DOCUMENTS OF THE GENERAL FACULTY

PROPOSED CHANGES TO THE BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING DEGREE PROGRAM IN THE COCKRELL SCHOOL OF ENGINEERING CHAPTER IN THE *UNDERGRADUATE CATALOG 2016-2018*

Dean Sharon L. Wood in the Cockrell School of Engineering has filed with the secretary of the Faculty Council the following changes to the *Undergraduate Catalog, 2016-2018*. The secretary has classified this proposal as legislation of *general* interest to more than one college or school.

The Committee on Undergraduate Degree Program Review recommended approval of the changes on January 7, 2016, and forwarded the proposal to the Office of the General Faculty. The Faculty Council has the authority to approve this legislation on behalf of the General Faculty. The authority to grant final approval on this legislation resides with UT System.

If no objection is filed with the Office of the General Faculty by the date specified below, the legislation will be held to have been approved by the Faculty Council. If an objection is filed within the prescribed period, the legislation will be presented to the Faculty Council at its next meeting. The objection, with reasons, must be signed by a member of the Faculty Council.

To be counted, a protest must be received in the Office of the General Faculty by February 14, 2016.

Hillary Hart, Secretary
General Faculty and Faculty Council

Posted on the Faculty Council website (http://www.utexas.edu/faculty/council/) on February 1, 2016.

PROPOSED CHANGES TO THE BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING DEGREE PROGRAM IN THE COCKRELL SCHOOL OF ENGINEERING CHAPTER IN THE *UNDERGRADUATE CATALOG 2016-2018*

Type of Change ☒ Academic Change
☐ Degree Program Change (THECB form required)

Proposed classification ☐ Exclusive ☒ General ☐ Major

1. IF THE ANSWER TO ANY OF THE FOLLOWING QUESTIONS IS YES, THE COLLEGE MUST CONSULT LINDA DICKENS, DIRECTOR OF ACCREDITATION AND ASSESSMENT, TO DETERMINE IF SACS-COC APPROVAL IS REQUIRED.

- Is this a new degree program? Yes ☐ No ☒
- Does the program offer courses that will be taught off campus? Yes ☐ No ☒
- Will courses in this program be delivered electronically? Yes ☐ No ☒

2. EXPLAIN CHANGE TO DEGREE PROGRAM AND GIVE A DETAILED RATIONALE FOR EACH INDIVIDUAL CHANGE:

Item 1.
Change to Curriculum: Remove statements referencing basic sequence and major sequence courses.
Rationale: A proposal to eliminate major sequence has been presented by the school. As a result, the wording is being changed to replace the references to basic and major sequence with lower and upper division, respectively. We also added language to clarify which courses are lower division and what constitutes upper division standing in the major. We noted key lower division courses in both the list of required courses and Suggested Arrangement of Courses sections.

Item 2.
Change to Curriculum: Modifying M 427K to M 427J or 427K.
Rationale: To reflect the changes made by the Mathematics department that denote either 427K or 427J will count toward the Advanced Calculus requirement for all Bachelor of Science in engineering degrees. This was added to both the list of required courses and Suggested Arrangement of Courses sections.

Item 3.
Change to Curriculum: Flag requirements.
Rationale: We have updated the flag requirements to include two writing flags that are required by the 2012-2014 Catalog. This requirement is fulfilled by required Chemical Engineering courses.

Item 4.
Change to Curriculum: Honors program.
Rationale: To clarify that students who are in the Engineering Honors Program and maintain a grade point average of at least
3.50 may take the honors research course.

Item 5.
Change to Curriculum: Technical focus area.
Rationale: To allow for increased flexibility, we are now allowing students selecting two technical areas to take a total of two Chemical Engineering courses across both areas. Previously, one Chemical Engineering course had to be from each area.

Item 6.
Change to Curriculum: Technical focus area electives.
Rationale: We have updated this list to reflect new courses which are being offered and have been approved for use as technical electives and to remove those which are rarely offered or rarely accessible to Chemical Engineering students. If a student were to gain access to one of these courses, they would still be allowed to count it as an elective, based on precedence. This will assist students in planning their course schedule.

