanities & Social Science	3
			Mat Elect <sup>7</sup>	Approved Materials Elective	3
		17			18
Seventh Semester			Eighth Semester		
ChE 3243	Unit Operations Laboratory	3	ChE 4370	Chemical Process Control	3
ChE 4363	Chemical Reaction Engineering	3	ChE 4980	Process Simulation and Design	3
ChE 4385	Chemical Engineering Design	3	ChE 4319 <sup>8</sup>	Polymers	3
ChE 4317 <sup>8</sup>	Semiconductors	3	Mat Elect <sup>7</sup>	Approved Materials Elective	3
Engr 2100	Circuit Theory I	3	HSS	Humanities & Social Science	3
		15			15

7. Materials elective choices: Engr 2200, EE 3510, 4650, 4670, MAE 4220, 4240, 4250, 4270, 4600, Geol 3250, NU 4349, Phy 3150, or anything listed under item 8.
8. Any 4000 level ChE elective that is related to materials science and engineering may be used to replace ChE 4317 and/or ChE 4319. Advisor's consent is required.