3. THIS PROPOSAL INVOLVES (Please check all that apply)

☒ Courses in other colleges	☐ Courses in proposer's college that are frequently taken by students in other colleges	☒ Flags
☐ Course in the core curriculum	☐ Change in course sequencing for an existing program	☐ Courses that have to be added to the inventory
☐ Change in admission requirements (external or internal)	☐ Requirements not explicit in the catalog language (e.g., lists of acceptable courses maintained by department office)	☐ Other

4. SCOPE OF PROPOSED CHANGE

a. Does this proposal impact other colleges/schools? Yes ☒ No ☐
If yes, then how?

b. Do you anticipate a net change in the number of students in your college? Yes ☐ No ☒
If yes, how many more (or fewer) students do you expect?

c. Do you anticipate a net increase (or decrease) in the number of students from outside of your college taking classes in your college? Yes ☐ No ☒
If yes, please indicate the number of students and/or class seats involved.

d. Do you anticipate a net increase (or decrease) in the number of students from your college taking courses in other colleges? Yes ☒ No ☐
If yes, please indicate the number of students and/or class seats involved. Less than five

If 4 a, b, c, or d was answered with yes, please answer the following questions. If the proposal has potential budgetary impacts for another college/school, such as requiring new sections or a non-negligible increase in the number of seats offered, at least one contact must be at the college-level.

How many students do you expect to be impacted? Less than five students per course (spring semesters only) for BIO 339 and PGE 430.

Impacted schools must be contacted and their response(s) included:

Person communicated with: Arletta Tompkins, PGE Academic Advising Coordinator Date of communication: April 9, 2015
Response: Two sections of PGE 430 have been offered in the fall, but now there only offer one, so non-majors usually are not able to get seats in the fall. The course is also offered in the spring. If non-majors get a seat it is more likely to be in the spring. Seats went unfilled in spring 2015.

Person communicated with: Greg Browning, Executive Assistant, Biology Instructional Office, College of Natural Sciences
Date of communication: April 9, 2015
Response: BIO 339 is offered in spring only. Non-majors are likely to get a seat. Ten seats went unfilled this semester.

e. Does this proposal involve changes to the core curriculum or other basic education requirements (42-hour core, signature courses, flags)? If yes, explain: **No**
If yes, undergraduate studies must be informed of the proposed changes and their response included:
Person communicated with:
Date of communication:
Response:

f. Will this proposal change the number of hours required for degree completion? If yes, explain: **No**

5. COLLEGE/SCHOOL APPROVAL PROCESS

Department approval date: April 8, 2015
College approval date: April 10, 2015
Dean approval date: April 29, 2015

PROPOSED NEW CATALOG TEXT:

BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING

Chemical engineering is one of the most broadly based engineering disciplines. Its field of practice covers the development, design, and control of processes and products that involve molecular change, both chemical and biological, and the operation of such processes. Because many of the products that sustain and improve life are produced by carefully designed and controlled molecular changes, the chemical engineer serves in a wide variety of industries. These industries range from chemical and energy companies to producers of all types of consumer and specialty products, pharmaceuticals, textiles, polymers, advanced materials, and solid-state and biomedical devices.

Careers are available in industry, government, consulting, and education. Areas of professional work include research and development, operations, technical service, product development, process and plant design, market analysis and development, process control, and pollution abatement.

~~The objective of the~~ The chemical engineering degree program ~~is to~~ prepares students for professional practice in chemically related careers after the bachelor's degree or an advanced degree. Chemical engineering graduates are expected attain the following capabilities at or within a few years of graduation: ~~to~~ apply the fundamentals of science and engineering to solve important chemical engineering problems in industry, government or academic settings; ~~of analysis and design of components, systems, and processes important in chemical engineering practice and research~~; communicate effectively and demonstrate the interpersonal skills required to lead and/or participate ~~effectively~~ in interdisciplinary projects; ~~recognize the importance of~~ appy lifelong learning ~~in~~ to meet~~ing~~ professional and personal goals ~~so they can be successful in~~ of their chosen profession, including graduate study ~~school~~; ~~exhibit effectiveness in communication skills; and~~ articulate and practice professional, ethical, environmental, and societal responsibilities, and value different global and cultural perspectives. To meet the program objective, the faculty has designed a rigorous, demanding, and state-of-the-art curriculum that integrates lectures and laboratory experience in basic science, mathematics, engineering science, engineering design, and the liberal arts.

Portable Computing Devices

Students entering chemical engineering are required to have a laptop computer at their disposal. Laptops do not need to be brought to campus on a daily basis, but individual courses may require that a laptop be brought to certain lectures, labs, and/or exams. Minimum requirements for the laptop are listed on the department's Web site.

Curriculum

Course requirements are divided into three categories: ~~basic sequence courses, major sequence courses, and other required courses. In addition~~ lower division courses in the major, upper division courses in the major, and other required courses. ~~In order to achieve upper division standing in the major, students must complete~~ Enrollment in some upper division Chemical Engineering courses requires completion of 8 hours of lower division Chemical Engineering coursework (ChE 210, ChE 317 and ChE 319 or ChE 353) and 11 hours of non-Chemical Engineering coursework (CH 328M, CH 128K, CH 353, PHY 303L and PHY 103N) in the major, while earning a grade of C- or better in each course. In addition, each student must complete the University's core curriculum. In some cases, a course required for the Bachelor of Science in Chemical Engineering may also be counted toward the core curriculum; these courses are identified below. ~~To ensure that courses used to fulfill the social and behavioral sciences and visual and performing arts requirements of the core curriculum also meet ABET criteria, students should follow the guidance given in Liberal Education for Engineers~~ ABET ~~criteria~~.

In the process of fulfilling engineering degree requirements, students must also complete coursework to satisfy the following flag requirements: one independent inquiry flag, one course with a quantitative reasoning flag, one ethics and leadership flag, one global cultures flag, one cultural diversity in the United States flag, and two writing flags. The independent inquiry flag, the quantitative reasoning flag, the ethics and leadership flag, and

~~one~~ two writing flags are carried by courses specifically required for the degree; these courses are identified below. ~~Students are advised to fulfill the second writing flag requirement with a course that meets another requirement of the core curriculum, such as the first-year signature course.~~ Courses that may be used to fulfill flag requirements are identified in the *Course Schedule*.

~~Enrollment in major sequence courses is restricted to students who have received credit for all of the basic sequence courses and have been admitted to the major sequence. Requirements for admission to a major sequence are given in Admission and Registration. Enrollment in other required courses is not restricted by completion of the basic sequence.~~

	Requirements	Hours
~~Basic Sequence Courses~~		
Chemical Engineering Courses		
CHE 210*	Introduction to Computing	2
CHE 253K	Applied Statistics	2
CHE 253M	Measurement, Control, and Data Analysis Laboratory	2
CHE 264	Chemical Engineering Process and Projects Laboratory (writing flag)	2
CHE 317*	Introduction to Chemical Engineering Analysis	3
CHE 322	Thermodynamics	3
CHE 333T	Engineering Communication (writing flag and ethics and leadership flag)	3
CHE 348	Numerical Methods in Chemical Engineering and Problem Solving	3
CHE 350	Chemical Engineering Materials	3
CHE 353* or CHE 319	Transport Phenomena	3
CHE 354	Transport Processes	3
CHE 360	Process Control	3
CHE 363	Separation Processes and Mass Transfer	3
CHE 372	Chemical Reactor Analysis and Design	3
CHE 473K	Process Design and Operations (independent inquiry flag)	4
Chemistry		
CH 302	Principles of Chemistry II (part II science and technology; quantitative reasoning flag)	3
CH 204	Introduction to Chemical Practice (quantitative reasoning flag)	2
CH 128K*	Organic Chemistry Laboratory	1
CH 328M*	Organic Chemistry I	3
CH 353*	Physical Chemistry I (quantitative reasoning flag)	3
Mathematics		
M 408C	Differential and Integral Calculus (mathematics; quantitative reasoning flag)	4
M 408D	Sequences, Series, and Multivariable Calculus	4
M 427J or K	~~Advanced Calculus for Applications I~~ Differential Equations with Linear Algebra (quantitative reasoning flag)	4
Physics		
PHY 103M	Laboratory for Physics 303K	1
PHY 103N*	Laboratory for Physics 303L	1
PHY 303K	Engineering Physics I (part I science and technology; quantitative reasoning flag)	3
PHY 303L*	Engineering Physics II (part I science and technology; quantitative reasoning flag)	3
Rhetoric and Writing		

RHE 306	Rhetoric and Writing (English composition)	3
~~Major Sequence Courses~~		
~~CHE 322~~	~~Thermodynamics~~	~~3~~
~~CHE 333T~~	~~Engineering Communication (writing flag and ethics and leadership flag)~~	~~3~~
~~CHE 348~~	~~Numerical Methods in Chemical Engineering and Problem Solving~~	~~3~~
~~CHE 350~~	~~Chemical Engineering Materials~~	~~3~~
~~CHE 253K~~	~~Applied Statistics~~	~~2~~
~~CHE 253M~~	~~Measurement, Control, and Data Analysis Laboratory~~	~~2~~
~~CHE 354~~	~~Transport Processes~~	~~3~~
~~CHE 360~~	~~Process Control~~	~~3~~
~~CHE 363~~	~~Separation Processes and Mass Transfer~~	~~3~~
~~CHE 264~~	~~Chemical Engineering Process and Projects Laboratory (writing flag)~~	~~2~~
~~CHE 372~~	~~Chemical Reactor Analysis and Design~~	~~3~~
~~CHE 473K~~	~~Process Design and Operations (independent inquiry flag)~~	~~4~~
Approved technical focus area electives in chemical engineering		6
Approved technical focus area electives		6
Other Required Courses		
BIO 311C	Introductory Biology I	3
CH 128L	Organic Chemistry Laboratory	1
CH 328N	Organic Chemistry II	3
CH 153K	Physical Chemistry Laboratory (writing flag)	1
Chemistry elective with a laboratory experience chosen from		4
CH 431	Inorganic Chemistry	
CH 354 & CH 154K	Quantum Chemistry and Spectroscopy and Physical Chemistry Laboratory	
CH 354L & CH 154K	Physical Chemistry II and Physical Chemistry Laboratory	
CH 455	Fundamentals of Analytical Chemistry	
BCH 369 & CHE 179	Fundamentals of Biochemistry and Topics in Chemical Engineering	
CH 354 & CHE 179	Quantum Chemistry and Spectroscopy and Topics in Chemical Engineering	
Approved advanced mathematics, physics, chemistry or biology elective		3
Remaining Core Curriculum Courses		
E 316L	British Literature (humanities) (some sections carry a global cultures flag)	3
or E 316M	American Literature (some sections carry a cultural diversity flag)	
or E 316N	World Literature (some sections carry a global cultures flag)	
or E 316P	Masterworks of Literature	
American and Texas government (some sections carry a global cultures and/or cultural diversity flag)		6
American history (some sections carry a cultural diversity flag)		6
Visual and performing arts (some sections carry a global cultures and/or cultural diversity flag)		3
Social and behavioral sciences (some sections carry a global cultures and/or cultural diversity flag)		3
UGS 302	First-Year Signature Course (~~some~~ all sections carry writing flag)	3
or UGS 303	First-Year Signature Course (some sections carry a writing flag)	
Total Hours		128

* Courses marked with an * must be completed with a C- or better in order to achieve upper division standing in the major.

Honors Program

Chemical engineering students who are in the Engineering Honors Program and maintain a grade point average of at least 3.50 may take the honors research course, Chemical Engineering 679H. In this course the student performs research over two consecutive semesters under the supervision of a faculty member, makes two oral presentations, and writes a thesis. Chemical Engineering 679H may be used to fulfill either the approved area electives requirement or the approved area electives in chemical engineering requirement.

Technical Focus Areas

Because of the broad training in natural sciences and engineering received by the chemical engineer, opportunities are provided for students also to develop particular talents and interests in one or two areas of emphasis. Each student must complete twelve semester hours in one of the following areas or six semester hours in each of two areas, including at least two chemical engineering courses. If two technical area options are selected, then one Chemical Engineering course from each technical area may be completed, or two Chemical Engineering courses in a single area. The technical ~~focus~~ area courses should be ~~selected in consultation~~ discussed with a faculty adviser ~~and must be approved by~~ during faculty advising for the ~~department chair~~ next registration period. The courses listed in each area do not constitute a complete list of technical focus area courses but illustrate the types of courses that are generally suitable for a given area. A list of suggested complementary biology, physics, mathematics, and chemistry electives for each of the technical focus areas is available from the Chemical Engineering Undergraduate Office and published on the departmental Web page.

Students with a grade point average of at least 3.50 who are interested in seeking an advanced degree in chemical engineering are encouraged to discuss their plans with the graduate adviser or another faculty member. These students are encouraged to take at least one advanced mathematics course among their electives. They should also inquire about undergraduate research positions in the department.

For all areas, Chemical Engineering 325L and 377K may be counted as chemical engineering electives ~~only with the approval of the student's undergraduate faculty adviser~~. Chemical Engineering 377K may be counted only once toward the degree as a technical area option elective.

Area 1, Process Systems and Product Engineering

The chemical process industry is one of the most advanced in the applications of modern design and control techniques and computer technology. Competence in design, economics, fault detection, optimization, control, and simulation is essential in this industry. Chemical engineers are also frequently involved in the development of new consumer and specialty products, an assignment that requires not only technical skills but also an understanding of the principles of successful marketing and quality control. Chemical engineering courses in this technical focus area cover topics such as optimization and statistical quality control, while courses in mechanical engineering and electrical engineering deal with both theory and applications in statistics, computer control, economic analysis, and operations research.

Chemical Engineering 341, *Design for Environment*
Chemical Engineering 342, *Chemical Engineering Economics and Business Analysis*
Chemical Engineering 356, *Optimization: Theory and Practice*
Chemical Engineering 376K, *Process Evaluation and Quality Control*
Chemical Engineering 379, Topic: *Electrochemistry for Chemical Engineering*
Chemical Engineering 379, Topic: *Process Safety*
Chemical Engineering 379, Topic: *Quantitative Cellular and Molecular Biology*
Electrical Engineering 370K, *Computer Control Systems*
Electrical Engineering 379K, Topic: *Statistical Quality Control*

Architectural Engineering 323K, *Project Management and Economics*
Mechanical Engineering 335, *Engineering Statistics*
Mechanical Engineering 348D, *Introduction to Mechatronics II*
Mechanical Engineering 353, *Engineering Finance*
Mechanical Engineering 366L, *Operations Research Models*
Marketing 320F, *Foundations of Marketing*
~~International Business 378, *International Business Operations*~~
~~Marketing 460, *Information and Analysis* (carries a quantitative reasoning flag)~~
Upper-division mathematics course

Area 2, Materials Engineering

Advances in technology and improvements in our quality of life are linked to the development, processing, and manufacture of engineering materials. Materials span the spectrum from "hard" to "soft" materials and include metals, ceramics, semiconductors, and polymers; all are prepared in carefully controlled chemical processes. These materials are used technologically in objects such as catalysts, fuel cells, microelectronic devices, membranes, solar cells, and high-performance plastics. With advancements in analytical probes and modeling, our understanding of materials has become increasingly more molecular and the traditional boundaries between disciplines have faded to the extent that this is a truly interdisciplinary area. Chemical engineers can assume a creative role in this area when provided with the appropriate fundamentals and applications background.
Chemistry 341, *Special Topics in Laboratory Chemistry*
Chemistry 354, *Quantum Chemistry and Spectroscopy*
Chemistry 354L, *Physical Chemistry II*
Chemistry 367L, *Macromolecular Chemistry*
Chemistry 376K, *Advanced Analytical Chemistry*
Chemical Engineering 322M, *Molecular Thermodynamics*
Chemical Engineering 323, *Chemical Engineering for Micro- and Nanofabrication*
Chemical Engineering 355, *Introduction to Polymers*
Chemical Engineering 379, Topic: *Atmospheric Physicochemical Processes*
Chemical Engineering 379, Topic: *Computation Methods with Applications to Materials*
Chemical Engineering 379, Topic: *Electrochemistry for Chemical Engineering*
Chemical Engineering 379, Topic: *Polymerization Kinetics and Reaction Engineering*
Chemical Engineering 379, Topic: *Process Safety*
Electrical Engineering 339, *Solid-State Electronic Devices*
Mechanical Engineering 349, *Corrosion Engineering*
Mechanical Engineering 359, *Materials Selection*
Mechanical Engineering 374S, *Solar Energy Systems Design*
~~Mechanical Engineering 378C, *Electroceramics*~~
~~Mechanical Engineering 378S, *Structural Ceramics*~~
Physics 338K, *Electronic Techniques*
Physics 355, *Modern Physics and Thermodynamics*
Physics 375S, *Introductory Solid-State Physics*

Area 3, Environmental Engineering

Chemical engineers are uniquely qualified to contribute to the solution of environmental problems and to design processes and products that minimize environmental hazards. From pollution prevention by process optimization, to new understanding of chemical processes that occur in the environment, to new materials for advanced catalysts and carbon-free energy sources, chemical engineers are creating the "green" technologies needed to sustain the planet.
Civil Engineering 341, *Introduction to Environmental Engineering*
Civil Engineering 342, *Water and Wastewater Treatment Engineering*
Civil Engineering 364, *Design of Wastewater and Water Treatment Facilities*
Civil Engineering 369L, *Air Pollution Engineering*
Civil Engineering 370K, *Environmental Sampling and Analysis*
Chemical Engineering 341, *Design for Environment*

Chemical Engineering 357, *Technology and Its Impact on the Environment*
Chemical Engineering 359, *Energy Technology and Policy*
Chemical Engineering 376K, *Process Evaluation and Quality Control*
Chemical Engineering 379, Topic: *Atmospheric Physicochemical Processes*
Chemical Engineering 379, Topic: *Process Safety*
Mechanical Engineering 374S, *Solar Energy Systems Design*
Mechanical Engineering 379M, *Topics in Mechanical Engineering*

Area 4, Biochemical, Biomolecular, and Biomedical Engineering

Track A: Cellular and Bioprocess Engineering
Chemical engineers are developing innovative solutions to practical problems in biotechnology and in the biochemical, pharmaceutical, and life science industries. This track is designed to prepare students for a career or research in the areas of applied cellular engineering and bioprocess engineering in the chemicals and pharmaceutical industry. Chemical engineering and elective courses are available that cover chemical engineering principles applied to biological systems and the fundamentals of biomolecular, cellular, and metabolic processes. This track is also suitable for students interested in biofuels.
Biology 311D, *Introductory Biology II*
Biology 325, *Genetics*
Biology 326R, *General Microbiology*
Biology 339, *Quantitative Cellular and Molecular Biology*
Chemical Engineering 339, *Introduction to Biochemical Engineering*
Chemical Engineering 339P, *Introduction to Biological Physics*
Chemical Engineering 379, Topic: *Fundamentals and Applications of Cellular Regulation*
Chemical Engineering 379, Topic: *Quantitative Cellular and Molecular Biology*
Chemical Engineering 379, Topic: *Biochemical, Cellular and Metabolic Engineering: Principles and Practices*
Biochemistry 369, *Fundamentals of Biochemistry*
Biochemistry 370, *Physical Methods of Biochemistry*

Track B: Biomedical Engineering
This track is designed to prepare students for careers in the biomedical and pharmaceutical industries that deal with medical systems or improvement of health treatment alternatives. This is also a natural track to be followed by students who plan to attend medical school. Chemical engineering courses and electives are available that cover the application of chemical engineering principles to the design of new medical and therapeutic devices, as well as to the understanding of physiological processes.
Biology 311D, *Introductory Biology II*
Biology 320, *Cell Biology*
Biology 325, *Genetics*
Biology 326R, *General Microbiology*
Neuroscience 365R, *Vertebrate Neurobiology*
Biology 365S, *Systems Physiology*
Biomedical Engineering 352, *Engineering Biomaterials*
Biomedical Engineering 353, *Transport Phenomena in Living Systems*
Biomedical Engineering 365R, *Quantitative Engineering Physiology I*
Chemical Engineering 339, *Introduction to Biochemical Engineering*
Chemical Engineering 339P, *Introduction to Biological Physics*
Chemical Engineering 339T, *Cell and Tissue Engineering*
Chemical Engineering 355, *Introduction to Polymers*
Chemical Engineering 379, Topic: *Fundamentals and Applications of Cellular Regulation*
Chemical Engineering 379, Topic: *Quantitative Cellular and Molecular Biology*
Biochemistry 369, *Fundamentals of Biochemistry*
Electrical Engineering 374K, *Biomedical Electronic Instrument Design*
Mechanical Engineering 354, *Introduction to Biomechanical Engineering*

Area 5, Energy Technologies

The need for energy sustainability and new energy technologies provides some of the most significant scientific and engineering challenges that face society. Chemical engineers are uniquely qualified to address these issues and contribute new solutions to the problem. Technologies include solar energy utilization in the form of photovoltaics, biofuels and solar fuels; new and more efficient ways to extract fossil fuels from existing reservoirs; alternative power sources like wind, geothermal, and nuclear. Policy is also an important and active area that involves chemical engineers. Chemical engineering and other elective courses are available that teach fundamentals of energy technology and policy.
Chemical Engineering 323, *Chemical Engineering for Micro- and Nanofabrication*
Chemical Engineering 339, *Introduction to Biochemical Engineering*
Chemical Engineering 341, *Design for Environment*
Chemical Engineering 355, *Introduction to Polymers*
Chemical Engineering 357, *Technology and Its Impact on the Environment*
Chemical Engineering 359, *Energy Technology and Policy*
Chemical Engineering 379, Topic: *Atmospheric Physicochemical Processes*
Chemical Engineering 379, Topic: *Electrochemistry for Chemical Engineering*
Chemical Engineering 379, Topic: *Process Safety*
Civil Engineering 341, *Introduction to Environmental Engineering*
Electrical Engineering 339, *Solid-State Electronic Devices*
Mechanical Engineering 374S, *Solar Energy Systems Design*
Mechanical Engineering 379M, *Topics in Mechanical Engineering*
Petroleum and Geosystems Engineering 305, *Energy and the Environment*
Petroleum and Geosystems Engineering 430, *Drilling*

Area 6, Engineering Economics and Business Leadership

Chemical engineers who understand the economic and policy issues faced by modern chemical and materials companies are needed to solve the challenges of modern industry. Globalization, sustainability, safety and modern labor practices, intellectual property protection, and the process of innovation are all issues facing modern industry. This focus area is designed to prepare students for business leadership in a technical arena.
Chemical Engineering 342, *Chemical Engineering Economics and Business Analysis*
Chemical Engineering 356, *Optimization: Theory and Practice*
Chemical Engineering 379, Topic: *Process Safety*
Architectural Engineering 323K, *Project Management and Economics*
Economics 304K, *Introduction to Microeconomics*
Economics 304L, *Introduction to Macroeconomics*
Economics 328, *Industrial Organization*
Economics 339K, *International Trade and Investment*
Economics 351K, *Current Issues in Business Economics*
Mechanical Engineering 353, *Engineering Finance*
Mechanical Engineering 366L, *Operations Research Models*
Marketing 320F, *Foundations of Marketing*
International Business 378, *International Business Operations*
Marketing 460, *Information and Analysis* (carries a quantitative reasoning flag)
Science, Technology, and Society 332, *The Nanotechnology and Science Revolution*

Suggested Arrangement of Courses

First Year

First Term	Hours	Second Term	Hours
CH 302	3	BIO 311C	3
CHE 102[1]	1	CH 204	2
CHE 210*	2	M 408D	4
M 408C	4	PHY 303K	3
RHE 306	3	PHY 103M	1
Social and behavioral sciences	3	UGS 302 or 303	3
	16		16

Second Year

First Term	Hours	Second Term	Hours
CH 128K*	1	CH 128L	1
CH 328M*	3	CH 328N	3
CHE 317*	3	CH 353*	3
M 427J or K	4	CHE 353* or CHE 319	3
PHY 303L*	3	E 316L, 316M, 316N, or 316P	3
PHY 103N*	1	American and Texas government	3
	15		16

Third Year

First Term	Hours	Second Term	Hours
CH 153K	1	CHE 253M	2
CHE 322	3	CHE 363	3
CHE 333T	3	CHE 348	3
CHE 253K	2	American history	3
CHE 354	3	Approved technical area course	3
Chemistry elective	4	Visual and performing arts	3
	16		17

Fourth Year

First Term	Hours	Second Term	Hours
CHE 350	3	CHE 360	3
CHE 264	2	CHE 473K	4
CHE 372	3	American history	3
Approved chemical engineering area course	3	Approved chemical engineering area course	3
American and Texas Government	3	Approved technical area course	3
Approved advanced math, physics, chemistry or biology elective	3		
	17		16

Total credit hours: 129

[1] Optional; students who do not take this course will take fifteen hours of coursework in the fall semester of the first year

* Courses marked with an * must be completed with a C- or better in order to achieve upper division standing in the major.